



# FULL GUIDE (MATH)

## FOR EST & SAT

### NOTES & CLASSIFIED

\* It covers all topics of math in EST and SAT.

\* Tons of Questions and Guide answers for each topic.

\* Practice.. Practice..Practice.. Is the only way for high score.

\* Minimum score maybe your hope .. but maximum score is our end



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# System of Equation

$$E=mc^2$$

Without Calculator

1

$$x + y = 3$$

$$2x - y = 12$$

A

Elimination

$$x + y = 3$$

$$2x + y = 12$$

$$3x = 15$$

$$x = \frac{15}{3}$$

$$x = 5$$

To find  $y$  substitution in any of the equation above.

$$x + y = 3$$

$$5 + y = 3$$

$$y = 3 - 5$$

$$y = -2$$

So, the Solution

$$(n, y)$$

$$(5, -2)$$

2

$$6x + 3y = 18$$

$$2x + 5y = 14$$



*Firstly, multiply the second equation by (-3)*

$$-3(2x + 5y) = 14(-3)$$

$$-6x - 15y = -42$$



*Then put the two equation. To use elimination process.*

$$6x + 3y = 18$$

$$-6x - 15y = -42$$

$$-12y = -24$$

$$y = \frac{-24}{-12}$$

$$y = 2$$

To find  $x$  substitute in any the original equations

$$6x + 3y = 18$$

$$6x + 3(2) = 18$$

$$6x + 6 = 18$$

$$6x = 18 - 6$$

$$6x = 12$$

$$x = \frac{12}{6} = 2$$

*So, the solution point*

$$(2, 2)$$

With Calculator

$$5x + 2y = 40$$

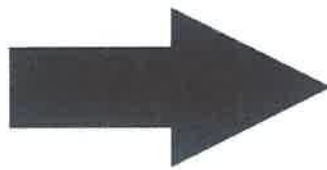
$$5x + 4y = 60$$

<i>M</i>
5
1

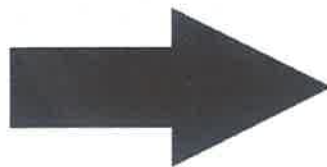
a	b	c
5	2	40
5	4	60

$$x_1 =$$

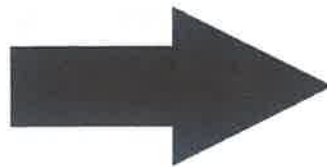
$$x_2 =$$



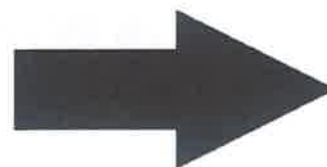
How to solve the linear equations with two variables using calculator CASIO fx-991ES PLUS



Solving Linear Equations Using the TI 83 or TI 84 Series Calculator



TI 84 Plus CE System of Linear Equations



Solve a System of 2 Equations with 2 Unknowns by Graphing on the TI84

# *Questions*



1- OCTOBER 2020 Q 6



Which value of  $x$  makes the equation  $\frac{7}{5}(3x - 2) = 14$  true?

- A. 2
- B. 3
- C. 4
- D. 5

2- DECEMBER 2020 Q 8



$$\begin{aligned} 3y &= 12 - 3y \\ y + a &= x - 1 \\ y + a &= x - 1 \end{aligned}$$

In the system of equations above,  $a$  is a constant and  $(x, y)$  is a solution, where  $x = 3$ . What is the value of  $a$ ?

- A. -4
- B. 0
- C. 2
- D. 4

3- DECEMBER 2020 Q 16



**SPR (Student Produced Responses)**

$$13x - 7y = 12$$

$$7x - 13y = 6$$

Based on the system of equations above, what is the value of  $4x + 4y$ ?

4- JUNE 2022 ( cancelled ) / Q 8



If  $x = \sqrt{2} + 3$ , what is the value of  $2x^2 + 3x - 1$ ?

- A.  $5\sqrt{2} + 14$
- B.  $3\sqrt{2} + 30$
- C.  $3\sqrt{2} + 24$
- D.  $15\sqrt{2} + 30$

5- MARCH 2021 Q 2



Among the following ordered pairs, which one is a solution of the system

$$\begin{cases} y > x \\ y \leq -x \end{cases} ?$$

- A.  $(-1, 0)$
- B.  $(0, -1)$
- C.  $(-1, 2)$
- D.  $(0, 1)$

6- MARCH 2021 Q 17



If  $2x - 3 = 0$ , what is the value of  $\frac{7}{3}x + \frac{1}{2}$ ?

(Grid in)

7- MAY 2021 Q 1



If  $2x - 3y = 14$  and  $-x + 2y = -8$ , what is the value of  $x + y$ ?

- A. -2
- B. 0
- C. 2
- D. 6

8- MAY 2021 Q 5



If  $\frac{-1}{2x-1} = \sqrt{3}$ , what is the value of  $6x$ ?

- A.  $-3\sqrt{3}$
- B.  $\sqrt{3} - 3$
- C.  $-\sqrt{3} + 3$
- D.  $\sqrt{3} + 3$

9- MARCH 2022 / Q 1



If  $x + y = 500$  and  $3x + 2y = 3000$ , what is the value of  $5x - y$ ?

- A. 8000
- B. 7000
- C. 11500
- D. -7000

10- OCTOBER 2021 Q 4



If  $\frac{2a-1}{b} = 6$ , what is the value of  $a - 3b$ ? ( $b \neq 0$ )

- A. 0.5
- B. 1
- C. 2
- D. 3

11- SAMPLE TEST / Q 4

A satellite company updated its prices for the upcoming year. To be provided with 30 sports channels and 55 political channels, the total price to be paid will be \$100. In contrast, to be provided with 60 sports channels and 20 political channels, the price to be paid will be \$110. How much does this company charge for each sports channel?

- A) \$0.5
- B) \$0.67
- C) \$1
- D) \$1.5

## 12- AUGUST 2021 Q 4



A truck contains 15 identical boxes that are either red or blue.

The red box weighs 3 kg and the blue box weighs 2 kg.

If the total weight of the boxes is 36 kgs, what is the difference between the red and blue boxes in the truck?

- A. 6
- B. 9
- C. 1
- D. 3

## 13- AUGUST 2021 Q 5



A 100-page album costs twice as much as a 50-page album. The cost of three 100-page albums and two 50-page albums is \$ $t$ . How much does a 50-page album cost?

- A.  $8t$
- B.  $4t$
- C.  $\frac{t}{4}$
- D.  $\frac{t}{8}$

## 14- SAMPLE TEST / Q 6



What is the solution of

$$\frac{1}{x+1} - \frac{2}{3} = -\frac{2}{5}?$$

- A)  $\frac{9}{2}$
- B)  $\frac{11}{4}$
- C)  $-\frac{11}{5}$
- D)  $-\frac{31}{16}$

## 15- OCTOBER 2021 Q 1



Given  $2x - 8 = 3y + 4$ , what is the value of  $x$  if  $y$  is equivalent to the square of 2?

- A. 4
- B. 8
- C. 12
- D. 24

## 16- OCTOBER 2021 Q 2



Amina went to the flower shop and bought 2 roses and 5 daisies for 6 EGP. Lara bought from the same shop, 4 roses and 2 daisies for 4 EGP. How much should Ahmad pay to buy 2 roses and 2 daisies?

- A. 1 EGP
- B. 1.5 EGP
- C. 2 EGP
- D. 3 EGP

## 1- OCTOBER 2020 Q 31



$$\frac{3y - 2(4 - 2y)}{3} = \frac{-11 + 3(2 + 3y)}{5}$$

What is the value of  $y$  in the equation above?

## 2- OCTOBER 2020 Q 32



A multiple *choice* test contains 50 questions. A correct answer is worth 3 points and an incorrect answer is worth -2 points. If a student receives 75 on the test, how many questions did he answer correctly?

## 3- DECEMBER 2020 Q 1



If  $4t - 10 = 11a$ , and  $a = -2$ , what is the value of  $10t - 10$ ?

- A. -40
- B. -8
- C. -3
- D. 1

## 4- DECEMBER 2020 Q 11



The solution set of the equation  $\sqrt{2x + 1} - x = -1$  is:

- A. {0, 1, 4}
- B. {1, 4}
- C. {4}
- D. {0}

## 5- DECEMBER 2020 Q 32



At a certain carnival booth, a trivia game can be played according to the following rule: the player wins 10 gold coins just for participating in the game; he then wins 3 gold coins for each correct answer and loses 1 gold coin for each wrong answer. At the end of the game when the time is up, the player gains money according to the equivalence: 1 gold coin = \$3. If Jad makes 4 mistakes and gains \$153 at the end of the game, how many correct answers does he have?

## 6- DECEMBER 2020 Q 34



$$\frac{x}{x+2} - \frac{1}{2} = x - 2$$

What is the positive solution of the equation given above?

## 7- MARCH 2021 Q 4



$$\begin{cases} \frac{2}{3}x + y = -3 \\ \frac{x}{3} + \frac{y}{2} = -3 \end{cases}$$

What is the solution of the above system?

- A.  $(-6,1)$
- B.  $(6,9)$
- C.  $(6, -7)$
- D.  $\emptyset$

## 8- MARCH 2021 Q 6



The total revenue of a magic show is 16,360 EGP. If each adult ticket to attend the show cost 12 EGP and each children ticket cost 2 EGP, then what is the number of tickets of each type sold if 3,480 tickets in all were sold?

- A. 930 adult tickets and 2,550 children tickets
- B. 940 adult tickets and 2,540 children tickets
- C. 955 adult tickets and 2,525 children tickets
- D. 960 adult tickets and 2,520 children tickets

## 9- MARCH 2021 Q 23



$$\left[ \left( 2 - \frac{a}{3} \right)^2 - (-2)^2 \left( 1 + \frac{a^2}{3} \right) \right]$$

Which of the expressions is equivalent to the above expression?

- A.  $a \left( \frac{11}{3}a + 4 \right)$
- B.  $-a \left( \frac{11}{3}a - 2 \right)$
- C.  $-\frac{a}{3} \left( \frac{11}{3}a + 4 \right)$
- D.  $\frac{a}{3} \left( \frac{11}{3}a + 4 \right)^2$

## 10- MARCH 2021 Q 25



From the set of equations below, which has a real solution?

- I.  $\sqrt{2x-1} = -x^2$
- II.  $|x+1| = -3$
- III.  $(x+1)^2 + 3 = 0$
- IV.  $\sqrt{2x-1} = x$

- A. I only
- B. IV only
- C. I, II, and III
- D. III and IV

11- MAY 2021 Q 3



$$\begin{cases} -2x + 5y = 39 \\ 3x = -4y + 45 \end{cases}$$

From the system of equations above,  
what is the value of  $2x + 7y$  ?

- A. -57
- B. 15
- C. 39
- D. 69

12- MAY 2021 Q 23



If  $4x + 14y = -7$ , what is the value  
of  $-x - \frac{7}{2}y$  ?

- A.  $-\frac{7}{4}$
- B.  $\frac{7}{4}$
- C.  $-\frac{7}{2}$
- D.  $\frac{7}{2}$

13- MAY 2021 Q 27



If  $\frac{a}{2b+1} = \frac{1}{2}$ , which of the following  
is correct?

- A.  $a + b = \frac{1}{2}$
- B.  $a - b = \frac{1}{2}$
- C.  $2a - b = \frac{1}{2}$
- D.  $a - 2b = \frac{1}{2}$

14- JUNE 2021 Q 16



If  $11x - 7y = 6$  and  $17x - 13y = 9$ , what  
is the value of  $x - y$ ?

- A. 0
- B.  $-\frac{1}{2}$
- C.  $\frac{1}{2}$
- D. -2

15- JUNE 2022 (cancelled) / Q 34



$$\begin{cases} -2x + y = 1 \\ ax + y = 4 \\ -4x = -y + 1 \end{cases} \quad (a \text{ is a positive constant})$$

The sum of the abscissas of the  
intersections of the lines of the three  
equations in the system above is 1.6.  
What is the value of  $a$ ?

- a. 0.5
- b. 1
- c. 1.5
- d. 2

16- AUGUST 2021 Q 13



If  $3x = 24y$ , what is the value of  $\left(\frac{3y}{x}\right)^2$   
?

- A.  $\frac{9}{64}$
- B.  $\frac{3}{4}$
- C.  $\frac{8}{3}$
- D. 24

17-AUGUST 2021 Q 19



$$\begin{cases} x + 3y = \frac{b}{2} \\ 4x + 4ay = 20 \end{cases}$$

In the system of equations above,  $a$  and  $b$  are constants. If the system has one solution, which of the following could be the values of  $a$  and  $b$ ?

- A.  $a = 3; b = 10$
- B.  $a = 3; b = 12$
- C.  $a = 3; b = -4$
- D.  $a = 10; b = 3$

18-JUNE 2022 (cancelled) / Q 27 -



$$\begin{cases} dx - 2my = -14 \\ 3dx + 6my = 78 \end{cases}$$

( $d$  and  $m$  are constants)

Given that the solution of the system above is  $(2, 5)$ , what is the value of  $2mx - 3dy$ ?

- A. -37
- B. -18
- C. 11
- D. 20

19-DECEMBER 2021 Q 4



Street food tickets at the park cost 10 EGP for children and 15 EGP for adults. On a certain day, 1,500 tickets were bought for a total of 19,750 EGP.

What is the amount of money made from the tickets for adults only on that day?

- A. 5,490 EGP
- B. 7,500 EGP
- C. 12,000 EGP
- D. 14,250 EGP

20-DECEMBER 2021 Q 5



$$2\left(\frac{x}{3} - \frac{1}{4}\right) - 2x = \frac{2}{5}$$

What is the solution to the equation above?

- A.  $x = \frac{-9}{28}$
- B.  $x = \frac{-27}{40}$
- C.  $x = \frac{-27}{10}$
- D.  $x = \frac{3}{40}$

21- DECEMBER 2021 Q 8



If  $ax + by = a - b$  and  $bx - ay = a + b$  then:

- A.  $x = y = 1$
- B.  $x = y = -1$
- C.  $x = 1$  and  $y = -1$
- D.  $x = -1$  and  $y = 1$

22 - DECEMBER 2021 Q 32



A father decides to give his son 10 EGP for every math question solved correctly as to encourage him to study mathematics more, but takes back 5 EGP if the solution is wrong. After 30 questions, each has given and received the same amount of money. How many correct questions did the son solve? (Grid in)

23- DECEMBER 2021 Q 37



How many solutions, in  $\mathbb{R}$ , does the equation  $e^{3x} - 3x - 3 = 0$  admit? (Grid in)

24 - MARCH 2022 / Q 3



The price of three squash and two zucchini is 10 EGP, while the price of five squash and three zucchini is 16.5 EGP. What is the price of one squash and four zucchini?

- A. 7 EGP
- B. 5 EGP
- C. 10 EGP
- D. 8.5 EGP

25 - MARCH 2022 / Q 23



If  $5x + 2y = 12\,000$ , what is the value of  $-0.625x - 0.25y$ ?

- A. 1500
- B. -1500
- C. 3000
- D. -3000

26 - MARCH 2022 / Q 30



If  $x - 2y = 1$ , which of the following is always true?

- A.  $x - y = 1 - y$
- B.  $x + y = 1 + y$
- C.  $2x - y = 1 + 3y$
- D.  $2y - 2x = -x - 1$

## 27 - SAMPLE TEST / Q 8



$$\begin{cases} -3y + 0.5x = 1 \\ -2.3x = -1.5 - 0.3y \end{cases}$$

From the system of equations above which can be graphed in the  $xy$ -plane, what is the sum of the abscissa and the ordinate of the intersection of the two lines ?

A)  $\frac{53}{135}$

B)  $\frac{65}{141}$

C)  $\frac{23}{27}$

D)  $\frac{157}{5}$

## ANSWERS OF LESSON ( SYSTEM OF EQUATION )

NON CALCULATOR



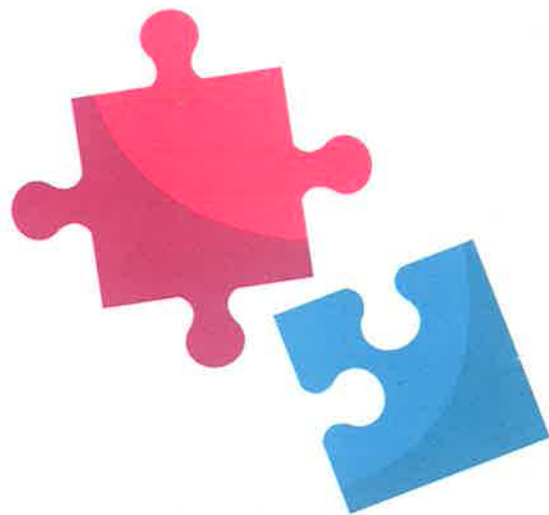
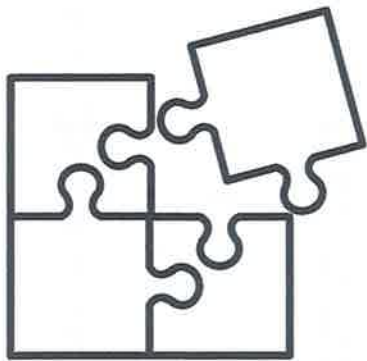
Question	Answer
1	C
2	B
3	4
4	D
5	A
6	4
7	C
8	C
9	C
10	A
11	D
12	D
13	D
14	B
15	C
16	D
17	
18	
19	
20	
21	
22	
23	
24	
25	
26	
27	
28	
29	

CALCULATOR



Question	Answer
1	25/8
2	35
3	A
4	C
5	15
6	2
7	D
8	B
9	C
10	B
11	D
12	B
13	B
14	C
15	B
16	A
17	D
18	A
19	D
20	B
21	C
22	10
23	2
24	B
25	B
26	D
27	A
28	
29	

# In Terms of (Isolation)



How to find a symbol in one side .... and the  
other variable in the other side

1  $y = \frac{2(x+10)}{3}$

Find  $x$  in terms of  $y$ ?

A)  $x = \frac{24}{3} - 10$

B)  $x = 4y$

C)  $x = 4y + 10$

D)  $\frac{3y}{2} - 10$

---

2 the formula  $B = \frac{703w}{h^2}$

Find  $h$  in terms of  $b$  and  $w$ ?

A)  $h = \sqrt{\frac{703w}{B}}$

B)  $h = \sqrt{\frac{B}{703w}}$

C)  $h = \frac{703w}{B}$

D)  $h = \frac{B}{703w}$

# *Questions*



## 1- OCTOBER 2020 / Q 1



The magnitude of the electrostatic force  $F$  between two point charges in vacuum is given by

$$F = \frac{q_1 q_2}{4\pi\epsilon_0 r^2} \text{ where:}$$

$F$  is the magnitude of the force exerted  
 $q_1$  is the charge on one body  
 $q_2$  is the charge on the other body  
 $r$  is the distance between the two bodies  
 $\epsilon_0$  is the permittivity of the vacuum.

Isolate  $r$ .

- A.  $r = \frac{4\pi\epsilon_0 F}{q_1 q_2}$   
 B.  $r = \sqrt{\frac{q_1 q_2 F}{4\pi\epsilon_0}}$   
 C.  $r = \frac{1}{2} \sqrt{\frac{q_1 q_2}{\pi\epsilon_0 F}}$   
 D.  $r = \left(\frac{q_1 q_2}{4\pi\epsilon_0}\right)^2$

## 2- DECEMBER 2020 / Q 12



Black holes are massive objects in the universe. The Schwarzschild Radius of a black hole is the maximum distance at which an object can escape the gravitational pull of the black hole. It is given by  $R = \frac{2GM}{c^2}$ ,  $R$  is the Schwarzschild Radius,  $G$  is called the gravitational constant,  $M$  is the mass of the black hole, and  $c$  is the speed of light in vacuum. What is  $c$  in terms of  $G$ ,  $M$ , and  $R$ ?

- A.  $c = \sqrt{\frac{R}{2GM}}$   
 B.  $c = \sqrt{2GMR}$   
 C.  $c = \sqrt{\frac{GMR}{2}}$   
 D.  $c = \sqrt{\frac{2GM}{R}}$

## 3- MAY 2021/ Q 4



The “Bond Number”  $B_o$  or “Eötvös Number” is a formula used in fluid dynamics that shows the importance of gravitational forces compared to surface tension forces and is used to describe the shape of a droplet moving in a surrounding fluid. To find the bond number we apply the formula  $B_o = \frac{\rho g D^2}{\sigma}$  where  $\rho$  represents the density of the liquid,  $g$  represents the acceleration due to gravity,  $D$  is the diameter of the droplet, and  $\sigma$  is the surface tension. What is  $D$  in terms of  $B_o$ ,  $\rho$ ,  $g$ , and  $\sigma$ ?

- A.  $D = \frac{B_o \sigma}{\rho g}$   
 B.  $D = \sqrt{\frac{B_o \sigma}{\rho g}}$   
 C.  $D = \sqrt{\frac{B_o \rho}{\sigma g}}$   
 D.  $D = \frac{B_o \rho}{\sigma g}$

## 4- JUNE 2021/ Q 1



For a point source, sound waves propagate in concentric spheres, therefore the intensity of the sound at a point A distant  $D$  from the source is given by:  $I = \frac{P}{4\pi D^2}$  where:

$I$  is the sound intensity

$P$  is the power of the point source

$D$  is the distance between the source and the point A where the intensity is to be found

Isolate  $D$ .

- A.  $D = 2\sqrt{\frac{\pi I}{P}}$   
 B.  $D = \frac{1}{2}\sqrt{\frac{P}{\pi I}}$   
 C.  $D = \left(\frac{P}{4\pi I}\right)^2$   
 D.  $D = \sqrt{\frac{P}{2\pi I}}$

5 - MARCH 2022 / Q 4



If  $N = \frac{2h^2 + 40}{100}$ , which of the following could be  $h$  in terms of  $N$ ?

- A.  $\sqrt{50N + 20}$
- B.  $\sqrt{100N - 20}$
- C.  $\sqrt{50N - 20}$
- D.  $\sqrt{100N + 20}$

6- Sample test



The energy stored in a capacitor can be called "electrical potential energy" and it is related to charge  $Q$ , voltage  $V$  on the capacitor, and the capacitance  $C$  of the capacitor. This energy is used mostly to preserve the memory of an item especially in regard to large capacitors. To find the value of the electrical potential energy that we will consider it as  $PE_{\text{electric}}$ , we apply the formula

$$PE_{\text{electric}} = \frac{1}{2} C \times V^2, \text{ with } V = \frac{Q}{C}$$

Which of the following

correctly expresses  $C$  in terms of  $Q$  and  $PE_{\text{electric}}$ ?

A)  $C = 2Q^2 \times PE_{\text{electric}}$

B)  $C = \frac{2Q^2}{PE_{\text{electric}}}$

C)  $C = \frac{PE_{\text{electric}}}{2Q^2}$

D)  $C = \frac{Q^2}{2PE_{\text{electric}}}$

7 - JUNE 2022 ( cancelled ) / Q 6



The impulsive force ( $f$ ) derives from impulse, and it is a big force acting for a small interval of time. It is like having a truck travelling at a full speed, and suddenly crashing a garden's gate because the driver did not pay attention to it. It can be represented by  $f = m \frac{v_f - v_i}{t}$ , with  $m$  the mass of the body,  $v_f$  the final velocity,  $v_i$  the initial velocity, and  $t$  the time interval through which the force is applied. Which of the following represents  $v_i$  in terms of  $f$ ,  $m$ ,  $t$ , and  $v_f$ ?

- A.  $v_i = v_f - \frac{ft}{m}$
- B.  $v_i = v_f + \frac{ft}{m}$
- C.  $v_i = v_f - \frac{fm}{t}$
- D.  $v_i = v_f + \frac{fm}{t}$

g- Sample test



$$(y + g)(kx + g) = 1$$

The given equation relates the positive numbers  $g$ ,  $k$ ,  $x$ , and  $y$ . Which equation correctly express  $y$  in terms of  $g$ ,  $k$ , and  $x$ ?

- A)  $y = \frac{1}{kx + g} - g$
- B)  $y = \frac{1 - g}{kx + g}$
- C)  $y = 1 - kx - 2g$
- D)  $y = kx - g$

9- Sample Test



$$z = \frac{x + 3}{2y}$$

The given equation relates the distinct positive real numbers  $x$ ,  $y$ , and  $z$ . Which equation correctly expresses  $x$  in terms of  $y$  and  $z$ ?

- A)  $x = 2yz + 3$
- B)  $x = 2yz - 3$
- C)  $x = \frac{z}{2y} - 3$
- D)  $x = \frac{z - 3}{2y}$

10- Sample Test



The equation  $y = \frac{x + w}{z}$  relates the positive numbers  $w$ ,  $x$ ,  $y$ , and  $z$ . Which equation correctly expresses  $x$  in terms of  $w$ ,  $y$ , and  $z$ ?

- A)  $x = yz - w$
- B)  $x = yz + w$
- C)  $x = \frac{z}{wy}$
- D)  $x = \frac{y}{zw}$

## 11- Sample test



A bricklayer uses the formula  $n = 7\ell h$  to estimate the number of bricks,  $n$ , needed to build a wall that is  $\ell$  feet long and  $h$  feet high. Which of the following correctly expresses  $\ell$  in terms of  $n$  and  $h$ ?

- A)  $\ell = \frac{7}{nh}$   
 B)  $\ell = \frac{h}{7n}$   
 C)  $\ell = \frac{n}{7h}$   
 D)  $\ell = \frac{n}{7+h}$

## 12- Sample test



The formula  $d = rt$  is used to calculate the distance an object travels over a period of time,  $t$ , at a constant rate,  $r$ . Based on this formula, what is the rate,  $r$ , in terms of  $d$  and  $t$ ?

- A)  $r = \frac{d}{t}$   
 B)  $r = dt$   
 C)  $r = \frac{t}{d}$   
 D)  $r = d - t$

## 13- Sample test



The formula below is often used by project managers to compute  $E$ , the estimated time to complete a job, where  $O$  is the shortest completion time,  $P$  is the longest completion time, and  $M$  is the most likely completion time.

$$E = \frac{O + 4M + P}{6}$$

Which of the following correctly gives  $P$  in terms of  $E$ ,  $O$ , and  $M$ ?

- A)  $P = 6E - O - 4M$   
 B)  $P = -6E + O + 4M$   
 C)  $P = \frac{O + 4M + E}{6}$   
 D)  $P = \frac{O + 4M - E}{6}$

1- AUGUST 2021 Q 27



$$f' = \left( \frac{v + v_0}{v} \right) f$$

You are riding in a car at a velocity  $v_0$ , in meters per second, towards a loud block party. Because of this movement, the actual frequency of the sound waves emitted by the speakers,  $f$ , in hertz, is perceived by you to be a different frequency  $f'$ , in hertz.

The speaker's sound waves travel at a velocity  $v$ , in meters per second. This phenomenon is called the Doppler effect. The formula above shows the relationship between these variables.

Which of the following expresses the velocity of the car  $v_0$  in terms of the other variables?

- A.  $v_0 = \frac{f' - f}{v f}$
- B.  $v_0 = \frac{f - f'}{f'} v$
- C.  $v_0 = \frac{f}{f'} v$
- D.  $v_0 = \frac{f' - f}{f} v$

2- OCTOBER 2021 Q 15



Intensity is the measure of the energy transmitted by a wave. Usually, it depends on the strength and the amplitude of a wave and its unit is Watts per square meters. The formula of intensity is given by  $I = \frac{P}{A}$ , where  $P$  is the power (in Watts), and  $A$  is the area of the cross section (in square meters).

What is the formula for the radius ( $R$ ) of a circular surface in terms of  $I$  and  $P$ ?

- A.  $R = \frac{P}{I}$
- B.  $R = \frac{P}{I\pi}$
- C.  $R = \sqrt{\frac{P}{I}}$
- D.  $R = \sqrt{\frac{P}{I\pi}}$

## 3 - SAMPLE TEST / Q 28



Ivana is driving her car on a straight highway. The table below shows a linear relation between her position and time.

Time (s)	4	6	8	10	12
Position (m)	9	13	17	21	25

To find the velocity of the car, we have to divide the displacement by the time

$$v_{avg} = \frac{x_f - x_i}{t_f - t_i}$$

with  $x_f$  being the final position for a certain period of time, and  $x_i$  the initial position,  $t_f$  represents the final time and  $t_i$  the initial time.

Which formula represents  $t_i$  in terms of  $v_{avg}$ ,  $x_f$ ,  $x_i$ , and  $t_f$ ?

A)  $t_i = v_{avg} \times \frac{x_f - x_i}{t_f}$

B)  $t_i = t_f - \frac{x_f - x_i}{v_{avg}}$

C)  $t_i = t_f + \frac{x_f - x_i}{v_{avg}}$

D)  $t_i = v_{avg} \times \frac{t_f}{x_f - x_i}$

## 4 - JUNE 2022 ( cancelled ) / Q 30



The sum of three numbers is equivalent to the product of the third number and half the difference of the first two numbers. Assuming that the first number is  $a$ , the second number is  $b$ , and the third number is  $c$ , which of the following statements represents  $a$  in terms of  $b$  and  $c$ ?

A.  $a = cb + 2b + 2c$

B.  $a = \frac{cb + 2b + 2c}{c - 2}$

C.  $a = \frac{-cb - 2b - 2c}{c + 2}$

D.  $a = -cb - 2b - 2c$

## 5- Sample test



Newton's second law of motion states that a force,  $F$ ,

acting on an object of mass  $m$  results in an

acceleration,  $a$ , and can be represented using the

equation  $F = ma$ . If mass is measured in kilograms

(kg), and acceleration is measured in meters per

second squared  $\left(\frac{\text{meter}}{\text{sec}^2}\right)$ , which of the following

units could be used to measure force?

A)  $\frac{\text{kg} \cdot \text{meter}}{\text{sec}^2}$

B)  $\frac{\text{kg} \cdot \text{sec}^2}{\text{meter}}$

C)  $\frac{\text{meter}}{\text{kg} \cdot \text{sec}^2}$

D)  $\text{kg} \cdot \text{meter} \cdot \text{sec}^2$

## 6- Sample test



If  $2\sqrt{2x} = a$ , what is  $2x$  in terms of  $a$ ?

- A)  $\frac{a}{2}$
- B)  $\frac{a^2}{4}$
- C)  $\frac{a^2}{2}$
- D)  $4a^2$

## 7- Sample test



The density  $d$  of an object is found by dividing the mass  $m$  of the object by its volume  $V$ . Which of the following equations gives the mass  $m$  in terms of  $d$  and  $V$ ?

- A)  $m = dV$
- B)  $m = \frac{d}{V}$
- C)  $m = \frac{V}{d}$
- D)  $m = V + d$

## ANSWERS OF LESSON (IN TERMS OF )

### NON CALCULATOR



Question	Answer
1	C
2	D
3	B
4	B
5	C
6	D
7	A
8	A
9	B
10	A
11	C
12	A
13	A
14	
15	
16	
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### CALCULATOR

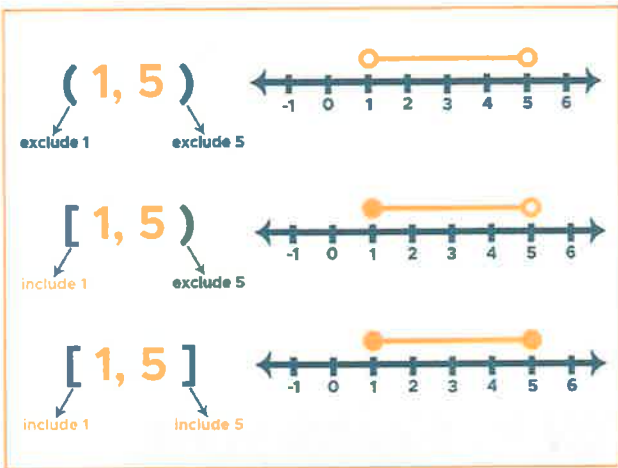
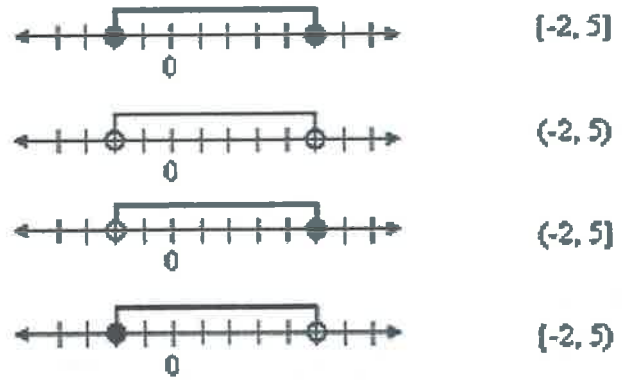
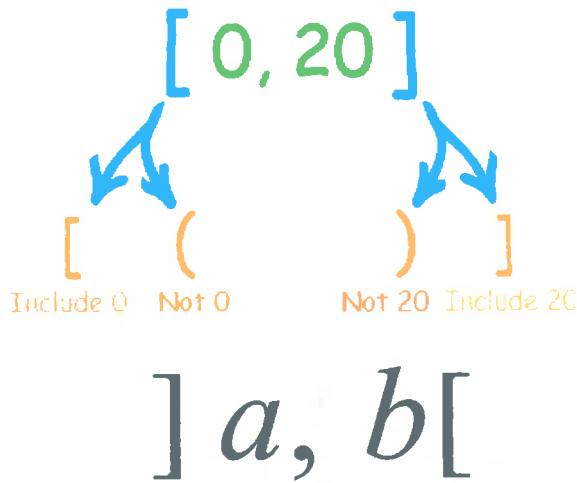


Question	Answer
1	D
2	D
3	B
4	B
5	A
6	B
7	A
8	
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12	
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# Inequality



# Interval Notation



Interval Notation For Disjunctions...

$$x \leq -1 \text{ OR } x > 6$$



$$(-\infty, -1] \cup (6, \infty)$$

DISJUNCTION

## Interval Notation – Symbols

□ Has 2 types of symbols: brackets and parentheses













$$[4, 12)$$

$[ ] \rightarrow$  brackets

$( ) \rightarrow$  parentheses

- Inclusive (the number is included)
- Exclusive (the number is excluded)
- $=, \leq, \geq$
- $\neq, <, >$

# Inequality vs. Interval Notation

$x > 5$		$(5, \infty)$
$x \geq 5$		$[5, \infty)$
$x < 5$		$(-\infty, 5)$
$x \leq 5$		$(-\infty, 5]$
$1 < x < 5$		$(1, 5)$
$1 \leq x < 5$		$[1, 5)$
$1 < x \leq 5$		$(1, 5]$
$1 \leq x \leq 5$		$[1, 5]$
$x < 1 \text{ or } x > 5$		$(-\infty, 1) \cup (5, \infty)$
$x \leq 1 \text{ or } x > 5$		$(-\infty, 1] \cup (5, \infty)$
$x < 1 \text{ or } x \geq 5$		$(-\infty, 1) \cup [5, \infty)$
$x \leq 1 \text{ or } x \geq 5$		$(-\infty, 1] \cup [5, \infty)$

	American	European
○ — ○	open & closed	bounded
● — ●	closed	"
● — ○	half-open	"
○ — ●	half-open	"
○ — ○	open	"
● — →	closed	unbounded
○ — →	open	"
← — ●	closed	"
← — ○	open	"
← — →	open & closed	"
$\emptyset$		
$\{x \mid a \leq x \leq b\}$	$[a, b]$	$[a, b]$
$\{x \mid a \leq x < b\}$	$[a, b)$	$[a, b[$
$\{x \mid a < x \leq b\}$	$(a, b]$	$]a, b]$
$\{x \mid a < x < b\}$	$(a, b)$	$]a, b[$
$\{x \mid a \leq x\}$	$[a, \infty)$	$[a, \infty[$
$\{x \mid a < x\}$	$(a, \infty)$	$]a, \infty[$
$\{x \mid x \leq b\}$	$(-\infty, b]$	$] - \infty, b]$
$\{x \mid x < b\}$	$(-\infty, b)$	$] - \infty, b[$
$\mathbb{R}$	$(-\infty, \infty)$	$] - \infty, \infty[$

How to find the variable in an inequality equation

$$3x + 5 > 15$$

$$3x > 15 - 5$$

$$3x > 10$$

$$x > \frac{10}{3}$$

When we flip the inequality sign?

$$7 - 3x \leq 10$$

$$-3x \leq 10 - 7$$

$$\frac{-3x}{-3} \leq \frac{3}{-3}$$

flip

$$x \geq -1$$

$$5 - x \geq 20$$

$$-x \geq 20 - 5$$

$$-1(-x) \geq (15) - 1$$

flip

$$x \leq -15$$

$$13 \geq 3x + 1 \geq 7$$

Firstly add  $(-1)$

$$13 - 1 \geq 3x + 1 - 1 \geq 7 - 1$$

Divide (3)  $\frac{12}{3} \geq \frac{3x}{3} \geq \frac{6}{3}$

$$4 \geq x \geq 3$$

# *Questions*



## 1- MARCH 2021 Q 2



Among the following ordered pairs, which one is a solution of the system

$$\begin{cases} y > x \\ y \leq -x \end{cases} ?$$

- A.  $(-1,0)$
- B.  $(0,-1)$
- C.  $(-1,2)$
- D.  $(0,1)$

## 3 - OCTOBER 2021 Q 13



If  $3 < 2x + 7 \leq 15$ , which of the following integers represents the smallest value for  $x + 3$ ?

- A. 1
- B. 2
- C.  $-2$
- D.  $-1$

## 2- MARCH 2021 Q 4



If  $(x - 2)(y + 3) \geq 0$ , then which of  $x$  and  $y$  could verify the inequality?

- A.  $x = 3 ; y = -4$
- B.  $x = 1 ; y = -2$
- C.  $x = -1 ; y = -4$
- D.  $x = -2 ; y = 0$

## 4 - MARCH 2022 / Q 11



If  $k$  is an integer, and  $\frac{k+5+6}{3}$  is greater than 15, what is the lowest possible value of  $k$ ?

- A. 34
- B. 35
- C. 33
- D. 36

5 - SAMPLE TEST / Q 10



If  $a$ ,  $b$ , and  $c$  are three positive numbers such that  $a - b = 12$  and  $a - c = 9$ , which of the following is correct?

- A)  $a < b < c$
- B)  $a < c < b$
- C)  $a > b > c$
- D)  $a > c > b$

6 - JUNE 2022 ( cancelled ) / Q 10



If  $a + b > 0$ , and  $a - c < 0$ , then  $b + c$ ?

- A. Is smaller than 0, with  $a < c$
- B. Is greater than 0, with  $a < c$
- C. Is smaller than 0, with  $a > c$
- D. Is greater than 0, with  $a > c$

## 1- OCTOBER 2020 Q 14



If  $5 - \frac{3}{2}x \geq 3$ , what is the highest value of  $\frac{9}{8}x + 1$ ?

- A. 2.5
- B. 3.5
- C. 4.5
- D. 5.5

## 2- OCTOBER 2020 Q 15



A craftsman is looking for two kinds of paint from a wholesaler. The first kind **a** is packaged in 10 kg jars, the second **b** in 25 kg jars. The 10 kg jar costs \$45 and the 25 kg one costs 120\$. The load must not exceed 250 kg and the total sum must be at least 900\$ in order to get a discount. Which system of inequalities verifies the given information?

- A.  $\begin{cases} 10a + 25b \geq 250 \\ 45a + 120b \leq 900 \end{cases}$
- B.  $\begin{cases} 10a + 25b \leq 250 \\ 45a + 120b \leq 900 \end{cases}$
- C.  $\begin{cases} 10a + 25b \geq 250 \\ 45a + 120b \geq 900 \end{cases}$
- D.  $\begin{cases} 10a + 25b \leq 250 \\ 45a + 120b \geq 900 \end{cases}$

## 3- DECEMBER 2020 Q 6



If  $2z - 7(z - 1) \leq 1$  and  $z$  is an integer, what is the least possible value of  $z$ ?

- A. -2
- B. 0
- C. 2
- D. 4

## 4- MAY 2021 Q 25



$$-3 < 2x - y \leq 14$$

Which point could be the solution for the inequality above?

- A. (0, 3)
- B. (4, -8)
- C. (3, 4)
- D. (4, 12)

## 5- JUNE 2021 Q 2



If  $-\frac{4}{5}x + 3 \geq 2 - \frac{1}{5}x$ , what is the highest value of  $\frac{3}{2}x + 4$ ?

- A. 3.5
- B. 4.5
- C. 5.5
- D. 6.5

6- JUNE 2021 Q 17



Anton has \$20 to spend on stationary. Pens ( $p$ ) cost \$1.4 each, coloring crayons ( $c$ ) are priced at \$3.5 per pack and highlighters ( $h$ ) sell for \$2 each. He must buy a notebook for \$5.5 as well. Which of the following describes how many highlighters Anton can buy?

- A.  $h \leq \frac{14.5 - 1.4p - 3.5c}{2}$   
 B.  $h \leq \frac{14.5 + 1.4p + 3.5c}{2}$   
 C.  $h \leq \frac{20 - 1.4p - 3.5c}{2} - 5.5$   
 D.  $h \leq \frac{20 - 1.4p - 3.5c}{2}$

7- JUNE 2021 Q 29



Which value of  $x$  could make the inequality  $\frac{2}{3}(x + 2) - x > 5$  true?

- A. -12  
 B. -10  
 C. -8  
 D. -6

8- JUNE 2021 Q 37



Consider the system  $\begin{cases} -2x + y < 3 \\ y + x \geq -5 \end{cases}$   
 For  $x = 2$ , what is the highest integer value of  $y$ ?

9- OCTOBER 2021 Q 26



Given  $2x - 7 < 5$  and  $\frac{3x}{2} - 2 > \frac{19}{4}$ , what is the only integer  $x$  that satisfies both inequalities?

- A. 3  
 B. 4  
 C. 5  
 D. 6

10- DECEMBER 2021 Q1



If  $x$  is a positive number less than 1, then which of the following is true?

- I.  $x^2 < x$   
 II.  $x^3 > x$   
 III.  $x + 1 > 1$
- A. III only  
 B. I and II  
 C. II and III  
 D. I and III

## 11 - MARCH 2022 / Q 25



If  $5(x + 2) - 3x \leq 4 + 2x + 3(x - 1)$ ,  
what is the solution of  $x$ ?

- A.  $x \leq -3$
- B.  $x \leq 3$
- C.  $x \geq 3$
- D.  $x \geq -3$

## 12 - SAMPLE TEST / Q 26



The two points  $A(2,5)$  and  
 $B(-1,-4)$  satisfy which inequality  
?

- A)  $2x - 5y > -3$
- B)  $-3x + 2y \geq 1$
- C)  $5x - y \geq -2$
- D)  $-x + 3y < 10$

## 13 - SAMPLE TEST / Q 37



What is the smallest integer  
that satisfies the inequalities

$$3 - 2n \leq -14 \text{ and } \frac{1}{2}n - 3 < 4?$$

## 14 - JUNE 2022 (cancelled) / Q 1



Given the two inequalities  
 $3x + 1 \geq 8$  and  $4x - 1 < 3(x + 3)$ ,  
what is the greatest possible integer  
for  $x$ ?

- A. 2
- B. 3
- C. 9
- D. 10

## 15 - JUNE 2022 (cancelled) / Q 7



Which of the following ordered pairs  
satisfy both inequalities:  $x + 3y \leq 8$   
and  $2x - y > 9$ ?

- A. (0, 3)
- B. (1, 2)
- C. (1, -2)
- D. (1, -9)

## ANSWERS OF LESSON ( INEQUALITY )

### NON CALCULATOR



Question	Answer
1	A
2	C
3	B
4	B
5	D
6	B

### CALCULATOR



Question	Answer
1	A
2	D
3	C
4	C
5	D
6	A
7	A
8	6
9	C
10	D
11	C
12	C
13	9
14	C
15	D
16	

# Absolute Value

$$|5| = 5$$

$$|-5| = 5$$



1

$$|x - 5| = 4$$

$$x - 5 = 4$$

$$x = 9$$

$$x - 5 = -4$$

$$x = 1$$

2

$$|x - 2| < 8$$

$$x - 2 < 8$$

$$x < 10$$

$$x - 2 > -8$$

$$x > -6$$

$$10 > x > -6$$

3

$$|-2x + 4| \leq 20$$

$$-2x + 4 \leq 20$$

$$\frac{-2x}{-2} \leq \frac{16}{-2}$$

$$x \geq -8$$

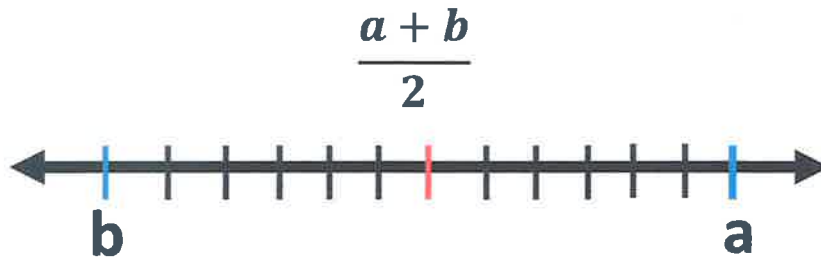
$$-2x + 4 \geq -20$$

$$-2x \geq -24$$

$$x \leq 12$$

$$-8 \leq x \leq 12$$

4



$$b < x \leq a$$

$$\left| x - \frac{a+b}{2} \right| < \left( a - \frac{a+b}{2} \right)$$

# *Questions*



1- DECEMBER 2020 Q 9



If  $a$  is a solution of the equation  $|2x - 4| = 5$ , what is the distance between  $a$  and the point of coordinate 2 on the number line?

- A. 0.5
- B. 2.5
- C. 4.5
- D. 5

2- JUNE 2021 Q 18



If  $|-2b - 3| \leq 7$ , how many possible integer values of  $b$  are there?

3- DECEMBER 2021 Q 11



The graphs of  $f(x) = |x| - 2$  and  $g(x) = 1$  in the same system will have:

- A. 0 points of intersection
- B. 1 point of intersection
- C. 2 points of intersection
- D. 4 points of intersection

4- MARCH 2022 / Q 3



Which of the following intervals could be part of the solution of the inequality  $|3x - 3| < 3$ ?

- A.  $\left[\frac{1}{2}, \frac{5}{2}\right]$
- B.  $\left[\frac{1}{4}, \frac{3}{2}\right]$
- C.  $\left[-\frac{1}{2}, \frac{1}{2}\right]$
- D.  $\left[0, \frac{1}{2}\right]$

## 5 - SAMPLE TEST / Q 18



Given the equation  $2 - |3b - 2| = -4$ , what is the greatest value of  $b$ ?

## 6- Sample Question



Which of the following expressions is equal to 0 for some value of  $x$ ?

- A)  $|x - 1| - 1$
- B)  $|x + 1| + 1$
- C)  $|1 - x| + 1$
- D)  $|x - 1| + 1$

## 7- Sample Question



$$\left| \frac{1}{2}x + 4 \right| = 2$$

Which of the following values of  $x$  satisfies the equation above?

- I. -12
  - II. -4
  - III. 4
- A) II only
  - B) III only
  - C) I and II only
  - D) II and III only

## 8- Sample Question



If  $\left| \frac{4}{3}x - 2 \right| < 3$  and  $x$  is an integer, what is one possible value of  $x$ ?

## 9- Sample Question



$$2x + 1 = 5$$

If  $a$  and  $b$  are the solutions to the equation above, what is the value of  $|a - b|$ ?

## 10 - Sample Question



$$|5 - x| = 4$$

The value of one solution to the equation above is 1. What is the value of the other solution?

## 11- Sample Question



The function  $f$  is defined by  $f(x) = |x - 2| - 3$ . If  $f(a) = f(0)$  and  $a > 0$ , what is the value of  $a$ ?

- A) 3
- B) 4
- C) 5
- D) 6

## 12- Sample Question



$$|x - 4| = 19$$

What are all the solutions to the given equation?

- A) 23 only
- B) 15 only
- C) 15 and -23
- D) -15 and 23

13- Sample test



$$|x - 1| = 8$$

If  $x$  is a solution to the given equation, what is a possible value of  $x - 1$ ?

- A) -8
- B) -6
- C) 6
- D) 7

14- Sample test



$$|2x + 6| + 4 = 8$$

What is the sum of the solutions to the given equation?

- A) -6
- B) -3
- C) 0
- D) 8

## 1- OCTOBER 2020 Q 33



If  $|2b - 1| \leq 3$ , how many possible integer values of  $b$  are there?

## 2- AUGUST 2021 Q 24



For what value of  $x$ ,  $|4 - x| - 2$  is less than 0?

- A. -7
- B. 1
- C. 3
- D. There is no such value of  $x$

## 3- OCTOBER 2021 Q 25



Which of the following points is not a solution to  $|2x - 1| > 3y$ ?

- A. (4, 2)
- B. (2, 1)
- C. (-1, -1)
- D. (-2, 1)

## 4- DECEMBER 2021 Q 2



In a school competition, students have to prepare sketches of length  $x$  minutes. The minimum length is 2 minutes and the maximum length is 3 minutes.

Which inequality represents the given situation?

- A.  $|x - 2| < 3$
- B.  $|x - 3| < 2$
- C.  $|x - 2.5| \leq 0.5$
- D.  $|x - 0.5| \leq 2.5$

## 5- DECEMBER 2021 Q 31



If  $|2x - 3| \leq 4$ , what is the greatest possible value of  $|3x - 2|$ ? (Grid in)

## 6- Sample test



$$2|x - 9| = 20$$

What is the sum of the solutions to the given equation?

## ANSWERS OF LESSON ( ABSOLUTE VALUE )

**NON CALCULATOR**



Question	Answer
1	B
2	8
3	D
4	B
5	8/3
6	A
7	C
8	$\frac{15}{4} > x > \frac{-3}{4}$
9	5
10	9
11	B
12	D
13	A
14	A
15	
16	
17	
18	
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28	
29	

**CALCULATOR**



Question	Answer
1	4
2	C
3	B
4	C
5	8.5 OR 17/2
6	18
7	
8	
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10	
11	
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Power



1)  $b^m \times b^n = b^{m+n}$

2)  $b^m \div b^n = b^{m-n}$

3)  $(b^m)^n = b^{mn}$

4)  $b^m = b^n \longrightarrow m = n$

5)  $b^0 = 1$

6)  $b^1 = b$

7)  $0^{10} = 0$

8)  $a^{-2} = \frac{1}{a^2}$

9)  $\sqrt{ab} = \sqrt{a} \times \sqrt{b}$

10)  $\sqrt{\frac{a}{b}} = \frac{\sqrt{a}}{\sqrt{b}}$

11)  $\sqrt{a \pm b} \neq \sqrt{a} \pm \sqrt{b}$

$$(\sqrt{x})^2 = (5)^2$$

$$x = 25$$

$$\sqrt{x} = x^{\frac{1}{2}}$$

$$\sqrt[3]{a^2} = a^{\frac{2}{3}}$$

$$\sqrt[m]{b^n} = b^{\frac{n}{m}}$$

$$(ax)^3 = a^3 \cdot x^3$$

# *Questions*



1- OCTOBER 2020 Q 3



$$\sqrt{1.25} \times \sqrt{1.8}$$

The above expression can be written in the form of a rational number  $k$ . What is the value of  $k$ ?

- A.  $\frac{2}{3}$
- B.  $\frac{3}{2}$
- C.  $\frac{2}{5}$
- D.  $\frac{5}{3}$

2- OCTOBER 2020 Q 19



What is the value of  $\frac{2^5 \times 16^4}{64^3}$ ?

3- DECEMBER 2020 Q 17



If  $\sqrt{2^m} = 8$ , what is the value of  $\sqrt{3^m}$ ?

4- MAY 2021 Q 10



If  $9^{2x-1} = 3^8$ , what is the value of  $2x - 5$ ?

- A. -5
- B. 0
- C. 5
- D. 10

5- JUNE 2021 Q 15



If  $m$  and  $k$  are positive numbers, which of the following expressions is equivalent to  $(16k^{12}m^4)^{\frac{1}{4}}$ ?

- A.  $4k^3m$
- B.  $2k^3$
- C.  $4k^3m^2$
- D.  $2k^3m$

6- JUNE 2021 Q 20



If  $(3^9)^{3^{12}} = 3^{3^x}$ , what is the value of  $x$ ?

7- AUGUST 2021 Q 16



If  $3x - y = 1$  and  $\frac{8^{2x}}{4^y} + t = 7$ , what is the value of  $t$ ?

8- OCTOBER 2021 Q 16



What is the value of  $m + \frac{3}{4}$  if  $4^{2m+1} = 32^3$ ? (Grid-in)

9- DECEMBER 2021 Q 8



Which of the following is the simplest form of the expression

$$\frac{24ab^4c^2}{27a^3b^4c}?$$

- A.  $\frac{8a^2c}{9}$   
 B.  $\frac{8c}{9a^2}$   
 C.  $\frac{8c}{9a^2}$   
 D.  $\frac{8b^8c}{9a^2}$

10- DECEMBER 2021 Q 13



$$\left(\frac{2x-3}{x-3}\right)^2 \div \frac{3}{2x-6}$$

Which of the following is equivalent to the expression above, given that  $x \neq 3$ ?

- A.  $\frac{2(2x-3)^2}{3(x-3)}$   
 B.  $\frac{2(x-3)}{3(2x-3)^2}$   
 C.  $\frac{2(2x-3)}{3(x-3)^2}$   
 D.  $\frac{2(2x-3)^2}{3}$

11- DECEMBER 2021 Q 17



$$3x - 1 = \sqrt{3k^2 - x}$$

If  $k > 0$  and  $x = 2$  in the equation above, what is the value of  $k$ ? (Grid in)

12 - MARCH 2022 / Q 5



If  $\sqrt{x-2} = 10$ , what is the value of  $3x$ ?

- A. 98
- B. 102
- C. 294
- D. 306

13 - MARCH 2022 / Q 9



If  $3^{2x-1} = 27$ , what is the value of  $\frac{1}{2}x + 3$ ?

- A. 3
- B. 0
- C. 5
- D. 4

14 - SAMPLE TEST / Q 1



If  $9^{2x+1} = \frac{1}{27}$ , then what is the value of  $4^{4x+5}$ ?

- A) 0
- B) 1
- C) 4
- D) 256

15 - SAMPLE TEST / Q 17



Given that the cube of a positive number is 150, what would be the value of the product of twice this number and its square?

16 - JUNE 2022 ( cancelled ) / Q 9



If  $4^{2x+4} = 16$ , what is the value of  $4^{3x}$ ?

- A.  $\frac{1}{64}$
- B. 64
- C. 4096
- D.  $\frac{1}{4096}$

1- OCTOBER 2020 Q 11



$$\sqrt{27x^3y^5 - 18x^2y^4}$$

Which of the following is equivalent to the above expression? (x and y > 0)

- A.  $3xy^2(\sqrt{3xy} - \sqrt{2})$
- B.  $3xy^2\sqrt{3xy - 2}$
- C.  $9xy^2\sqrt{3xy - 2}$
- D.  $9xy^2(\sqrt{3xy} - \sqrt{2})$

2- MAY 2021 Q 36



Given that  $3^x = 11$ , what is the value of  $2(3^{3x}) - 4$ ? (grid-in)

3- JUNE 2021 Q 27



$$\frac{\sqrt[4]{3}}{\sqrt[8]{3}}$$

Which of the following is equivalent to the quotient of the division given above?

- A.  $\sqrt{3}$
- B.  $\sqrt[4]{3}$
- C.  $\sqrt[8]{3}$
- D. 9

4- OCTOBER 2021 Q 7



Which of the following is equivalent to  $\frac{4m\sqrt{3a} - 2\sqrt{27am^2} + m\sqrt{12a}}{\sqrt{243a^5}}$  for all positive values of a and m?

- A.  $\frac{2m}{9a^2}$
- B.  $\frac{m}{9a^2}$
- C.  $-\frac{m}{9a^2}$
- D. 0

5- DECEMBER 2021 Q 22



If  $3^x \cdot \sqrt[4]{3} = 9^{2x}$ , then x =

- A. 4
- B.  $\frac{1}{12}$
- C.  $\frac{4}{3}$
- D.  $-\frac{7}{4}$

6- DECEMBER 2021 Q 24



If  $A = \frac{\sqrt{16x^2y^2}}{\sqrt[3]{-125x^3y^3 + 2xy}}$  and  $x > 0, y < 0$  then A =

- A.  $-\frac{4}{7}$
- B.  $\frac{3}{4}$
- C.  $-\frac{4}{3}$
- D.  $\frac{4}{3}$

7- MARCH 2022 / Q 13



If  $\frac{a}{b}$  is negative, which of the following is definitely negative?

- A.  $2ab$
- B.  $a^2b$
- C.  $(b-a)^2$
- D.  $a-b$

8 - MARCH 2022 / Q 28



What is the average (arithmetic mean) of  $2^{11}$  and  $2^{23}$ ?

- A.  $2^{17}$
- B.  $2^{15}$
- C.  $2^{10} + 2^{22}$
- D.  $2^{34}$

9 - MARCH 2022 / Q 36



Given that  $2(16^x) = 64$ , what is the value of  $2x$ ? (grid-in)

10 - JUNE 2022 (cancelled) / Q 10



What is the solution for  $x$  in  $2 = \sqrt{2x - 3}$ ?

- A. 2.5
- B. 3.5
- C. 4.5
- D. 0.5

## ANSWERS OF LESSON ( POWER )

### NON CALCULATOR



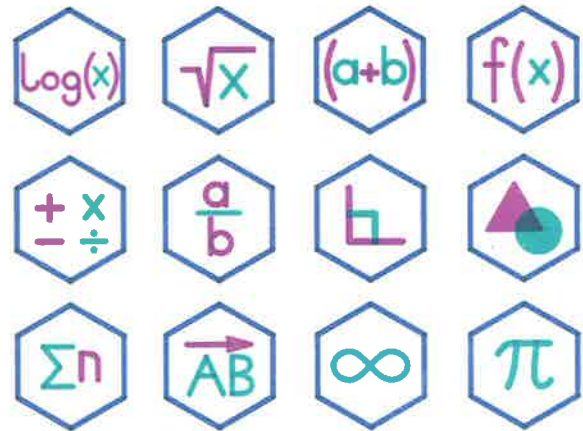
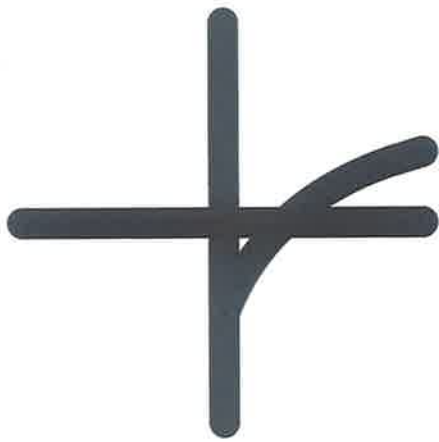
Question	Answer
1	B
2	8
3	27
4	B
5	D
6	14
7	3
8	4
9	B
10	A
11	3
12	D
13	D
14	B
15	300
16	A
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### CALCULATOR



Question	Answer
1	B
2	2658
3	C
4	D
5	B
6	D
7	A
8	C
9	2.5 OR 5/2
10	B
11	
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# Log and Ln



$$\log_3 9 = 2 \Leftarrow 3^2 = 9$$

$$\log_5 7 = x \Leftarrow 5^x = 7$$



★  $Log_b(m.n) = \log_b m + \log_b n$

★  $\log_b\left(\frac{m}{n}\right) = \log_b m - \log_b n$

★  $Log_b m^k = k.\log_b m$

★  $Log_b(1) = 0 \Rightarrow b^0 = 1$

★  $Log_b b = 1 \Rightarrow b^1 = b$

★  $Log_b b^k = k$

★  $bLog_b k = k$

**ln** : is the natural log or in inverse of (*e*)

what (*e*) : it is a mathematical constant = 2.71828

$$\ln(5) = Log_e(5) = 1.609$$



★  $\ln(xy) = \ln(x) + \ln(y)$

★  $\ln\left(\frac{x}{y}\right) = \ln x - \ln y$

★  $\ln\left(\frac{1}{x}\right) = -\ln(x)$

★  $\ln(x^y) = y.\ln x$

★  $\ln(0) = \textit{undifiend}$

★  $\ln(\infty) = \infty$

★  $\ln(e) = 1$

★  $\ln e^x = x$

★  $e^{\ln x} = x$

# *Questions*



## 1- Sample test



For all  $x > 0$ , which of the following expressions is equivalent to  $\log\left((2x)^{\frac{1}{2}}\right)$ ?

- A.  $\log x$
- B.  $\log 1 + \log \frac{x}{2}$
- C.  $\log 2 + \frac{1}{2} \log x$
- D.  $\frac{1}{2} \log 2 + \frac{1}{2} \log x$

## 2- Sample test



$$\log_{10} A/B =$$

- A.  $\frac{\log_{10} A}{\log_{10} B}$
- B.  $\log_A 10 - \log_B 10$
- C.  $\log_{10} A - \log_{10} B$
- D.  $\log_A 10 + \log_B 10$

## 3- Sample test



What is the real value of  $x$  in the equation  $\log_2 24 - \log_2 3 = \log_5 x$ ?

- F. 3
- G. 21
- H. 72
- J. 125

## 4- Sample test



What is the value of  $\log_2 8$ ?

- A. 3
- B. 4
- C. 6
- D. 10

## 5- Sample test



Given that  $a$ ,  $b$ , and  $c$  are all positive, which of the following is equivalent to  $\log\left(\frac{ab^2}{c}\right)$ ?

- F.  $\log a + 2 \log b - \log c$
- G.  $2(\log a + \log b) - \log c$
- H.  $\frac{2a \log b}{\log c}$
- J.  $\frac{(\log a)(\log b^2)}{\log c}$

## 6- Sample test



If  $A = 10^{B+C}$ , what is  $\log_{10} A$ ?

- F.  $B$
- G.  $B + C$
- H.  $10^A$
- J.  $10^B + 10^C$

## 7- Sample test



If  $\log_a x = s$  and  $\log_a y = t$ , then  $\log_a (xy)^2 = ?$

- A.  $2(s + t)$
- B.  $s + t$
- C.  $4st$
- D.  $2st$

## 1- MARCH 2021 Q 28



The solution of the equation  $3^x = 5^{x-2}$  is

- A.  $x = \frac{\ln 5}{2\ln(\frac{5}{3})}$   
 B.  $x = \frac{2\ln 5}{\ln(\frac{5}{3})}$   
 C.  $x = \frac{\ln 5}{\frac{\ln 3}{5}}$   
 D.  $x = \frac{-2\ln 5}{\ln(\frac{5}{3})}$

## 2- DECEMBER 2021 Q 27



Which of the following represents  $3^4 = 81$  in logarithmic form?

- A.  $\log_3 4 = 81$   
 B.  $\log_4 81 = 3$   
 C.  $\log_3 81 = 4$   
 D.  $\log_{81} 3 = 4$

## 3- sample question



Express the following in logarithmic form :

$$81 = 3^4$$

- A.  $\log_3 81 = 4$   
 B.  $\log_9 81 = 2$   
 C.  $2 \log_3 9 = 4$   
 D.  $4 \log_9 3 = 2$

## 4- sample question



The logarithmic form of  $(81)^{\frac{3}{4}} = 27$  is

- A.  $\log_{66} 36 = \frac{2}{9}$   
 B.  $\log_{81} 27 = \frac{3}{4}$   
 C.  $\log_{16} 33 = \frac{7}{2}$   
 D.  $\log_{78} 12 = \frac{1}{3}$

## 5- sample question



The logarithm form of  $(81)^{\frac{3}{m}} = 27$  is  $\log_{81} 27 = \frac{3}{m}$ .

Then value of  $m$  is equal to

- A 2
- B 0
- C 4
- D 3

## 6- sample question



Express  $\log 144$  in terms of  $\log 2$  and  $\log 3$

- A  $4 \log 2 + 2 \log 3$
- B  $4 \log 2 + \log 3$
- C  $4 \log 2 - 2 \log 3$
- D  $\log 2 + 2 \log 3$

## 7- sample question



Solve for  $x$ ,  $\log_6 9 - \log_9 27 + \log_8 x = \log_{64} x - \log_6 4$

- A  $\frac{7}{8}$
- B  $\frac{11}{8}$
- C  $\frac{1}{8}$
- D  $\frac{5}{8}$

## 8- sample question



Here is an exponential expression:

$$a^b = c$$

Which of the following is equivalent to the expression above?

- A.  $\log_a(b) = c$
- B.  $\log_b(c) = a$
- C.  $\log_a(c) = b$
- D.  $\log_c(a) = b$

## 9- sample question



For all  $x > 2$ ,  $\log(x - 2) + \log x = ?$

- A.  $\log(-2)$
- B.  $\log(2x - 2)$
- C.  $\log(x^2 - 2x)$
- D.  $\log\left(\frac{x-2}{x}\right)$

## ANSWERS OF LESSON ( LOGARITHMS )

### NON CALCULATOR



Question	Answer
1	D
2	C
3	J
4	A
5	F
6	G
7	A
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### CALCULATOR



Question	Answer
1	B
2	C
3	A
4	B
5	C
6	A
7	C
8	C
9	C
10	
11	
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# Complex Number

$$\mathbb{C}$$
$$a+bi$$

$\sqrt{-1} = i$  (imaginary numbers)  
to change from imaginary to real

$$(\sqrt{-1})^2 = i^2$$

$$-1 = i^2$$

$i^1 = i$	$i^5 = i$	$i^9$	
$i^2 = -1$	$i^6 = -1$		
$i^3 = -i$	$i^7 = -i$		
$i^4 = 1$	$i^8 = 1$	$i^{12} = 1$	$i^{4x} = 1$

any power multiple of 4 = 1

If we have

$$3i + 2 = a + bi$$

So  $a = 2$

$b = 3$

# *Questions*



1- OCTOBER 2020 Q 20



If the expression  $\frac{2i^2-3i}{1-2i}$  is written in the form  $a+bi$  where  $a$  and  $b$  are real numbers and  $i = \sqrt{-1}$ , what is the value of  $a$ ?

2- DECEMBER 2020 Q 3



In the complex number system, which of the following is equal to  $3i(1+i) - (1-i)^2$ ?

(Note:  $i = \sqrt{-1}$ )

- A.  $-3 + i$
- B.  $-3 + 5i$
- C.  $3 + i$
- D.  $3 + 5i$

3 - MAY 2021 Q3



For  $i = \sqrt{-1}$ , which of the following is equivalent to  $\frac{2i-3}{i-5}$ ?

- A.  $\frac{13-7i}{24}$
- B.  $\frac{13-13i}{24}$
- C.  $\frac{17-7i}{26}$
- D.  $\frac{17-13i}{24}$

4 - JUNE 2021 Q 16



If the expression  $\frac{-2i-i^3}{1+3i}$  is written in the form  $a+bi$  where  $a$  and  $b$  are real numbers and  $i = \sqrt{-1}$ , what is the value of  $b - a$ ?

5 - AUGUST 2021 Q 2



$$Z - Z' = a + bi$$

In the equation above,  $a$  and  $b$  are real numbers and  $i$  is the imaginary unit such that  $i^2 = -1$ .

If  $Z = 3 + 2i$  and  $Z' = 4 - 3i$ , what is the value of  $(Z - Z')^2$ ?

- A.  $2i$
- B.  $-24 - 10i$
- C.  $-26 - 10i$
- D.  $-1 + 5i$

6 - OCTOBER 2021 Q 3



What is the simplified form of  $2(3i - 7) + i(2i - 1)$  given that  $i = \sqrt{-1}$ ?

- A.  $-16 + 7i$
- B.  $-14 + 3i$
- C.  $-16 + 5i$
- D.  $-15 + 4i$

## 7 - SAMPLE TEST / Q 11



If  $i = \sqrt{-1}$  which of the following is equivalent to

$$\frac{-3}{2-i} ?$$

A)  $\frac{3}{5}(2+i)$

B)  $-\frac{3}{5}(2+i)$

C)  $-2-i$

D)  $2+i$

## 8- sample question



Which of the following is equal to  $-(2-7i) - (4-3i)$ ? (Note:  $i = \sqrt{-1}$ .)

A)  $-6-10i$

B)  $-6+10i$

C)  $-6-4i$

D)  $-6+4i$

## 9- sample question



$$(5-2i)(1-i)$$

Which of the following is equivalent to the complex number expression above? (Note:  $i = \sqrt{-1}$ )

A)  $3-7i$

B)  $5-5i$

C)  $5+9i$

D)  $7+3i$

## 10- sample question



In the complex number system, what is the value of the expression  $16i^4 - 8i^2 + 4$ ? (Note:  $i = \sqrt{-1}$ )

## 11- sample question



$$(15-4i)(6-3i) = a+bi$$

In the equation above,  $a$  and  $b$  are real numbers and  $i = \sqrt{-1}$ . What is the value of  $a$ ?

## 12- sample question



For  $i = \sqrt{-1}$ , what is the quotient  $\frac{3+i}{3-i}$ ?

- A.  $1 + \frac{3i}{5}$
- B.  $1 + \frac{3i}{4}$
- C.  $\frac{4}{5} + \frac{3i}{5}$
- D.  $\frac{5}{4} + \frac{3i}{4}$

## 13- sample question



$$(3i^2+2)(3i^2-2)$$

The expression shown above can be written as the complex number  $ai+b$ , where  $a$  and  $b$  are real numbers. What is the value of  $a+b$ ?

(Note  $i = \sqrt{-1}$ )

## 14- sample question



$$\frac{8-i}{3-2i} = a+bi$$

find  $a$ ?

- A) 2
- B)  $\frac{8}{3}$
- C) 3
- D)  $\frac{11}{3}$

## 15- sample question



Which of the following complex numbers is equal to  $(5+12i) - (9i^2 - 6i)$ , for  $i = \sqrt{-1}$ ?

- A)  $-14 - 18i$
- B)  $-4 - 6i$
- C)  $4 + 6i$
- D)  $14 + 18i$

## 16- sample question



The product of the complex numbers  $(2+3i)$  and  $(3-i)$  can be written as  $a+bi$ , where  $a$  and  $b$  are real numbers and  $i = \sqrt{-1}$ . What is the value of  $100a+b$ ?

## 17- sample question



$$(3i^2+2)(3i^2-2)$$

The expression shown above can be written as the complex number  $ai+b$ , where  $a$  and  $b$  are real numbers. What is the value of  $a+b$ ?

(Note  $i = \sqrt{-1}$ )

## 1- MARCH 2021 Q 30



Which of the following is equal to  $\frac{2-i}{3+2i}$ ?

- A.  $\frac{4}{13} + \frac{7}{13}i$   
 B.  $\frac{4}{13} - \frac{7}{13}i$   
 C.  $\frac{4}{5} + \frac{7}{5}i$   
 D.  $\frac{2}{5} - \frac{7}{10}i$

## 2- OCTOBER 2021 Q 29



If  $\frac{a+2i}{3-i} = 2 - 5i$  with  $i = \sqrt{-1}$ ,  
 what is the value of  $a^2$ ?

- A.  $2(19i + 180)$   
 B.  $19i + 180$   
 C.  $-19i - 180$   
 D.  $-2(19i + 180)$

## 3- sample question



If  $w = 3 - 2i$  and  $z = -2 + 4i$ , then  $\frac{w}{z}$  can be  
 written as  $a + bi$ , which is equivalent to

- A.  $-\frac{3}{2} - \frac{1}{2}i$   
 B.  $-\frac{7}{10} - \frac{2}{5}i$   
 C.  $\frac{13}{20} - \frac{1}{2}i$   
 D.  $\frac{7}{6} + \frac{2}{3}i$

## 4- sample question



Express the following complex  
 numbers in the standard form  $a + ib$ :

$$\frac{3+2i}{-2+i}$$

- A.  $\frac{7}{5} + \frac{4}{5}i$   
 B.  $\frac{4}{5} + \frac{7}{5}i$   
 C.  $-\frac{7}{5} - \frac{4}{5}i$   
 D.  $-\frac{4}{5} - \frac{7}{5}i$

## 5- sample question



If  $z \cdot (1-i) = (8+2i)$ , what is the value of  $z$ ?

- A.  $3 + 4i$   
 B.  $1 + 3i$   
 C.  $3 + 5i$   
 D.  $2 - 2i$

## ANSWERS OF LESSON ( COMPLEX NUMBER )

NON CALCULATOR



Question	Answer
1	4/5
2	B
3	C
4	0.2 OR 1/5
5	B
6	C
7	B
8	B
9	A
10	28
11	78
12	C
13	5
14	A
15	D
16	907
17	5
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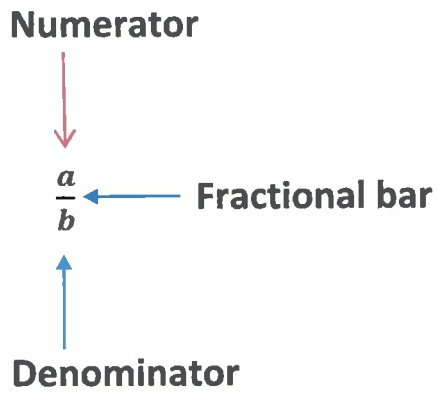
CALCULATOR



Question	Answer
1	B
2	D
3	C
4	D
5	C
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# Fraction

$$\frac{1}{4}$$



Transformation from mixed fraction to fraction

$$3\frac{2}{5} \Rightarrow 5 \times 3 + 2 = 17 \Rightarrow \frac{17}{5}$$



Transformation from fraction to mixed fraction

$$\frac{17}{5} \quad 17 \left. \begin{array}{l} \xrightarrow{5} \\ \xrightarrow{5} \\ \xrightarrow{5} \\ \xrightarrow{2} \end{array} \right\} 3 = 3\frac{2}{5}$$


 Operation With fraction

$$\star \quad \frac{a}{b} \pm \frac{c}{b} = \frac{a \pm c}{b}$$


$$\star \quad \frac{a}{b} + \frac{c}{k} = \frac{ak + bc}{bk}$$

$$\star \quad \frac{a}{b} - \frac{c}{k} = \frac{ak - bc}{bk}$$

$$\star \quad \frac{a}{b} \times \frac{c}{k} = \frac{ac}{bk}$$

$$\star \quad \frac{a}{b} \div \frac{c}{k}$$

$$\frac{a}{b} \times \frac{k}{c} = \frac{ak}{bc}$$

$$\star \quad \frac{a}{b} \times \frac{c}{k}$$




$$\frac{\frac{3}{2}}{\frac{5}{1}} = \frac{3}{10}$$

$$\frac{\frac{5}{3}}{\frac{2}{2}} = \frac{10}{3}$$

$$\frac{\frac{4}{3}}{\frac{2}{5}} = \frac{20}{6}$$

1- OCTOBER 2020 Q 14



If  $\frac{1}{x-y} = \frac{3}{5y}$ , which of the following proportions is equivalent?

- A.  $\frac{x}{y} = \frac{3}{8}$
- B.  $\frac{x}{y} = \frac{8}{3}$
- C.  $\frac{x}{y} = \frac{8}{15}$
- D.  $\frac{x}{y} = \frac{15}{8}$

2- AUGUST 2021 Q 8



If  $\frac{3a}{b} \div c = 7$ , what is the value of  $\frac{bc}{2a}$ ?

- A.  $\frac{3}{14}$
- B.  $\frac{7}{3}$
- C. 21
- D.  $\frac{6}{7}$

3- AUGUST 2021 Q 1



If  $\frac{2x-4}{3} - \frac{x+1}{6} = t+1$  and  $t = 3$ , what is the value of  $x$ ?

- A. 27
- B. -1
- C. 11
- D.  $\frac{31}{3}$

4- sample question



$$\frac{2b+2c}{ab+ac} = 1$$

In the equation above,  $a$ ,  $b$ , and  $c$  are constants,  $b \neq -c$ , and  $a \neq 0$ . Which of the following must be true?

- A)  $a = \frac{1}{2}$
- B)  $a=2$
- C)  $a+b=1$
- D)  $b=c$

# *Questions*



## 5- sample question



$\frac{2}{5}y = \frac{1}{2}(y - 700)$  What is the solution  $y$  of the equation above?

## 6- sample question



$$\frac{x^4 - 16}{x - 2}$$

Which of the following is equivalent to the expression above, where  $x > 2$ ?

- A)  $x^3 - 8$
- B)  $x^3 + 8$
- C)  $(x - 2)(x^2 - 4)$
- D)  $(x + 2)(x^2 + 4)$

## 7- sample question



$$\frac{1}{x+2} + \frac{2}{x-2}$$

which of the following is equivalent to the expression above?

- A)  $\frac{3x-2}{(x+2)(x-2)}$
- B)  $\frac{3x+2}{(x+2)(x-2)}$
- C)  $\frac{3}{(x+2)(x-2)}$
- D)  $\frac{2}{(x+2)(x-2)}$

## 8- sample question



If  $x > 1$  which of the following is equivalent to

$$\frac{x}{\frac{1}{x-1} + \frac{1}{x+1}}$$

- A)  $\frac{2x^2}{(x-1)(x+1)}$
- B)  $\frac{2}{(x-1)(x+1)}$
- C)  $\frac{x(x-1)(x+1)}{2}$
- D)  $\frac{(x-1)(x+1)}{2}$

## 9- sample question



$$2p + 6 = 8 + 7p$$

What value of  $p$  satisfies the given equation?

- A)  $-\frac{2}{9}$
- B)  $-\frac{2}{5}$
- C)  $\frac{14}{15}$
- D)  $\frac{14}{9}$

## 10- Sample test



Which expression is equivalent to  $\frac{2 + 3x}{16 - 81x^4}$ ,

where  $x > 1$ ?

- A)  $\frac{1}{8 - 27x^3}$
- B)  $8 - 27x^3$
- C)  $\frac{1}{(4 + 9x^2)(2 - 3x)}$
- D)  $(4 + 9x^2)(2 - 3x)$

## 1- AUGUST 2021 Q 5



Jack has  $k$  dollars. He spends  $\frac{3}{4}$  of his money on a T-shirt and  $\frac{1}{3}$  of what was left on a sandwich. If this left him with  $t$  dollars, which of the following is the value of  $k$  in terms of  $t$ ?

- A.  $6t$
- B.  $9t$
- C.  $12t$
- D.  $24t$

## 2- AUGUST 2021 Q 15



If  $x$  is different than  $-1$ ,  $0$  and  $1$ , which of the following is equivalent to

$$\frac{x}{\frac{1}{x-1} + \frac{1}{1+x}}?$$

- A.  $\frac{1}{x^2 - 1}$
- B.  $\frac{1}{(x-1)(x+1)}$
- C.  $\frac{2x}{x^2 - 1}$
- D.  $2$

## 3 - MARCH 2022 / Q 12



Three friends divided a prize as follows: the youngest received  $\frac{3}{5}$  of the prize, the middle friend received  $\frac{1}{4}$  of the prize, and the eldest received the remaining \$57. What was the value, in dollars, of the prize?

- A. 380
- B. 420
- C. 140
- D. 270

## 4 - MARCH 2022 / Q 27



If  $\frac{2a+1.2b}{a-5} = \frac{4}{5}$ , which of the following is correct?

- A.  $3a+3b = -7$
- B.  $a - b = 10$
- C.  $a + b = -10/3$
- D.  $2a - b = 5$

## 5- sample question



$$\frac{5}{x-3} - \frac{3}{3-x}$$

Which of the following expression is equivalent to the one above, for  $x \neq 3$ ?

- A)  $\frac{2}{x-3}$
- B)  $\frac{2}{3-x}$
- C)  $\frac{8}{x-3}$
- D)  $\frac{8}{3-x}$

## 6- sample question



If  $\frac{1}{2}x - \frac{1}{6}x = 1$ , what is the value of  $x$ ?

- A) -4
- B)  $\frac{1}{3}$
- C) 3
- D) 6

## 7- sample question



$$\frac{2}{x-2} + \frac{3}{x+5} = \frac{rx+t}{(x-2)(x+5)}$$

The equation above is true for all  $x > 2$ , where  $r$  and  $t$  are positive constants. What is the value of  $rt$ ?

- A) -20
- B) 15
- C) 20
- D) 60

## 8- sample question



If  $\frac{1}{x} + \frac{1}{2x} = 2$ , where  $x > 0$ , what is the value of  $\frac{2x}{3}$ ?

- A) 8
- B)  $\frac{3}{2}$
- C)  $\frac{1}{2}$
- D)  $\frac{1}{9}$

## 9- sample question



Let  $a$  and  $b$  be constants such that

$$\frac{6x^2 + 4x - 9}{ax + b} = 2x + 4 + \frac{7}{ax + b} \text{ for all } x. \text{ What is the}$$

product  $ab$ ?

- A) -3
- B) -12
- C) -18
- D) -27

## 10- Sample test



The expression  $\frac{x^6(x-3)}{2x} + \frac{3x^6}{2x}$  is equivalent to  $\frac{1}{2}x^c$ , where  $c$  is a constant and  $x > 0$ . What is the value of  $c$  ?

## 11- Sample test



If  $\frac{6}{x+1} = 3$ , what is the value of  $x+1$  ?

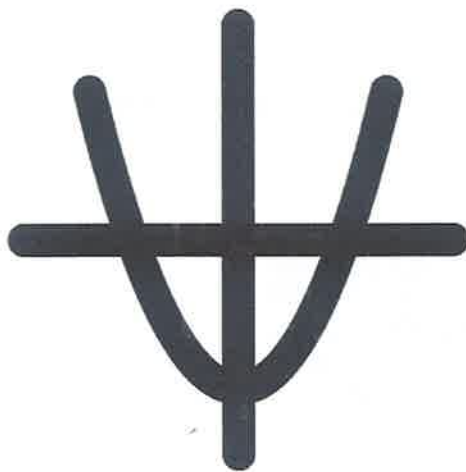
- A) 0.5
- B) 1
- C) 2
- D) 3



Question	Answer
1	B
2	A
3	C
4	B
5	3500
6	D
7	B
8	D
9	B
10	C
11	
12	
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Question	Answer
1	A
2	D
3	A
4	C
5	C
6	C
7	C
8	C
9	B
10	6
11	C
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# Polynomial



$$x^2 + 7x + 12$$

## Polynomial

☞  $(a + b)^2 = a^2 + 2ab + b^2$

☞  $(a - b)^2 = a^2 - 2ab + b^2$

☞  $a^2 - b^2 = (a - b)(a + b)$

☞  $a^2 + b^2 \neq$  **No Factorizing**

☞  $a^3 - b^3 = (a - b)(a^2 + ab + b^2)$

☞  $a^3 + b^3 = (a + b)(a^2 - ab + b^2)$

## Matching Coefficients

$$ax^2 + bx + c = 10x^2 + 5x + 20$$

$$a = 10 \quad b = 5 \quad c = 20$$

**Practice**

1)  $x^2 - y^2 = 70$

$x + y = 10$

Find

$x - y = ?$ 

---

2)  $(x + y)^2 = 20$

$xy = 10$

Find

$x^2 + y^2 = ?$ 

---

3)  $x^2 + y^2 = 50$

$xy = 20$

Find

$(x - y)^2 = ?$ 

---

4)  $x^2 - y^2 = 50$

$x + y = 10$

Find  $x$ ?

## Factorizing Technique

### + Technique

$$x^2 + 5x + 6 = 0$$

$$(x + 2)(x + 3) = 0$$

$$x = -2 \quad \text{or} \quad x = -3$$

### - Technique

$$x^2 + 3x - 70 = 0$$

$$(x + 10)(x - 7) = 0$$

$$x = -10 \quad x = 7$$

$$x^2 - 4x + 3 = 0$$

$$(x - 1)(x - 3) = 0$$

$$x = 1 \quad x = 3$$

$$x^2 - 5x - 50 = 0$$

$$(x - 10)(x + 5) = 0$$

$$x = 10 \quad x = -5$$

**Factorizing with  
coefficient of  $x^2$**

$$\textcircled{2} \quad x^2 + 9x + 4 = 0$$

$$x^2 + 9x + 8 = 0$$

$$\begin{array}{cc} & \swarrow \searrow \\ +1 & +8 \end{array}$$

$$(x + 1)(x + 8) = 0$$

$$\left(x + \frac{1}{2}\right)\left(x + \frac{8}{2}\right) = 0$$

$$(2x + 1)(x + 4) = 0$$

$$2x = -1 \quad x = -4$$

$$x = -\frac{1}{2}$$

**Practice**

- 1)  $x^2 + 7x + 12$
- 2)  $x^2 + 9x + 8$
- 3)  $x^2 - 10x + 21$
- 4)  $x^2 - 12x + 35$
- 5)  $x^2 + 4x - 60$
- 6)  $x^2 + 11x - 12$
- 7)  $x^2 - 3x - 10$
- 8)  $x^2 - 8x - 20$
- 9)  $2x^2 + 7x + 6$
- 10)  $6x^2 + 16x + 8$
- 11)  $8x^2 + 14x + 6$
- 12)  $14x^2 + 24x + 6$

# *Questions*



7- MARCH 2021 Q 20



If  $a^2 + b^2 = 20$  and  $ab = 8$ , then what is  $(b - a)^2$ ?

(Grid in)

8- MAY 2021 Q 2



Which of the following is equivalent to  $4a^2 - 9 + (2a - 3)(a - 1) + 3(2a - 3)$ ?

- A.  $(3a + 5)(2a - 3)$
- B.  $2(3a + 5)(2a - 3)$
- C.  $(2a - 3)(a + 5)$
- D.  $(2a - 3)(3a + 7)$

9- JUNE 2021 Q 13



What is the resulting coefficient of  $x$  when  $-2x+3$  is multiplied by  $-3x-2$ ?

- A. -9
- B. -5
- C. 5
- D. 6

10- AUGUST 2021 Q 7



$$\left[ (2x - y)^2 - (2x + y)^2 \right]^2$$

Which of the following is equivalent to the expression above?

- A.  $16x^4 - y^2$
- B.  $-64x^4y^4$
- C.  $-8x^2y^2$
- D.  $64x^2y^2$

11- OCTOBER 2021 Q 14



Given  $\frac{d^2 - 4m^2}{2d + 4m} = \frac{3}{8}$ . What is the value of  $d - 2m$ ?

- A.  $\frac{3}{8}$
- B.  $\frac{3}{6}$
- C.  $\frac{3}{4}$
- D.  $\frac{3}{16}$

12- OCTOBER 2021 Q 19



If  $\frac{1}{x-1} - \frac{1}{x+1} = 1$ , and  $x \neq \pm 1$ , what is the value of  $11x^2$ ? (Grid-in)

## 13- DECEMBER 2021 Q 9



A factor of the polynomial  $7x^2 + 14x - 21$  is:

- A.  $7x - 7$
- B.  $7x + 7$
- C.  $x - 3$
- D.  $7x + 3$

## 14 - MARCH 2022 / Q 2



Which of the following is equivalent to

$$(2x+3)^2 + (2x+3)(x-1) - 2(4x^2 - 9)$$

?

- A.  $(2x+3)(-x+4)$
- B.  $2(2x+3)(-3x+4)$
- C.  $(2x+3)(-x+8)$
- D.  $(-3x+5)(2x+3)$

## 15 - SAMPLE TEST / Q 3



Which of the following is equivalent to:

$$3x(x+1)(4x-1) + 2(x-5)(3x-7) - (2x-3)^2$$

- A)  $12x^3 + 11x^2 - 35x + 61$
- B)  $12x^3 + 19x^2 - 59x + 79$
- C)  $4x^3 + 11x^2 - 35x + 61$
- D)  $12x^3 + 11x^2 + 35x - 61$

## 16 - JUNE 2022 ( cancelled ) / Q 3



In a company, the total cost, in dollars, of the production of a certain product  $x$  is given by  $C(x) = \frac{1}{3}x^3 - 15x^2 + 2000x$ . The profit made out of selling this product is given by  $P(x) = -\frac{1}{3}x^3 + \frac{79}{3}x^2 + 1500x$ . If  $R(x)$  indicates the revenue made out of selling this product, and the relationship between the cost, the revenue, and the profit is represented by  $P(x) = R(x) - C(x)$ , which of the following expressions is equivalent to  $R(x)$ ?

- A.  $R(x) = \frac{64}{3}x^2 + 3500x$
- B.  $R(x) = \frac{34}{3}x^2 + 3500x$
- C.  $R(x) = -\frac{2}{3}x^3 + \frac{64}{3}x^2 + 3500x$
- D.  $R(x) = -\frac{2}{3}x^3 + \frac{124}{3}x^2 - 500x$

## 17 - JUNE 2022 ( cancelled ) / Q 16



Given that  $2x^2 + ax + (4c - 1) = (2b - 1)x^2 + 7x + c + 1$ , what is the value of  $bc + a$ , where  $a$ ,  $b$  and  $c$  are real numbers?

- A. 8
- B.  $\frac{37}{4}$
- C. 7.5
- D.  $\frac{67}{9}$

1- OCTOBER 2020 Q 26



$$(3x - 2)^2 - (x + 3)^2 = 0$$

What is the absolute value of the difference between the two roots of the above equation?

- A.  $\frac{11}{4}$
- B.  $\frac{9}{4}$
- C.  $\frac{5}{3}$
- D.  $\frac{11}{2}$

2- DECEMBER 2020 Q 34



$$\frac{x}{x+2} - \frac{1}{2} = x - 2$$

What is the positive solution of the equation given above?

3- MARCH 2021 Q 24



Which of the following is a solution for the equation  $2x^2 - 7|x| + 5 = 0$ ?

- A. 0
- B. -1
- C. 2
- D. -3

4- MAY 2021 Q 22



What are the values of  $a$  and  $b$  if  $f(x) = (2a - 3)x^2 + bx - 1$  is equivalent to  $g(x) = (4a + 3)x^2 + (3 - b)x - 1$ ?

- A.  $a = 3$  and  $b = 1.5$
- B.  $a = -3$  and  $b = 1.5$
- C.  $a = -3$  and  $b = -1.5$
- D.  $a = 3$  and  $b = -1.5$

5- AUGUST 2021 Q 11



$$f(x) = (x - 2)(x + 3) - (2x - 4)^2$$

Which of the following is an equivalent form of the function above?

- A.  $(x - 2)(11 + 3x)$
- B.  $(x - 2)(-x + 7)$
- C.  $(x - 2)(11 - 3x)$
- D.  $(x - 2)(x - 7)$

6 - SAMPLE TEST / Q 19



$6n^3 - 5n^2 - 83n + 28$  Which of the following cannot be a factor of the polynomial above?

- A)  $n - 4$
- B)  $2n + 7$
- C)  $2n + 3$
- D)  $3n - 1$

7 - SAMPLE TEST / Q 38



If  $(2c - 3)^2 - (2c - 5)^2 = -12$ ,  
what is the value of  $c$ ?

8 - JUNE 2022 (cancelled) / Q 21



Which of the following is a factor of the polynomial:  
 $2x^3 + 13x^2 + 5x - 6$ ?

- A.  $x - 1$
- B.  $x - 6$
- C.  $2x + 1$
- D.  $2x - 1$

## ANSWERS OF LESSON ( POLYNOMIAL )

NON CALCULATOR



Question	Answer
1	D
2	B
3	4
4	D
5	C
6	2
7	4
8	A
9	B
10	D
11	C
12	33
13	A
14	C
15	A
16	B
17	A
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CALCULATOR



Question	Answer
1	A
2	2
3	B
4	B
5	C
6	C
7	1/2
8	D
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# Percent





## Translation Equation

1- What / what number  $\Rightarrow$   $n$

2- Is  $\Rightarrow$   $=$

3- Of  $\Rightarrow$   $\times$

4- What Percent  $\Rightarrow$   $\frac{n}{100}$

5- And  $\Rightarrow$   $+$

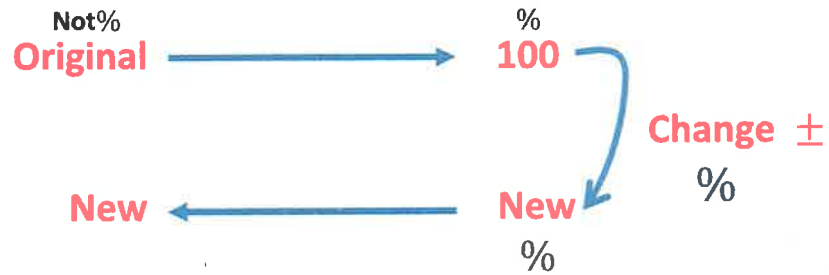
6- 5%  $\Rightarrow$   $\frac{5}{100}$



Example:

9 is what percent of 36?

Golden rule of percent



If  $k$  is incensed by 20%

$$k + \frac{20}{100}(k)$$

$$k \left[ 1 + \frac{20}{100} \right] = k(1.2) = 1.2k$$

If  $t$  is decreased by 40%

$$t - \frac{40}{100}(t)$$

$$t \left[ 1 - \frac{40}{100} \right] = 0.6t$$

# *Questions*



1- DECEMBER 2021 Q 2



If 50% of  $a$  is  $b$ , then  $a =$

- (A)  $50b$
- (B)  $\frac{b}{2}$
- (C)  $2b$
- (D)  $0.50b$

2.



6. What percent of 40 is 16?

- (A) 20
- (B)  $2\frac{1}{2}$
- (C)  $33\frac{1}{3}$
- (D) 40

3.



What percent of 16 is 40?

- (A) 20
- (B)  $2\frac{1}{2}$
- (C) 200
- (D) 250

4.



\$4 is 20% of what?

- (A) \$5
- (B) \$20
- (C) \$200
- (D) \$500

5.



12 is 150% of what number?

- (A) 18
- (B) 15
- (C) 9
- (D) 8

1- OCTOBER 2020 Q 7



The table below summarizes the results of a survey about travel destination preferences for a group of 750 university students of 4 different majors.

	History	Math	Audit	IT	Total
Rome	65	35	35	15	150
Paris	75	65	10	25	175
Tokyo	40	115	50	20	225
NYC	70	60	30	40	200
Total	250	275	125	100	750

In which major can you find the highest percentage of students who prefer NYC?

- A. History
- B. IT
- C. Audit
- D. Math

2- OCTOBER 2020 Q 17



From 2018 to 2019, the amount in Julias's bank account increased by 22.5% to \$14325. To the nearest dollar, what was the initial amount in her bank account?

- A. 11694\$
- B. 14010\$
- C. 11102\$
- D. 12775\$

3- OCTOBER 2020 Q 29



A local supermarket offered a discount of 15% on its items after the government raised all the prices by 25%. Overall, by what percentage were the original prices raised in this supermarket in particular?

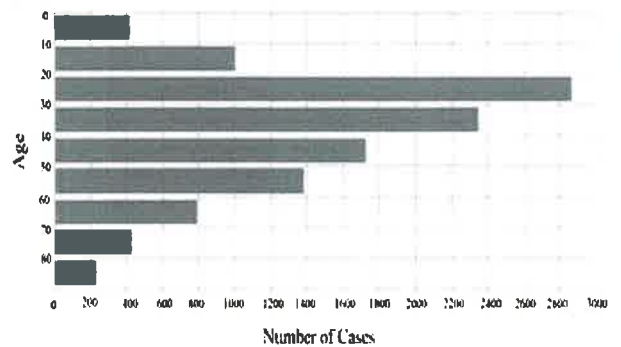
- A. 8.625%
- B. 7.250%
- C. 6.250%
- D. 5.625%

4- DECEMBER 2020 Q 17



Number of Covid-19 cases according to age

The histogram shown summarizes the number of people who got infected by the Covid-19 virus according to their age in Lebanon. The survey was done over 11,200 people.



If 15% of the tests performed in each age group to identify the people who were infected gave wrong results, which of the following gives the closest estimate to the number cases in the age range 20 to 30 who are actually healthy (rounded to the nearest whole number)?

- A. 431
- A. 1680
- B. 2440
- C. 9520

5- DECEMBER 2020 Q 19



In a certain chip manufacturing company, there are three operating machines A, B, and C. Every day, Machine A produces 30% more chips than machine B, and machine B produces twice as many chips as machine C. If on any particular day machine A produces  $x$  chips, what is the total number of chips produced by machines A, B, and C combined on that day in terms of  $x$ ?

- A.  $x + 1.3x + 2.6x$   
 B.  $x + 0.3x + 0.6x$   
 C.  $x + \frac{x}{0.3} + \frac{x}{0.6}$   
 D.  $x + \frac{x}{1.3} + \frac{x}{2.6}$

6- JUNE 2022 (cancelled) / Q 31



30% of a number is 86.4% of 50.  
 What is this number?

- A. 144  
 B. 17.36  
 C. 1440  
 D. 92

7- MARCH 2021 Q 32



A musical band agrees to play for 350\$ plus 20% of the ticket sales. What is the total sale price of the tickets needed for the band to receive at least 700\$?

8- MARCH 2021 Q 35



The original price of an article is 30,000 EGP and its discount price is 27,600 EGP. What is the discount percent?

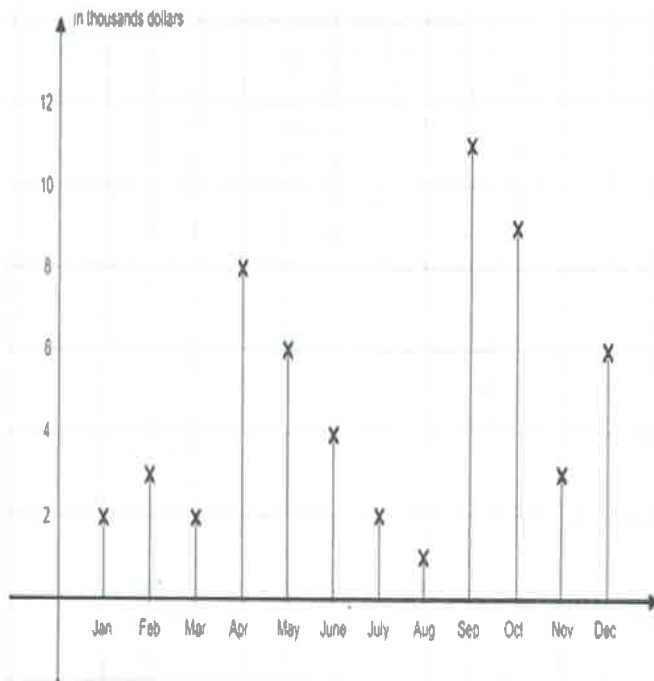
9- MAY 2021 Q 2



In his SAT Math practice test, Hamad solved 80% of the first section correctly, which included 20 questions. In the second section that included 38 questions,  $\frac{1250}{19}$  % of the questions were solved correctly. How many questions were correct in Hamad's test?

- A. 6 questions  
 B. 41 questions  
 C. 42 questions  
 D. 58 questions

10- MAY 2021 Q 6



Adam and his fiancée worked as freelance graphic designers all year long during 2019 to save money for their wedding and to buy furniture for their home. Their mixed salary each month, in thousands of dollars, is shown in the graph above.

What is the percentage of May's income out of their total annual income?

- A. 3.41%
- B. 5.27%
- C. 9.52%
- D. 10.53%

11- MAY 2021 Q 7



A company lost 20% of their stock the first year, then 26% the second year. In the third year, their stock increased by 30%. Which of the following statements is true?

- A. The company's stock increased by 23.04% in comparison with the price of the stock before the start of the loss.
- B. The company's stock decreased by 23.04% in comparison with the price of the stock before the start of the loss.
- C. The company's stock decreased by 76.96% in comparison with the price of the stock before the start of the loss.
- D. The company's stock increased by 76.96% in comparison with the price of the stock before the start of the loss.

12- MAY 2021 Q 18



Gold is one of the most important items in the world. Its price increases and decreases every day. The average closing price for the past 8 years is shown in the table below.

Year	Average Closing Price (\$)
2020	1,771.9
2019	1,393.34
2018	1,268.93
2017	1,251.92
2016	1,158.86
2015	1,266.06
2014	1,409.51
2013	1,668.86

Which of the following statements is true when comparing the annual percentage change from 2018 to 2020?

- A. It increased by 27.17%.
- B. It decreased by 27.17%.
- C. It decreased by 39.64%.
- D. It increased by 39.64%.

13- JUNE 2022 (cancelled) / Q 23



A store did a sale on a pair of shoes. It is now for \$103.5 instead of \$230. What is the percent discount?

- A. 50%
- B. 45%
- C. 55%
- D. 58%

14- JUNE 2021 Q 7



A shop sells two sizes of doughnuts: mini and regular. Mini doughnuts have a diameter of 1.8 inches while regular ones have a diameter of 3 inches. Approximately, by what percentage is a regular normal doughnut larger (in area) than a mini doughnut?

- A. 67%
- B.  $67\pi\%$
- C. 78%
- D. 178%

15- JUNE 2021 Q 13



The table below summarizes the results of a survey about the favorite school subject for a group of 350 students according to their educational stage.

	Primary	Secondary	Tertiary	Total
Math	65	80	30	175
English	35	55	10	100
Science	15	10	25	50
History	10	5	10	25
Total	125	150	75	350

According to the data, which subject had the lowest percentage of likers among primary students?

- A. Math
- B. English
- C. Science
- D. History

16- JUNE 2021 Q 19



The general elections in a country provided a parliament composed of 35% deputies from the democratic party, 20% for the conservative party, 20% for the republican party, 30% for the republican party and 27 members of the labor party. How many more democrats are there than conservatives?

- A. 9
- B. 18
- C. 27
- D. 36

17- JUNE 2021 Q 28



The number of bees in a beehive rose from 2400 to 2520 in a month. How many bees do we expect to have in the next month knowing that the population experiences the same percent increase every month?

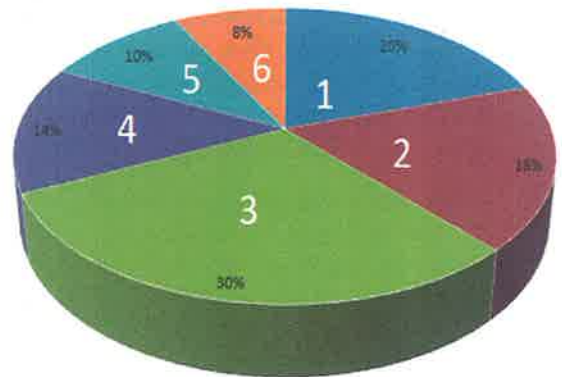
- A. 2600
- B. 2640
- C. 2646
- D. 2656

18- JUNE 2021 Q 38



Trevor has \$600 to spend on shopping, 25 percent of which he spent to buy groceries. If he budgets 30 percent of the remaining amount for clothes, allots \$120 for cooking utensils and spends the rest on gaming accessories, what percentage of the original \$600 did he spend on gaming accessories? (Input your answer without the % sign)

19- AUGUST 2021 Q 2



The circular diagram above shows the results of a survey made on the number of books read by 200 pupils in a certain school.

What is the number of pupils who read less than 3 books?

- A. 68
- B. 116
- C. 38
- D. 76

20- AUGUST 2021 Q 21



A container is filled with 200 balls, 80 of them are yellow. After removing  $x$  yellow balls, 75% of the remaining balls in the container are not yellow.

Which of the following is the value of  $x$ ?

- A. 20
- B. 30
- C. 40
- D. 50

21- AUGUST 2021 Q 31



A supermarket has three branches **A**, **B** and **C** in three different cities. The head manager realized that, in average per day, branch **A** has 20% more customers than branch **B** and branch **B** has 20% less customers than branch **C**.

If the number of customers in branch **A** is 1200 on a random day, what is the estimated number of customers in branch **C** that same day?

22- AUGUST 2021 Q 37



Job title	Commission percentage rate
Trainee	1%
Employee	2%
Supervisor	3%
Senior supervisor	4%
Manager	5%

The chart above shows the commission structure for staff members working in a company.

All members of the staff benefit from a fixed salary of \$800 monthly plus a commission on the profit of the company as shown in the chart.

The salary of the manager Sam for the month of January was \$7,000. What is the salary of the supervisor John in January?

23- AUGUST 2021 Q 38



Job title	Commission percentage rate
Trainee	1%
Employee	2%
Supervisor	3%
Senior supervisor	4%
Manager	5%

The chart above shows the commission structure for staff members working in a company.

All members of the staff benefit from a fixed salary of \$800 monthly plus a commission on the profit of the company as shown in the chart.

In February, the salary of an employee, a senior supervisor and a trainee was \$13,650 altogether.

What was the approximate salary, rounded to the nearest dollar, of the trainee alone in February?

24- OCTOBER 2021 Q 3



The table below shows the distance Amir walked every day during the first week of April, 2021.

	Distance (in <i>m</i> )
Thursday, April 1 <sup>st</sup>	1678
Friday, April 2 <sup>nd</sup>	2091
Saturday, April 3 <sup>rd</sup>	1245
Sunday, April 4 <sup>th</sup>	1566
Monday, April 5 <sup>th</sup>	2100
Tuesday, April 6 <sup>th</sup>	1989
Wednesday, April 7 <sup>th</sup>	1888

If on Thursday, April 8<sup>th</sup>, Amir walked the same distance he did the second day of April with an addition of 20%. What is the distance he walked?

- A. 4182 *m*
- B. 2509.2 *m*
- C. 2420.6 *m*
- D. 2007.6 *m*

25- OCTOBER 2021 Q 4



The table below shows the distance Amir walked every day during the first week of April, 2021.

	Distance (in <i>m</i> )
Thursday, April 1 <sup>st</sup>	1678
Friday, April 2 <sup>nd</sup>	2091
Saturday, April 3 <sup>rd</sup>	1245
Sunday, April 4 <sup>th</sup>	1566
Monday, April 5 <sup>th</sup>	2100
Tuesday, April 6 <sup>th</sup>	1989
Wednesday, April 7 <sup>th</sup>	1888

By what approximate percent did Amir increase the distance he walked from April 3<sup>rd</sup> to April 5<sup>th</sup>?

- A. 34%
- B. 60%
- C. 67%
- D. 69%

26 - JUNE 2022 (cancelled ) / Q 20



Fares decided to sell his 450 books. 22% of the books are new, and the rest are considered old. If each new book will be sold for \$11, and each old book will be sold for \$6.5, how much will Fares get from selling his books?

- A. \$4504.5
- B. \$3370.5
- C. \$2281.5
- D. \$1089

27- OCTOBER 2021 Q 14



Brenda went to the mall on a sale day, and bought all the items shown in the table below. If all the items were on a 35% sale except for the socks which were on a 15% sale, how much would she pay if she bought the items on a non-sale day?

Item	Price (in \$)
T-shirt	25.6
Pants	35.25
Shoes	50.22
Jacket	71.21
Socks	11.44

- A. \$ 193.72
- B. \$ 259.23
- C. \$ 261.52
- D. \$ 293.89

28- OCTOBER 2021 Q 23



A school conducted a survey on the brand of the phone its employees are using. The survey data is shown in the table below:

	Huawei	Samsung	IPhone	Other brands
Staff	13	15	20	3
Teachers	22	56	44	7

What is the percentage of staff members using iPhone out of all the employees?

- A. 39.2%
- B. 31.25%
- C. 11.11%
- D. 9%

29- OCTOBER 2021 Q 35



Lucas bought a car for \$3,500. He lost 12% of its price when he sold it for Brad, while Brad won 5% of what he paid when he sold it to Amira. How much did Amira pay for the car? (grid-in)

30- DECEMBER 2021 Q9



On a math test of 30 questions, Mona got 75% of the 12 geometry questions correct, 60% of the 10 algebra questions correct and 25% of the 8 trigonometry questions wrong. What percentage of all the questions did Mona get correct?

- A. 56.6%
- B. 160%
- C. 70%
- D. 210%

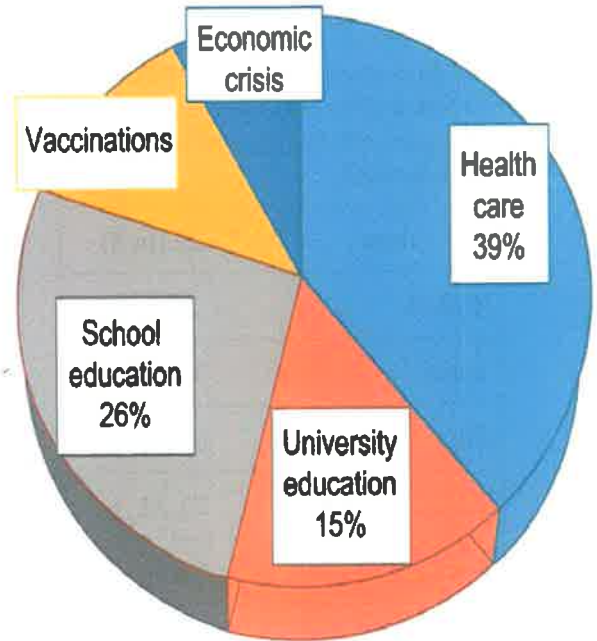
31- DECEMBER 2021 Q 10



The price of the COVID-19 vaccine in the black market was first increased by 15% and then increased by 10% after two weeks. What is the percent increase in the price of the vaccine?

- A. 126.5%
- B. 26.5%
- C. 25%
- D. 1.265%

32- DECEMBER 2021 Q 11



Alice surveyed all the students in the secondary department at her school to see their most important concern through the pandemic situation of corona virus. The results are shown in the figure above. If the ratio of students who answered “Vaccinations” to those who answered “Economic crisis” was 3:2, what percentage of the students answered “Vaccinations”?

- A. 8%
- B. 12%
- C. 18%
- D. 10%

33- DECEMBER 2021 Q 33



What is 17% of 36% of 2500? (Grid in)

34 - MARCH 2022 / Q 2



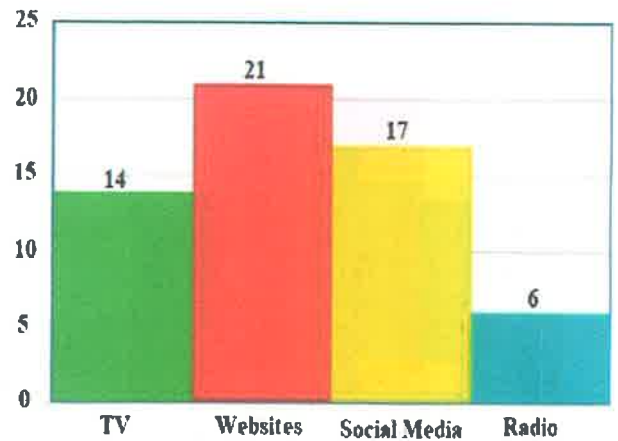
Tony's salary was \$4600. It increased by 10% in the first year and decreased by 3% in the second year. What will be the salary of Tony at the end of the second year?

- A. \$6500
- B. \$5580.4
- C. \$4908.2
- D. \$4800.6

35 - MARCH 2022 / Q 4



The histogram below shows the results of a survey done by a group of students on the source of news their parents trust most.



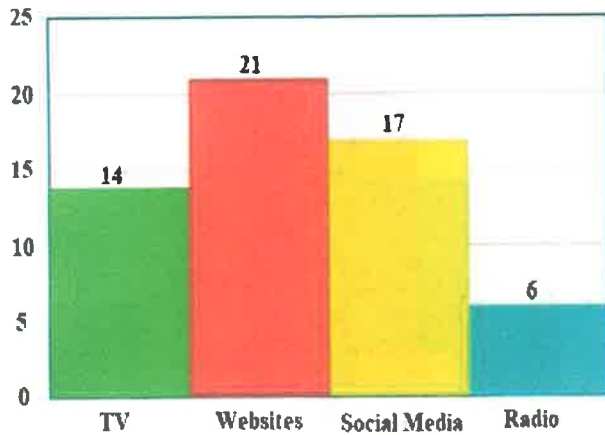
What is the percentage of parents trusting the news from social media platforms in this survey?

- A. 17%
- B. 25.7%
- C. 29.3%
- D. 34%

36 - MARCH 2022 / Q 5



The histogram below shows the results of a survey done by a group of students on the source of news their parents trust most.



If this survey was conducted on 120 people, and the results showed the same percentage for each source. How many people approximately would say that radio stations or TV channels are the most trustworthy?

- A. 29
- B. 41
- C. 53
- D. 58

37 - MARCH 2022 / Q 7



If Tony's salary is 25% greater than Sami's salary. Which of the following statements is true?

- A. Sami's salary is lower than Tony's salary by 16%.
- B. Sami's salary is lower than Tony's salary by 20%.
- C. Sami's salary is lower than Tony's salary by 25%.
- D. Sami's salary is lower than Tony's salary by 33%.

38 - MARCH 2022 / Q 17



The price of a CD player is 180 €. It is on sale at the price of 135 €. A customer wishes to purchase this device. He has a loyalty card from the store that allows him to benefit from a 10% discount at checkout. How much will he pay for this device?

- A. 148.5
- B. 121.5
- C. 125
- D. 145

## 39 - MARCH 2022 / Q 19



The price of dairy products has increased by 7% in 2011 and then decreased by 8% in 2012.

What is the new price in 2012 of a box of cheese knowing that the original price in 2010 was \$20?

- A. \$18.85
- B. \$19.688
- C. \$19.573
- D. \$18.24

## 40 - SAMPLE TEST / Q 5



The original price of Ron's house is \$180,400. In order to sell it, Ron asked the help of a broker who added an extra 3% to the price as his own commission. The person who bought the house paid \$187,165 as he decided to give an extra gift to the broker. What percent of the original price was the gift given to the broker by the buyer?

- A) 3.75%
- B) 1%
- C) 0.75%
- D) 0.6765%

## 41 - JUNE 2022 (cancelled) / Q 4



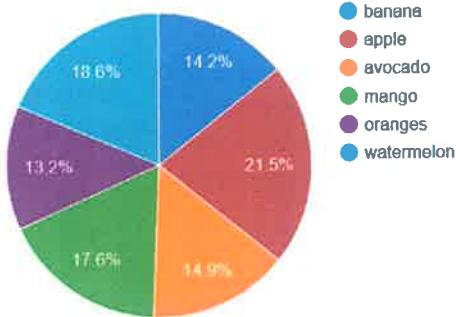
A company for renting cars published on their website a summary of the amount they won during the past few years from renting cars and trucks.

Year	Amount won in \$ for renting cars	Amount won in \$ for renting trucks
2015	10004.6	7888.3
2016	12456.7	7985.2
2017	14899.9	8050.2
2018	13899.5	9000.5
2019	12003.4	8599.4
2020	13990.1	7995.5

What is the percentage increase of the amount won for renting trucks from 2015 to 2017?

- A. 1.62%
- B. 2.01%
- C. 2.05%
- D. 48.93%

42 - JUNE 2022 (cancelled) / Q 15



The pie chart above shows the results of a survey that asked 1420 students in a school about their favorite fruit. How many students like mango more than any other fruit? And, approximately how many more students said apple was their favorite fruit than said oranges was their favorite one?

- A. 250 students like mango, and 110 students said apple was their favorite fruit more than said orange was their favorite one.
- B. 250 students like mango, and 118 students said apple was their favorite fruit more than said orange was their favorite one.
- C. 306 students like mango, and 63 students said apple was their favorite fruit more than said orange was their favorite one.
- D. 187 students like mango, and 56 students said apple was their favorite fruit more than said orange was their favorite one.

43 - JUNE 2022 (cancelled) / Q 17



Santa Clara County is the 6<sup>th</sup> most populous county in California, United States of America, with 1.928 million people were living there in 2019. If this number was decreased by 7% the next year due to people who died or left this county, and 4% of year 2020's population was added again in the population of year 2021 due to newborns or newcomers to the county, how many people are in this county in 2021?

- A. 1,734,229
- B. 1,793,040
- C. 1,864,762
- D. 1,939,353

44- JUNE 2021 Q 18



By what percentage should we raise the price of a good to return to its initial price knowing that it was subject to a 20% discount 2 weeks ago?

- A. 15%
- B. 20%
- C. 25%
- D. 30%

## ANSWERS OF LESSON ( PERCENT )

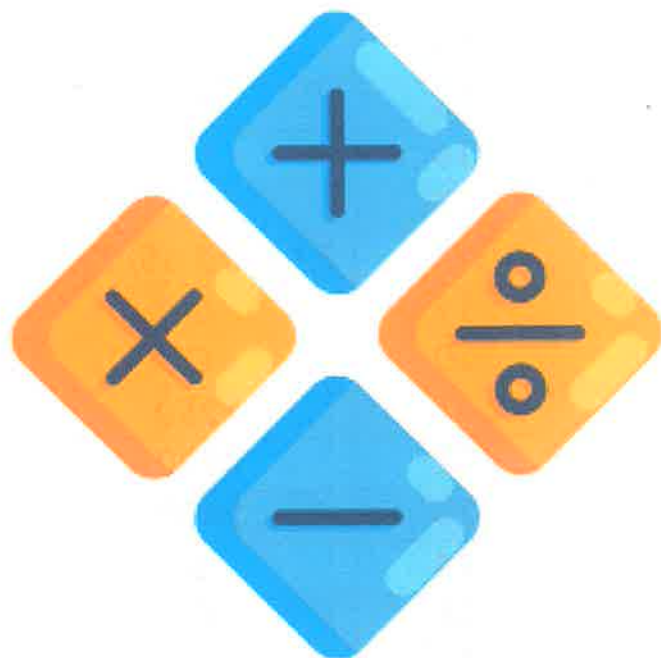
NON CALCULATOR

CALCULATOR



Question	Answer	Question	Answer	Question	Ans
1	C	1	B	30	C
2	D	2	A	31	B
3	D	3	C	32	B
4	B	4	A	33	1
5	D	5	D	34	C
6		6	A	35	C
7		7	1750	36	B
8		8	8	37	B
9		9	B	38	B
10		10	D	39	B
11		11	B	40	C
12		12	D	41	C
13		13	C	42	B
14		14	D	43	C
15		15	D	44	B
16		16	C	45	
17		17	C	46	
18		18	32.5 OR 65/2	47	
19		19	D		
20		20	C		
21		21	1250		
22		22	4520		
23		23	2407		
24		24	B		
25		25	D		
26		26	B		
27		27	D		
28		28	C		
29		29	3234		

# Complex interest



$$Pf = Pi (1 + r\%)^t$$

→ Period of time

↓

Initial

↘

Rate  
of  
increase  
or  
decrease

Compounded each (n)

$$Pf = Pi \left(1 + \frac{r\%}{n}\right)^{nt}$$

double every 3 years

☆ after t year

$$\frac{t}{3}$$

3 times every year

☆ after t years

$$3t$$

# *Questions*



1- MARCH 2021 Q 12



In planning maintenance for a city's infrastructure, a civil engineer estimates that, starting from the present, the population of the city will decrease by 15% every 25 years. If the present population of the city is 40,000, which of the following expressions represents the engineer's estimate of the population of the city  $t$  years from now?

- A.  $40,000(0.15)^{25t}$
- B.  $40,000(0.85)^{25t}$
- C.  $40,000(0.85)^{\frac{t}{25}}$
- D.  $0.85 (40,000)^{\frac{t}{25}}$

## 1- DECEMBER 2020 Q 12



In a certain village, the number of people doubles every three months. If there were 120 people in the village in March, which of the following equations should be solved to find when the population reaches 1500 assuming no deaths occur? ( $m$  represents the number of months)

- A.  $120(2)^{\frac{m}{3}} = 1500$
- B.  $120(2)^{3m} = 1500$
- C.  $2(120)^{\frac{m}{3}} = 1500$
- D.  $1500(2)^{\frac{m}{3}} = 120$

## 2- MARCH 2021 Q 22



A bank has opened a new branch and, as part of a promotion, the bank branch is offering 2,000\$ certificates of deposit at an interest rate of 6% per year, compounded semi-annually. The bank is selling certificates with terms of 1, 2, 3 or 4 years. Which of the following functions gives the total amount,  $A$ , in dollars, a customer will receive when a certificate with a term of  $k$  years is finally paid?

- A.  $A = 2000(1 + 0.03k)$
- B.  $A = 2000(1 + 0.06k)$
- C.  $A = 2000(1.06)^k$
- D.  $A = 2000(1.03)^{2k}$

## 3- JUNE 2021 Q 11



From 2020 to 2021, the amount in Tom's bank account decreased by 11% to \$49840. What was the initial amount in her bank account?

- A. \$54820
- B. \$44358
- C. \$56000
- D. \$45309

## 4- MAY 2021 Q



In 2011, the population in Cairo was 9.12 million. Considering the population was increasing by 1% each year, what could be the approximate population in Cairo in 2022?

- A. 10.074154 million
- B. 10.123200 million
- C. 10.174896 million
- D. 10.276645 million

## 5- AUGUST 2021 Q 9



A study showed that the number of users of a mobile application has been growing exponentially with the number of new members doubling every 3 months. We know that the initial number of users when the study started was 100,000 users. The equation of the growth is given by  $= 100e^{\alpha t}$  ( $\alpha \in \mathbb{R}$ ), measured in thousands of users after  $t$  months.

How many users will the application have in 2 years?

- A. 25,600 users
- B. 25,600,000 users
- C. 12,151 users
- D. 12,151,041 users

## 6- AUGUST 2021 Q 35



Myriam opens a bank account with an initial deposit of 10,000 EGP. The bank account will earn 5 percent interest compounded annually for the first 3 years, after which it will earn 8 percent interest compounded annually.

What is the approximate amount, rounded to the nearest EGP, added to Myriam's account after 5 years?

## 7- DECEMBER 2021 Q 17



How much money would you need to deposit today at 8% annual interest compounded monthly to have \$10,000 in the account after 5 years?

- A. \$6,500.5
- B. \$6,680.13
- C. \$6,712.10
- D. \$5,989.3

## 8 - SAMPLE TEST / Q 33



One of the worldwide publishers designed an EST preparatory guide and decided to publish a new edition at the end of the third year. The first edition was sold for \$10 in the bookstores, and its price decreased by 10% at the end of each year.

If one student decided to come to a bookstore at the launch of the second edition but decided to buy the old one, how much will he/she pay ?

## 9- Sample question



Moses deposited Rs. 850 into the bank in July. From July to December, the amount of money he deposited into the bank increase by 25% per month. Whats the total amount of money in his account after December?

- A 6570
- B 7570
- C 8570
- D 9570

## 10- Sample question



A music artist released a new album. The function  $f$  models the weekly sales, in dollars, of the album  $x$  weeks since the first week of sales. The model predicts that each week the album will have 2% fewer sales than the previous week. Which of the following could define  $f$ ?

- A)  $f(x) = 350(0.02)^x$
- B)  $f(x) = 350(0.80)^x$
- C)  $f(x) = 350(0.98)^x$
- D)  $f(x) = 350(1.02)^x$

## 11- Sample question



$$T(x) = 24(0.97)^x$$

A sample of bacteria in a liquid growth medium that has an initial temperature of 24 degrees Celsius ( $^{\circ}\text{C}$ ) is placed in a refrigerator with the temperature set to  $0^{\circ}\text{C}$ . The function above approximates the temperature  $T$ , in  $^{\circ}\text{C}$ , of the medium  $x$  minutes after being placed in the refrigerator. Which of the following best approximates the amount that the temperature, in  $^{\circ}\text{C}$ , of the medium has decreased after 20 minutes?

- A)  $T(0)$
- B)  $T(20)$
- C)  $\frac{T(20)}{T(0)}$
- D)  $T(0) - T(20)$

## 12- Sample question



When Olivia purchased a minivan, its value was \$21,000. For each year that Olivia owned the minivan, the minivan's value decreased by 12% of it's value from the previous year. Which of the following equations could be used to determine how many years,  $x$ , it took for the value of Olivia s minivant ?? be one halt of its value at the time she purchased??

- A)  $21,000(1+0.12)^x = \frac{1}{2}(21,000)$
- B)  $21,000(1-0.12)^x = \frac{1}{2}(21,000)$
- C)  $21,000\left(\frac{1}{2}\right)^x = 0.12(21,000)$
- D)  $21,000\left(\frac{1}{2}\right)^x = (1-0.12)(21,000)$

## 13- Sample question



At 1:00 p.m., the population of bacteria in a liquid medium is 80 thousand. The population doubles every 40 minutes. If the population at 5:00 p.m. will be  $n$  thousand, what is the value of  $n$ ?

## 14- Sample question



Due to a viral infection, the population of panda bears in a certain area in China was estimated to have decreased at an annual rate of 40 percent, for five consecutive years.

After the five years, biologists developed a vaccine that helped the panda bears become immune to the virus. The population of panda bears in the region then began to increase at an annual rate of 20 percent.

If the initial population of panda bears was 310, what was the population of panda bears five years after the virus started to spread? (Give your answer to the nearest integer.)

## 15- Sample question



Due to a viral infection, the population of panda bears in a certain area in China was estimated to have decreased at an annual rate of 40 percent, for five consecutive years.

After the five years, biologists developed a vaccine that helped the panda bears become immune to the virus. The population of panda bears in the region then began to increase at an annual rate of 20 percent.

How many years after the population of panda bears reaches its lowest point will the population equal its original size? (Give your answer to the nearest integer.)

## 16- Sample question



$$F = P(1 + r)^n$$

A broker uses the formula above to estimate the future value  $F$  of an investment. The investment  $P$  earns an annual rate of return  $r$  for  $n$  years.

If the investment  $P$  is doubled, by what percent does the future value  $F$  increase?

- A) 50%
- B) 100%
- C) 150%
- D) 200%

## 17- Sample question



An economist thinks that the price of an investment will increase at an annual rate of 4%. If the current price of the investment is \$25.25, which of the following equations models the price,  $p$ , after  $t$  years?

- A)  $p = 25.25(1.04t)$
- B)  $p = 25.25(0.04)^t$
- C)  $p = 25.25(1.04)^t$
- D)  $p = 25.25(t^{0.04})$

## 18- Sample question



Jessica opened a bank account that earns 2 percent interest compounded annually. Her initial deposit was \$100, and she uses the expression  $\$100(x)^t$  to find the value of the account after  $t$  years.

What is the value of  $x$  in the expression?

## 19- Sample question



Jessica opened a bank account that earns 2 percent interest compounded annually. Her initial deposit was \$100, and she uses the expression  $\$100(x)^t$  to find the value of the account after  $t$  years.

Jessica's friend Tyshaun found an account that earns 2.5 percent interest compounded annually. Tyshaun made an initial deposit of \$100 into this account at the same time Jessica made a deposit of \$100 into her account. After 10 years, how much more money will Tyshaun's initial deposit have earned than Jessica's initial deposit? (Round your answer to the nearest cent and ignore the dollar sign when gridding your response.)

## 20- Sample question



A piece of jewelry is initially valued at \$100. Every month the value of the piece of jewelry increases by 1% of its value the previous month. Which of the following represents the value  $Q(t)$ , in dollars, of the piece of jewelry at the end of  $t$  months?

A)  $Q(t) = 100 \left( 1 + \frac{t}{100} \right)$

B)  $Q(t) = 100 (1.01)^t$

C)  $Q(t) = 100 \left( 1 + \frac{0.01}{12} \right)^t$

D)  $Q(t) = 100 (1 + (.01)^t)$

## 21- Sample question



The volume of water in a reservoir at the start of a construction project is  $V_0$ . For every 10-day period, the volume of water in the reservoir will decrease by 3% of the volume from 10 days before. Which of the following equations represents the amount of water left in the reservoir,  $V_t$ , after  $t$  days?

A)  $V_t = V_0(0.97)^{10t}$

B)  $V_t = V_0(0.97)^{\frac{t}{10}}$

C)  $V_t = V_0(0.03)^{10t}$

D)  $V_t = \frac{t}{10}(0.97V_0)$

22- DECEMBER 2020 Q 38



In the year 1990, 12000 tourists visited country X. Due to bad weather conditions, the number of tourists visiting country X started decreasing by 10% per year. How many more tourists visited country X in the year 1993 than the year 2000? (Give the answer to the nearest whole number).

## ANSWERS OF LESSON ( COMPLEX INTEREST )

### NON CALCULATOR



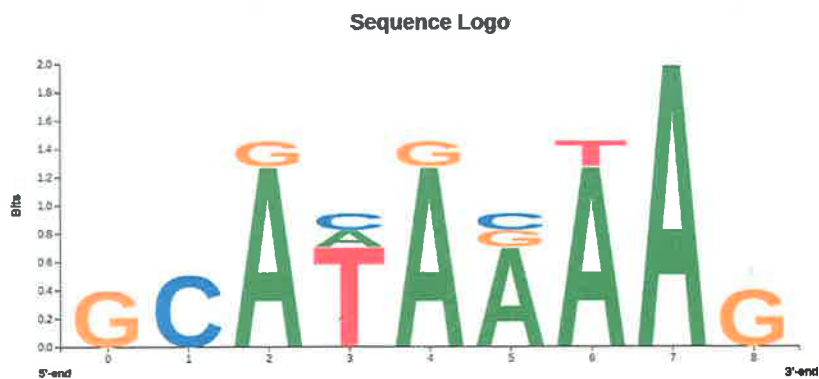
Question	Answer
1	C
2	
3	
4	
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28	
29	

### CALCULATOR



Question	Answer
1	A
2	D
3	C
4	C
5	C
6	3503
7	C
8	7.29
9	D
10	C
11	D
12	B
13	5120
14	24
15	14
16	B
17	C
18	1.02
19	6.11
20	B
21	B
22	4564
23	
24	
25	
26	
27	
28	
29	

# Sequence



# SEQUENCE

## A Arithmetic Sequence

1    2    3    4  
2, 4, 6, 8 -----

$$T_n = a_1 + (n - 1)d \longrightarrow \begin{aligned} \text{Diff} &= T_2 - T_1 \\ &= T_3 - T_2 \end{aligned}$$

Term Volume
First Term
Term Numbers

$$T_5 = 2 + (5 - 1)(2)$$

$$T_5 = 2 + 8 = 10$$

$$S_n = \frac{n}{2} (a_1 + a_n) \text{ [sum of the } n^{\text{th}} \text{ seq.]}$$

$$S_5 = \frac{5}{2} (2 + 10)$$

B

## Geometric Seq.

Term Numbers → 1    2    3

Term Volume → 2,    4,    8

★

$$T_n = a_1 (r)^{n-1}$$

Term Volume →  $T_n$     First Term →  $a_1$     Term Numbers →  $(r)^{n-1}$   
 Ratio =  $\frac{T_2}{T_1} = \frac{T_3}{T_2}$



## Sum of Geometric seq.

$$S_n = \frac{a(1-r^n)}{1-r}$$

When  $r \neq 1$

(a) the first term

(r) ratio

(n) term number



Sum of infinite  $|r| < 1$

$$sum = \frac{a}{1-r}$$

# *Questions*



## 1- AUGUST 2021 Q 34



James adds to an oil tank 10 liters on day 1, then every day he adds 50% the amount he filled the day before.

After 1000 days, how much oil is there approximately in the tank?

## 2- JUNE 2022 (cancelled) / Q 35



17 is subtracted from triple the sum of all integers from 1 to 44. What is the result?

- a. 973
- b. 939
- c. 5923
- d. 2953

## 3- sample test



The first term is 1 in the geometric sequence 1, -3, 9, -27, ... What is the SEVENTH term of the geometric sequence?

- A. -243
- B. -30
- C. 81
- D. 729

## 4- sample test



4, 11, 18, ...

In the sequence above, the first term is 4 and each term after the first is 7 more than the previous term. What is the 12th term of the sequence?

- (A) 77
- (B) 81
- (C) 84
- (D) 86

## 5- sample test



A sequence is defined for all positive integers by  $s_n = 2s_{(n-1)} + n + 1$  and  $s_1 = 3$ . What is  $s_4$ ?

- F. 9
- G. 18
- H. 22
- J. 49

## 6- Sample test



The 3rd and 4th terms of an arithmetic sequence are 13 and 18, respectively. What is the 50th term of the sequence?

- A. 248
- B. 250
- C. 253
- D. 258

## 7- Sample test



The sum of an infinite geometric series with first term  $a$  and common ratio  $r < 1$  is given by  $\frac{a}{1-r}$ . The sum of a given infinite geometric series is 200, and the common ratio is 0.15. What is the second term of this series?

- F. 25.5
- G. 30
- H. 169.85
- J. 170

## 8- sample test



The first term of an arithmetic sequence is 1. The common difference of the sequence is 2. What is the sum of the first 15 terms of this sequence?

- F. 29
- G. 64
- H. 210
- J. 225

## 9- sample test



In a geometric sequence where the 1st term is 2 and the ratio is  $-2$ , what is the 6th term?

- F.  $-64$
- G.  $-32$
- H.  $-8$
- J.  $-\frac{1}{8}$

## 10- sample test



In an arithmetic series, the terms of the series are equally spread out. For example, in  $1 + 5 + 9 + 13 + 17$ , consecutive terms are 4 apart. If the first term in an arithmetic series is 3, the last term is 136, and the sum is 1,390, what are the first 3 terms?

- A. 3, 10, 17
- B. 3, 23, 43
- C. 3,  $36\frac{1}{3}$ , 70
- D. 3,  $69\frac{1}{2}$ , 136

## 11- Sample test



The first and second terms of a geometric sequence are  $n$  and  $an$ , in that order. What is the 1,000th term of the sequence?

- A.  $a^{999}n$
- B.  $a^{1,000}n$
- C.  $a^{1,001}n$
- D.  $(an)^{999}$

## 12- Sample test



Which of the following statements is NOT true about the arithmetic sequence 17, 12, 7, 2, ... ?

- A. The fifth term is  $-3$ .
- B. The sum of the first 5 terms is 35.
- C. The eighth term is  $-18$ .
- D. The common ratio of consecutive terms is  $-5$ .

## 13- sample test



The first 3 terms of a geometric sequence are 4, 10, and 25. What is the next term in the sequence?

- A. 35
- B. 40
- C. 55
- D. 62.5

## ANSWERS OF LESSON ( SEQUENCE )

### NON CALCULATOR



Question	Answer
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	
16	
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18	
19	
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22	
23	
24	
25	
26	
27	
28	
29	

### CALCULATOR



Question	Answer
1	20
2	D
3	D
4	B
5	J
6	A
7	F
8	J
9	F
10	A
11	A
12	D
13	D
14	
15	
16	
17	
18	
19	
20	
21	
22	
23	
24	
25	
26	
27	
28	
29	

# Ratio

3.14159265358979323846264338327950288419716939937510582097494459230781640628620899862803482534217706798214808651328230664709384460955058223172533594  
 $\pi$

Adobe Stock | #272300873



$x$  :  $y$  :  $z$       Total  
 1 : 2 : 3      6

$$\frac{1 \times 2400}{6} : \frac{2 \times 2400}{6} : \frac{3 \times 2400}{6} \quad 2400$$

Or

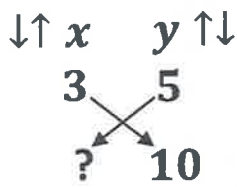
$$1x + 2x + 3x = 24$$

$$6x = 24$$

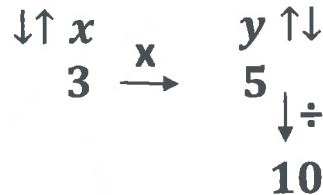


**Direct Ratio**

**Inversely ratio**



$$\frac{3 \times 10}{5}$$



$$\frac{3 \times 5}{10}$$



## Triple ratio

$$x : y$$

$$3 : 5$$

$$y : z$$

$$2 : 7$$

$$x : z$$

$$6 : 35$$

$$x : y : z$$

$$3 : 5$$
  
$$2 : 7$$

---

$$6 : 10 : 35$$

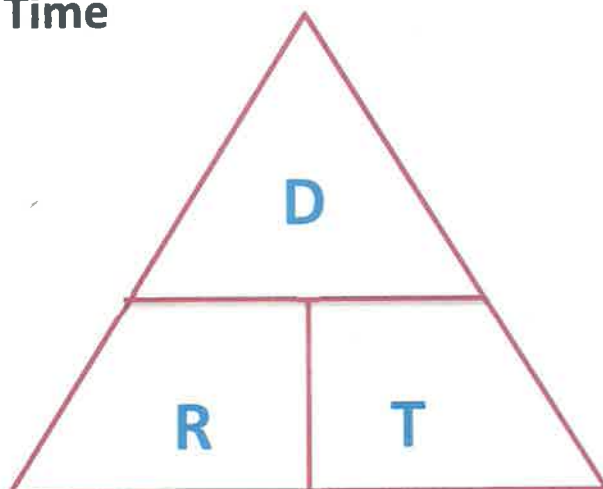


$$D = R \times T$$

Distance      Rate      Time

$$T = \frac{D}{R}$$

$$R = \frac{D}{T}$$



# *Questions*



## 1- OCTOBER 2020 Q 2



The magnitude of the electrostatic force  $F$  between two point charges in vacuum is given by

$$F = \frac{q_1 q_2}{4\pi\epsilon_0 r^2} \text{ where:}$$

$F$  is the magnitude of the force exerted

$q_1$  is the charge on one body

$q_2$  is the charge on the other body

$r$  is the distance between the two bodies

$\epsilon_0$  is the permittivity of the vacuum.

If the charges are to be separated by a distance of  $3r$ , an electrostatic force  $F_1$  is created. What is the relationship between  $F_1$  and  $F$ ?

- A.  $F_1 = 3F$
- B.  $F_1 = F/3$
- C.  $F_1 = 9F$
- D.  $F_1 = F/9$

## 2- OCTOBER 2020 Q 14



If  $\frac{1}{x-y} = \frac{3}{5y}$ , which of the following proportions is equivalent?

- A.  $\frac{x}{y} = \frac{3}{8}$
- B.  $\frac{x}{y} = \frac{8}{3}$
- C.  $\frac{x}{y} = \frac{8}{15}$
- D.  $\frac{x}{y} = \frac{15}{8}$

## 3- JUNE 2021 Q 2



For a point source, sound waves propagate in concentric spheres, therefore the intensity of the sound at a point A distant  $D$  from the source is given by:  $I = \frac{P}{4\pi D^2}$  where:

$I$  is the sound intensity

$P$  is the power of the point source

$D$  is the distance between the source and the point A where the intensity is to be found

If the power of the source doubles ( $P' = 2P$ ), and the distance between the source and point A also doubles ( $D' = 2D$ ), the sound intensity becomes  $I'$ . What is the relationship between  $I'$  and  $I$ ?

- A.  $I' = I$
- B.  $I' = 4I$
- C.  $I' = I/2$
- D.  $I' = I/4$

## 1- OCTOBER 2020 Q 9



The selling price of an apartment is directly proportional its area. If an apartment of 127 sqm is sold for \$168,275, what would be the price of a 156 sqm apartment?

- A. 237,900\$
- B. 208,500\$
- C. 136,993\$
- D. 206,700\$

## 2- OCTOBER 2020 Q 10



In a hospital, the medical staff is composed of 34 doctors and 68 nurses. How many additional doctors should join the hospital in order for the ratio of doctors to total number of medical staff to become 3 to 7?

- A. 21
- B. 19
- C. 17
- D. 15

## 3- OCTOBER 2020 Q 13



Maria downloaded to her music library a total of 350 pop and rock songs. If the ratio of pop to rock song is 3 to 11. How many rock songs are there in Maria's library?

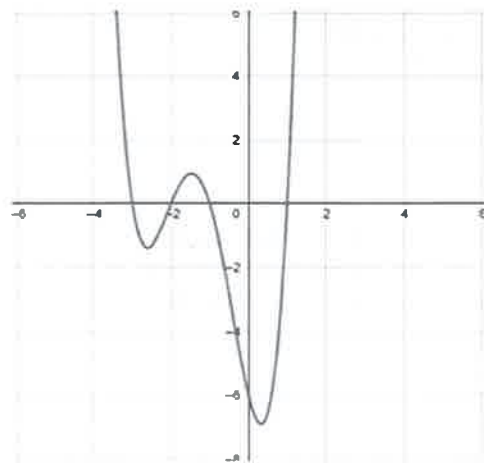
- A. 75
- B. 125
- C. 175
- D. 275

## 4- OCTOBER 2020 Q 23



A secretary types on her computer keyboard at an average speed of 1.75 words per second. Her manager asked her to type a document containing 16 pages with an average of 525 words per page. How long will she be actively typing this document?

- A. 1 hour, 10 minutes
- B. 1 hour, 20minutes
- C. 2 hours, 5 minutes
- D. 4 hours, 5 minutes



## 5- OCTOBER 2020 Q 34



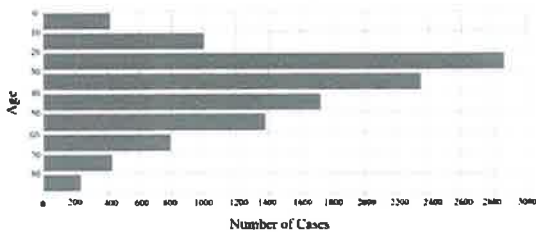
We chose randomly a sample of 250 lawyers out of the 4900 registered in the syndicate, and we asked them about the most frequent case they defend. The results showed that 45 answered divorce, 125 answered theft and 80 answered murder. Presumably, what is the total number of lawyers registered in the syndicate who deal most frequently with murder?

6- DECEMBER 2020 Q 16



Number of Covid-19 cases according to age

The histogram shown summarizes the number of people who got infected by the Covid-19 virus according to their age in Lebanon. The survey was done over 11,200 people.



Which of the following is closest to the ratio of the number of infected people below the age of 10 to those above the age of 80?

- A.  $\frac{10}{80}$
- B.  $\frac{215}{410}$
- C.  $\frac{410}{215}$
- D.  $\frac{80}{10}$

7- DECEMBER 2020 Q 35



Distance covered by data as it is transferred between different parts of a large computer is measured in light-nanoseconds (lns). 1 light-nanosecond is equivalent to 29.9cm. If a certain data is transferred at the rate of 19 centimeters every second, what distance, in lns, does the data cover in 3 seconds? (Round your answer to the nearest tenths).

8- MARCH 2021 Q 15



If 35% of a number is equal to two-thirds of another number, what is the ratio of the first number to the second number?

- A.  $\frac{21}{40}$
- B.  $\frac{2}{95}$
- C.  $\frac{40}{21}$
- D.  $\frac{35}{150}$

9- MARCH 2021 Q 31



Two numbers are in ratio 3:5. If 9 is subtracted from each, the new numbers are in the ratio 12:23. What is the biggest number?

10- MARCH 2021 Q 33



Ahmad runs half the distance to school and walks for the remaining part of the journey. He runs at 3m/s but slows to 2m/s for the second half of the journey. He takes 55 minutes to complete the trip. Find the distance (in meters) Ahmad has to travel to reach school.

11- MARCH 2021 Q 36



Bob is paid an hourly rate. One week he earned 165 \$ by working 30 hours. If he works 40 hours the next week, how much will he earn?

12- MAY 2021 Q 9



Tanta University is an Egyptian university located in Tanta, Egypt. Since 1962, the administration was developed and was able to create more than 10 faculties. Statistics show, in an old release, that 3,636 students attend the Faculty of Medicine, and the ratio of female students to male students is 11:25. How many male students are attending the faculty?

- A. 2,544
- B. 2,525
- C. 2,000
- D. 1,604

13- MAY 2021 Q 24



Acceleration is a vector quantity that represents the rate of change of velocity over time. In physics, when the velocity of an object is changing, it means the object is either accelerating or decelerating. The formula used to find the velocity  $\vec{v}$  of an object is  $\vec{v} = \frac{\Delta\vec{r}}{\Delta t}$  and that of the acceleration is  $\vec{a} = \frac{\Delta\vec{v}}{\Delta t}$ , where  $\Delta\vec{r}$  is the displacement vector (change in position),  $\Delta\vec{v}$  is the change in velocity vector, and  $\Delta t$  is the change in time of the object.

Which of the following statements is true regarding the given formula?

- I. If  $\Delta\vec{r}$  increases and  $\Delta t$  decreases, the acceleration will increase.
- II. If  $\Delta\vec{r}$  decreases and  $\Delta t$  increases, the acceleration will increase.
- III. If  $\Delta\vec{r}$  decreases and  $\Delta t$  increases, the acceleration will decrease.

- A. I only
- B. II only
- C. I and II
- D. I and III

14- MAY 2021 Q 33



If  $y$  varies directly as the cube of  $2x$ , and  $y = 8$  when  $x = 2$ , what is  $y$  when  $x$  is equal to 4 ? (grid-in)

15- MAY 2021 Q 38



The density of a substance is equal to the quotient of its mass and its volume. What is the mass, in kilograms, of a liquid whose density is  $14.2 \text{ g/cm}^3$  if its volume is equal to 6 L? ( $1 \text{ mL} = 1 \text{ cm}^3$ ) (grid-in)

16- JUNE 2021 Q 30



Harvey wants to buy a new apartment. He estimates that he will need its area to be around 1400 square feet. But, the provider measures its units in square meters. If 1 meter is nearly 3.28 feet, how many square meters approximately will Harvey need?

- A. 427
- B. 130
- C. 4592
- D. 15062

17 - JUNE 2021 Q 34



The concentration of solution in sugar is directly proportional to the mass of sugar dissolved in the solution. If the concentration of a solution is  $1.5 \text{ mol/L}$  when 54g are dissolved, how many grams are dissolved if the concentration is  $2.1 \text{ mol/L}$ ?

18 - AUGUST 2021 Q 3



A machine finishes the paving of 600m of a road in 1 hour. At the same steady rate, how much time would take two identical machines to finish paving 300m?

- A. 15 minutes
- B. 2 hours
- C. 1 hour
- D. 30 minutes

## 19- AUGUST 2021 Q 22



In 2007, a watch manufacturer found that 2 out of every 30 watches produced are defected.

If the manufacturer produces 2 million watches in a year, which of the following is closest to the estimated number of non-defected watches?

- A. 1,866,000
- B. 1,867,000
- C. 133,000
- D. 134,000

## 20- AUGUST 2021 Q 28



$$f' = \left( \frac{v + v_0}{v} \right) f$$

You are riding in a car at a velocity  $v_0$ , in meters per second, towards a loud block party. Because of this movement, the actual frequency of the sound waves emitted by the speakers,  $f$ , in hertz, is perceived by you to be a different frequency  $f'$ , in hertz.

The speaker's sound waves travel at a velocity  $v$ , in meters per second. This phenomenon is called the Doppler effect. The formula above shows the relationship between these variables.

If the velocity of the car is 22 m/s, the velocity of the sound waves of the speaker is 340 m/s and you perceive the frequency of the speaker's sound waves to be 500 Hz.

Which of the following is the closest to the actual frequency of the speaker's sound waves?

- A. 469
- B. 532
- C. 470
- D. 533

## 21- OCTOBER 2021 Q 31



If  $h$  varies inversely as  $k$ , and  $h = 9$  when  $k = 20$ , what is the value of  $k + 4$  when  $h = 15$ ? (grid-in)

## 22- OCTOBER 2021 Q 36



In 2010, at a school, 3:5 of the seniors wanted to celebrate their prom night at restaurant X, while 30% of the rest voted for restaurant Y, and the 84 students left voted for restaurant Z. How many senior students voted for restaurant X? (grid-in)

23 - MARCH 2022 / Q 24



Ohm's law states that the current through a conductor between two points is directly proportional to the voltage across the two points. Introducing the constant of proportionality, the resistance, one arrives at the usual mathematical equation that describes this relationship:

$$I = \frac{U}{R}$$

Which of the following statements is true regarding the given formula?

- I. If R increases, the current I will increase.
  - II. If U increases, the current I will increase.
  - III. If R increases, the current I will decrease.
- A. I only  
 B. II only  
 C. I and II  
 D. II and III

24 - MARCH 2022 / Q 32



If y varies directly as the square of 3x and y=16 when x=4, what is y when x is equal to 6? (grid-in)

25 - MARCH 2022 / Q 38



The formula for speed is speed = distance ÷ time. If a girl cycles for 2.3 hours at a speed of 42 km/h, what distance does she travel? (grid-in)

26 - SAMPLE TEST / Q 12



In a sports academy, the ratio of kids learning basketball to kids learning football is 8:10, while the ratio of kids learning football to kids learning ping-pong is 15:6. If there are 20 kids learning basketball, how many kids are learning ping-pong?

- A) 10  
 B) 12  
 C) 25  
 D) 40

27 - SAMPLE TEST / Q 27



If  $(m + 1)$  is inversely proportional to  $n^2$ ,  $n \geq 0$ . If  $m = 4$  when  $n = \frac{2}{5}$ , what would be the value of  $n$  if  $m = 6$ ?

A)  $\frac{\sqrt{35}}{35}$

B)  $\frac{2\sqrt{35}}{35}$

C)  $\frac{\sqrt{35}}{25}$

D)  $\frac{2\sqrt{35}}{25}$

28 - JUNE 2022 (cancelled) / Q 9



During the final game of UEFA Euro 2020 between Italy and England, 67,173 fans attended the game in Wembley Stadium in London, England. Assuming that the ratio of adults to children who attended the game was approximately 13 to 6, which of the following numbers represents approximately the number of children who attended the game live in the stadium?

- A. 21213
- B. 31002
- C. 36170
- D. 45960

29 - JUNE 2022 (cancelled) / Q 22



Karim drove his car from his village to the city. It took him 2.5 hours to reach the city driving at a constant speed of 60 km per hour. Approximately, how much will he save time if he starts driving at a constant speed of 70 km per hour?

- A. 0.357 hours
- B. 0.765 hours
- C. 1.544 hours
- D. 2.143 hours

30 - JUNE 2022 (cancelled) / Q 28



Patrick is twice as old as Alonso. Alonso is 7 years older than Fatima, and Fatima is 2 years younger than Patricia. If Patricia's age to Salma's age is 4 to 3, what is the age of Patrick if Salma is 12 years old?

- A. 16 years old
- B. 21 years old
- C. 42 years old
- D. 48 years old

31 - MARCH 2022 / Q 38



The formula for speed is  $\text{speed} = \text{distance} \div \text{time}$ . If a girl cycles for 2.3 hours at a speed of 42 km/h, what distance does she travel? (grid-in)

## ANSWERS OF LESSON ( RATIO )

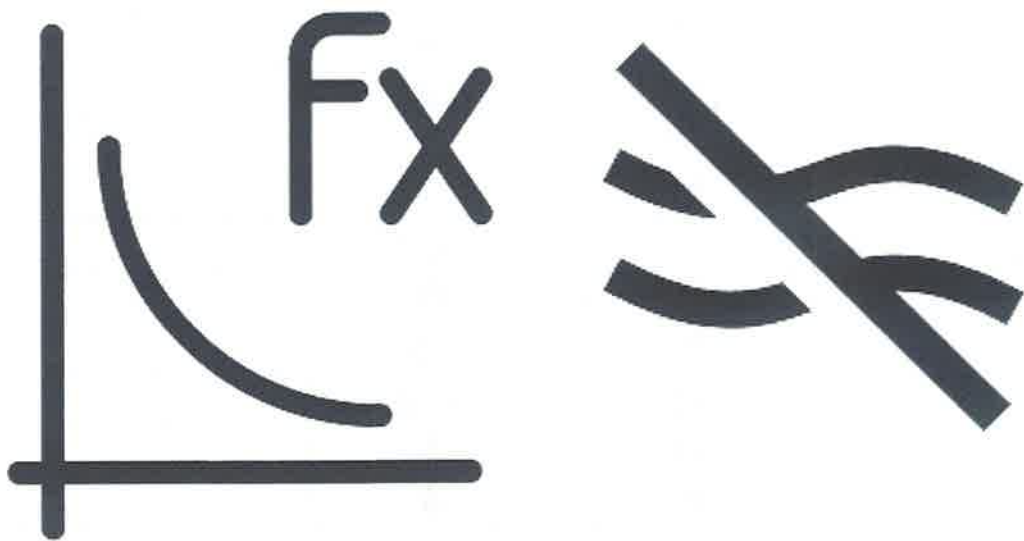
**NON CALCULATOR**

**CALCULATOR**



Question	Ans	Question	Answer	Question	An
1	D	1	D	30	C
2	B	2	C	31	96.6
3	C	3	D	32	
4		4	B	33	
5		5	1568	34	
6		6	C	35	
7		7	1.9	36	
8		8	C	37	
9		9	55	38	
10		10	7920	39	
11		11	220	40	
12		12	B		
13		13	D		
14		14	64		
15		15	85.2		
16		16	B		
17		17	75.6 OR 378/5		
18		18	A		
19		19	B		
20		20	C		
21		21	16		
22		22	180		
23		23	D		
24		24	36		
25		25	96.6		
26		26	A		
27		27	B		
28		28	A		
29		29	A		

# Average & Outliers



# average

---

a) **mean** (*A. mean*)

$$\text{mean} = \frac{\text{sum}}{\text{number}}$$

Set of numbers as

3, 5, 20, 1, 7, 4

To find the

$$\text{mean} = \frac{3+5+20+1+7+4}{6}$$

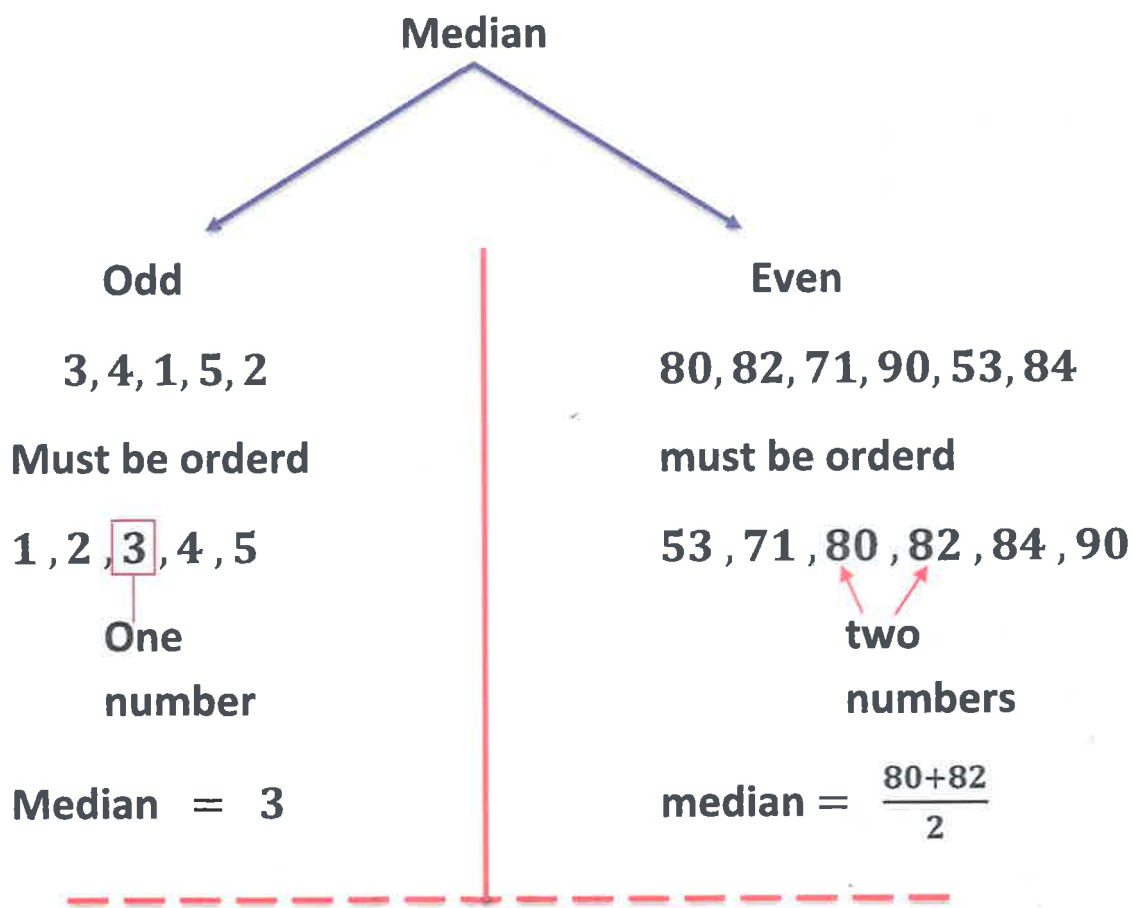
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b) **Mode** (*most repeated number*)

3, 1, 2, 4, 5, 3, 7

*Mode* = 3

c) **Median**



d) **Range**

(The diff. between the biggest and the smallest volues)

3, 5, 7, 8, 10, 12, 13, 20, 25

Range = 25 - 3 = 22

e)

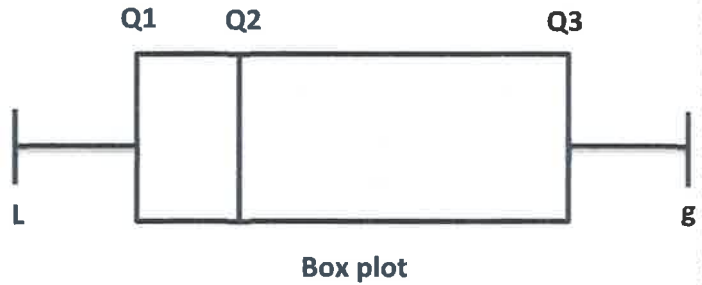
Interquartile range IQR

25, 28, 29, 30, 34, 35, 37, 38

Step1 : Find the median

$$\frac{30+34}{2} = 32$$

Mediam 32



Step 2 : Find the first quartile Q1

25, 28, 29

Q1 = 28

Step 3 : Find the third quartile Q3

35, 37, 38

Q3 = 37

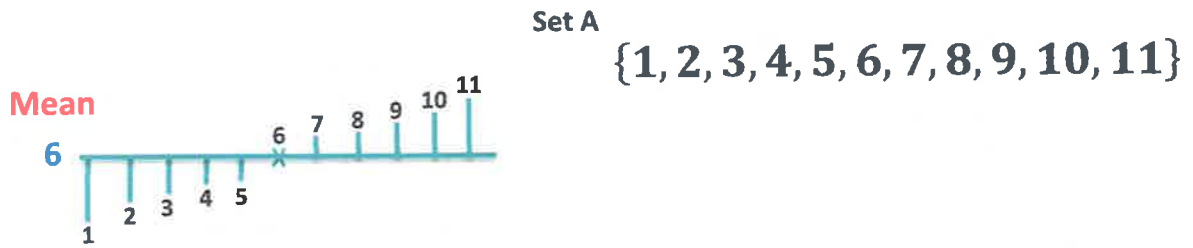
Step 4 : Find the diff Q3-Q1

IQR = 37 - 28

= 9

f) Standard deviation

If we have 4 set of numbers



Standard deviation arrangement  $A > B > C > D > E$

**A****1, 2, 3, 4, 5, 20****High outliers** ↓↑ Remove***mean > mediam > mode*****B****100, 99, 89, 87, 10****Low outliers** ↓↑ Remove***mean < mediam < mode***

# *Questions*



## 1- OCTOBER 2020 Q 9



We survey 125 employees at random from each of two companies labeled **A** and **B**, and separated into groups based on how many siblings do they have. The results are shown in the table below.

Number of siblings	Company A	Company B
0	15	25
1	45	40
2	30	25
3	25	15
4	10	20

What is the median number of siblings of the sample of employees in company B?

- A. 1
- B. 2
- C. 3
- D. 4

## 2- OCTOBER 2020 Q 10



We survey 125 employees at random from each of two companies labeled **A** and **B**, and separated into groups based on how many siblings do they have. The results are shown in the table below.

Number of siblings	Company A	Company B
0	15	25
1	45	40
2	30	25
3	25	15
4	10	20

Which measure of center is the same in both companies?

- A. Range
- B. Mean
- C. Median
- D. Mode

3- JUNE 2021 Q 11



The table below summarizes the grades out of 10 obtained by 4 players in a competition over a total of 5 rounds.

	<b>Diego</b>	<b>Mark</b>	<b>Tyler</b>	<b>Toni</b>
<b>Round 1</b>	7	3	8	10
<b>Round 2</b>	5	10	7	4
<b>Round 3</b>	8	9	6	9
<b>Round 4</b>	9	5	7	10
<b>Round 5</b>	4	8	8	7
<b>Standard deviation</b>	<b>1.85</b>	<b>2.61</b>	<b>0.75</b>	<b>2.28</b>

The winner is the player with the highest average. Who won the competition?

- A. Diego
- B. Toni
- C. Tyler
- D. Mark

1- OCTOBER 2020 Q 16



Brad got an average of 76 on his last three math tests. What grade should he get on the fourth test to obtain an average of 80?

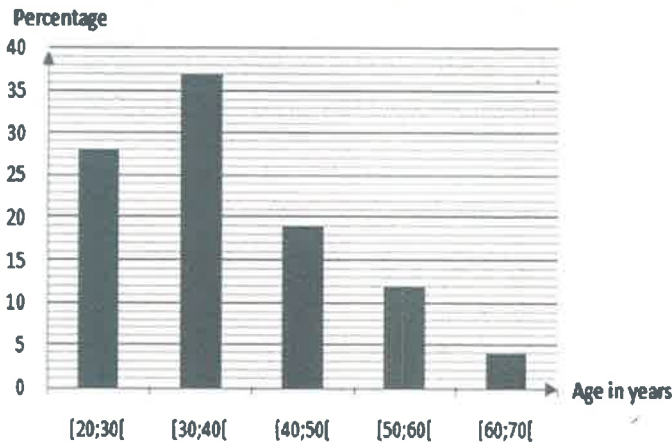
- A. 88
- B. 90
- C. 92
- D. 94

2- OCTOBER 2020 Q 20



The bar graph below shows the age distribution of the employees in a multi-branched bank.

Age distribution of the employees in a company



In which interval does the median age lie?

- A. [20;30[
- B. [30;40[
- C. [40;50[
- D. [50;60[

3- DECEMBER 2020 Q 10



If the average (arithmetic mean) of three numbers  $a$ ,  $b$ , and  $c$  is 10, what is the average of  $a$  and  $b$  in terms of  $c$ ?

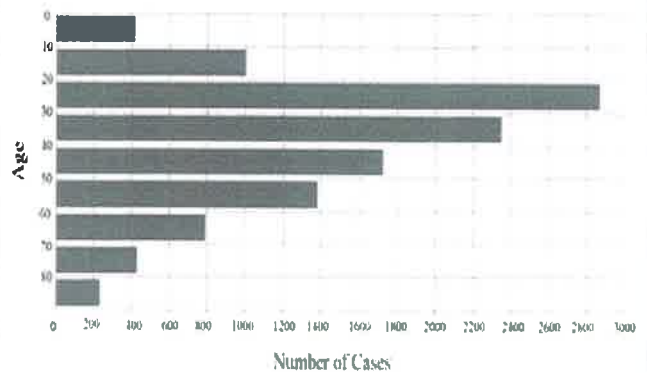
- A.  $5 - 0.5c$
- B.  $15 - c$
- C.  $30 - 0.5c$
- D.  $15 - 0.5c$

4- DECEMBER 2020 Q 15



Number of Covid-19 cases according to age

The histogram shown summarizes the number of people who got infected by the Covid-19 virus according to their age in Lebanon. The survey was done over 11,200 people.



Based on the information shown in the graph, which of the following is the most likely median age of those infected by the virus?

- A. 23
- B. 31
- C. 56
- D. 68

5- DECEMBER 2020 Q 18



46	55	60	65	71	71	76	80	86
88	89	90	92	95	98	100	100	100

The table above shows the scores of 18 students on an online history exam. Due to technical issues, the score of the 19<sup>th</sup> student was not added to the list. The professor adds the score and finds out that doing so increases the median score. Which of the following is the most likely score of the 19<sup>th</sup> student?

- A. 74
- B. 86
- C. 87
- D. 88

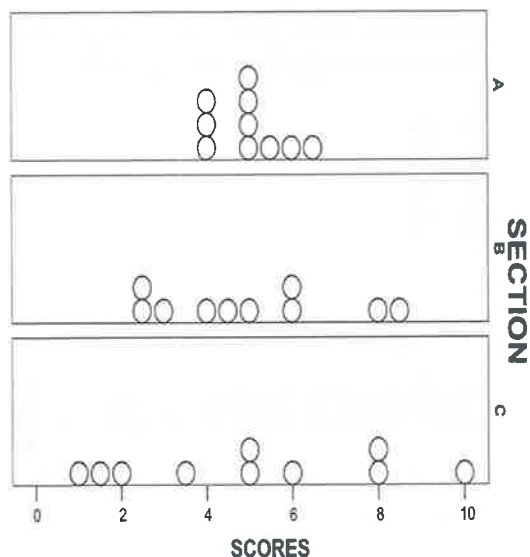
6- DECEMBER 2020 Q 26



15, 5, 10, 12, 13, 15, 17, 40, 31,  $x$   
 If the range of the list above is 29, which of the following can be the value of  $x$ ?  
 (34, 2)

- I. 2
  - II. 34
- A. Only I
  - B. Only II
  - C. Both I and II
  - D. Neither I nor II

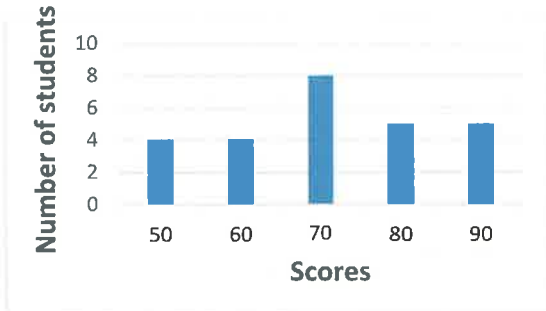
7- MARCH 2021 Q 9



The dot plots above show the scores on a common quiz for the three sections A, B, and C. Knowing that the average score is the same for the three sections, which of the following correctly compares the standard deviation ( $x$ ) of the scores in each of the three sections?

- A.  $x_A < x_B < x_C$
- B.  $x_A < x_C < x_B$
- C.  $x_C < x_B < x_A$
- D.  $x_B < x_A < x_C$

8- MARCH 2021 Q 10

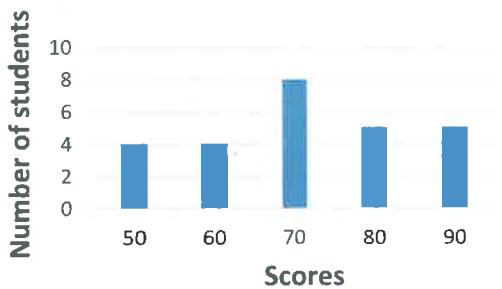


The above bar chart shows the scores of a philosophy test over 100.

What is the median score?

- A. 8
- B. 60
- C. 70
- D. 80

9- MARCH 2021 Q 11



What is the range of the scores?

- A. 40
- B. 3
- C. 10
- D. 20

10- MAY 2021 Q 17



Gold is one of the most important items in the world. Its price increases and decreases every day. The average closing price for the past 8 years is shown in the table below.

Year	Average Closing Price (\$)
2020	1,771.9
2019	1,393.34
2018	1,268.93
2017	1,251.92
2016	1,158.86
2015	1,266.06
2014	1,409.51
2013	1,668.86

What is the mean of the average closing price of the last 5 years according to the given table?

- A. 1,137.2
- B. 1,351.82
- C. 1,368.99
- D. 1,622.18

11- MAY 2021 Q 30



A football club published on its website the number of entrance tickets sold in 2018 and in 2019.

	Average number of tickets sold at the entrance door per game			Seasonal tickets	
	Male	Female	Child	Male	Female
2018	4521	1254	759	1122	780
2019	4668	1102	884	1088	794

	Ticket revenue from selling them at the entrance door per game (\$)			Seasonal ticket revenue (\$)	
	Male	Female	Child	Male	Female
2018	72336	16552.8	4402.2	78540	47970
2019	79822.8	15428	4420	80512	47640

What is the average revenue ticket from selling them at the entrance door per game in 2019?

- A. \$13.16
- B. \$14.31
- C. \$14.98
- D. \$17.27

12- JUNE 2021 Q 4



A survey is done on 80 families from two cities A and B, separated into groups based on the number of cars they own. The results are shown in the table below.

Number of cars	City A	City B
1	25	20
2	31	19
3	14	23
4	8	12
5	2	6

What is the mean number of cars owned by citizens in both cities A & B combined?

- A. Between 1 and 2
- B. Between 2 and 3
- C. Between 3 and 4
- D. Between 4 and 5

13- JUNE 2021 Q 5



A survey is done on 80 families from two cities A and B, separated into groups based on the number of cars they own. The results are shown in the table below.

Number of cars	City A	City B
1	25	20
2	31	19
3	14	23
4	8	12
5	2	6

Which measure of center is unchanged in both cities?

- A. Mode
- B. Mean
- C. Median
- D. None of the above

14- JUNE 2021 Q 21



A painter paints walls at an average rate of 1.2 walls per hour. He is asked to paint a villa containing 18 rooms each containing 5.4 walls on average. How long will he be actively painting the villa?

- A. 2 days, 18 hours
- B. 3 days
- C. 3 days, 9 hours
- D. 3 days, 18 hours

15- AUGUST 2021 Q 7



Tina got on her exams the following grades:

Physics 75/100 with coefficient 2

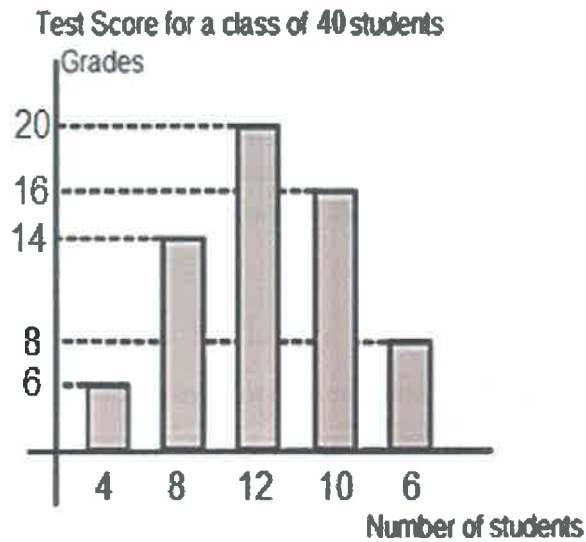
English 60/100 with coefficient 4

Chemistry 80/100 with coefficient 1

Knowing that the coefficient of Math is 5, what should her minimum grade in Math be to have at least an average of 80/100?

- A. 100
- B. 85
- C. 98
- D. She won't be able to have at least this average

16- AUGUST 2021 Q 23



The graph above shows the test grades over 20 of 40 students.

Based on the bar graph above, what is the average grade on the test?

- A. 10
- B. 11.6
- C. 12.8
- D. 14.6

17- OCTOBER 2021 Q 2



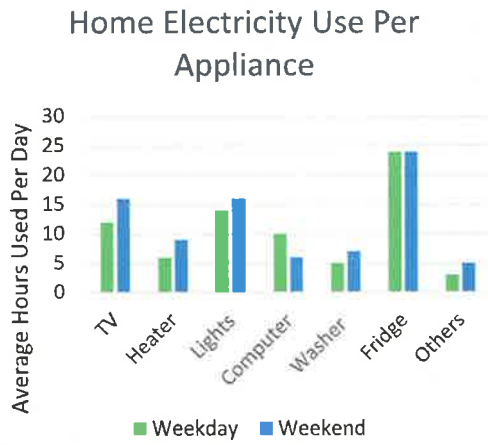
The table below shows the distance Amir walked every day during the first week of April, 2021.

	Distance (in m)
Thursday, April 1 <sup>st</sup>	1678
Friday, April 2 <sup>nd</sup>	2091
Saturday, April 3 <sup>rd</sup>	1245
Sunday, April 4 <sup>th</sup>	1566
Monday, April 5 <sup>th</sup>	2100
Tuesday, April 6 <sup>th</sup>	1989
Wednesday, April 7 <sup>th</sup>	1888

What is the average (arithmetic mean) of the data shown in the table?

- A. 2511.4
- B. 1888
- C. 1793.9
- D. 1672.5

18- DECEMBER 2021 Q 14



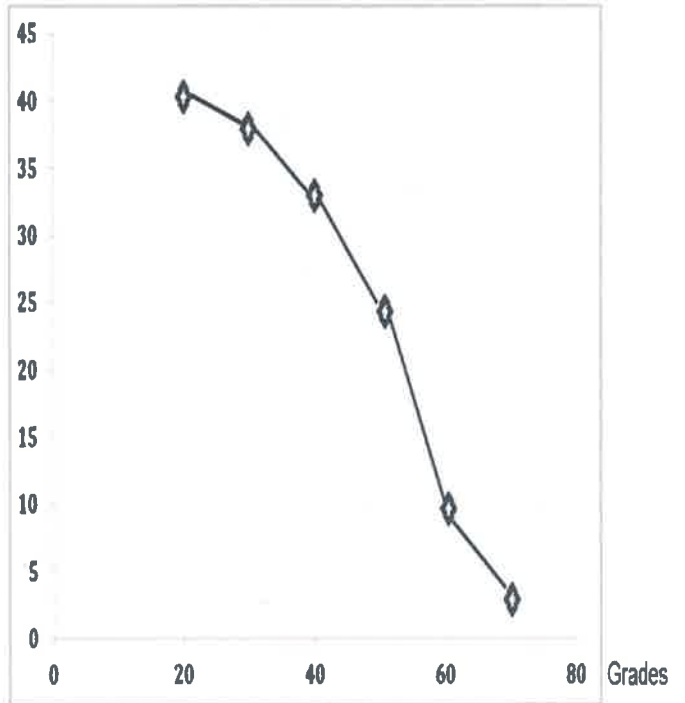
How many hours a day, on average, is the washer used on weekdays?

- A. 5
- B. 6
- C. 7
- D. 12

19- DECEMBER 2021 Q 21



Decreasing cumulative Frequency

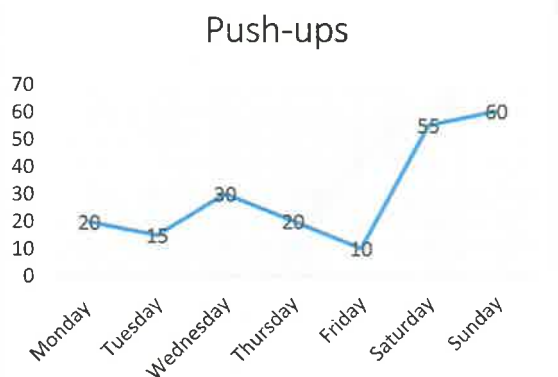


The polygon line above represents the grades distribution of a class on a history exam.

What is the mode of the above distribution?

- A. 20
- B. 40
- C. 50
- D. 60

20- DECEMBER 2021 Q 34



The graph above shows the number of push-ups Bob did last week.

What was the average number of push-ups?

21- DECEMBER 2021 Q 36



In a class of 25 students, the average of the grades of the boys, girls and the class is 12, 14 and 13.2 respectively. How many girls are in this class? (Grid in)

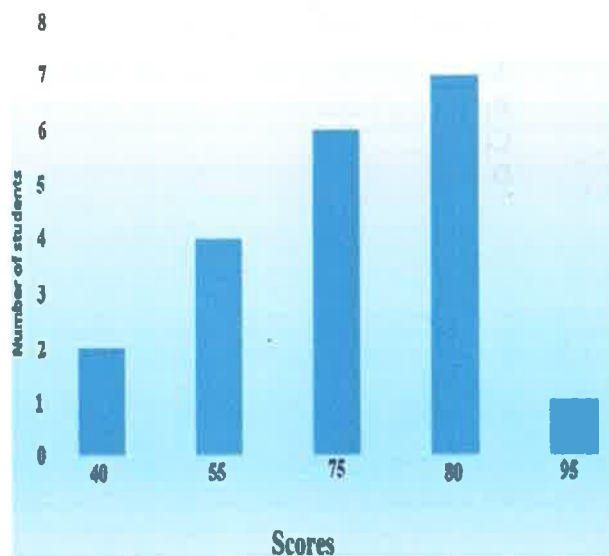
22 - MARCH 2022 / Q 28



What is the average (arithmetic mean) of  $2^{11}$  and  $2^{23}$ ?

- A.  $2^{17}$
- B.  $2^{15}$
- C.  $2^{10} + 2^{22}$
- D.  $2^{34}$

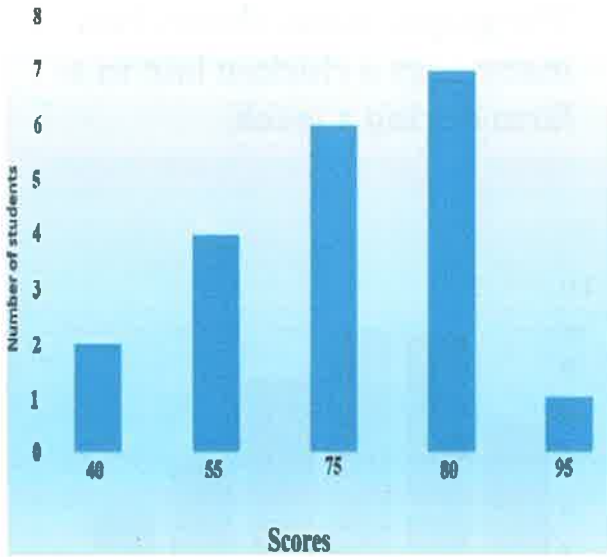
23 - MARCH 2022 / Q 33



The bar chart above shows the scores of a Math test over 100.

What is the median score? (grid-in)

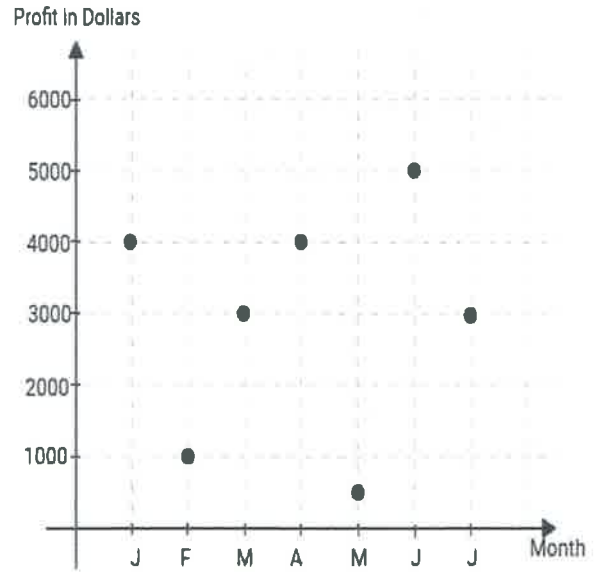
24 - MARCH 2022 / Q 34



The bar chart above shows the scores of a Math test over 100.

What is the range of the scores?  
(grid-in)

25 - SAMPLE TEST / Q 6



A company that produces and sells cotton clothes in Cairo, Egypt published their profit (in dollars), which they made during the first seven months of year 2020, on its website.

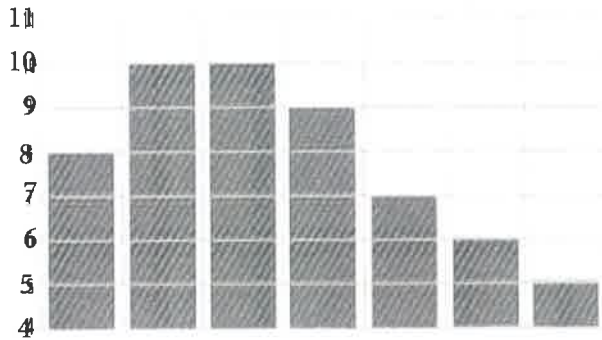
According to the graph, what is the average (arithmetic mean) of the profit made ?

- A) 2562.5
- B) 2928.57
- C) 3000
- D) 3416.67

26 - SAMPLE TEST / Q 24



The graph below shows how many eggs a chicken laid in a farm during a week.



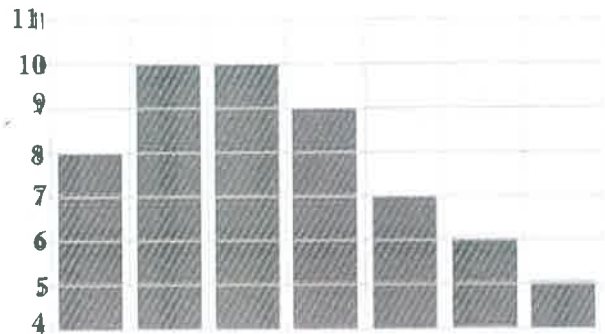
From the chart, which of the following is true ?

- A) The distribution of the data is negatively skewed.
- B) The distribution of the data is symmetric.
- C) The distribution of the data is positively skewed.
- D) The distribution of the data is symmetric and positively skewed.

27 - SAMPLE TEST / Q 25



The graph below shows how many eggs a chicken laid in a farm during a week.



What is the average of the sum of the mean and mode of the data shown ?

- A)  $\frac{125}{7}$
- B)  $\frac{125}{14}$
- C)  $\frac{111}{14}$
- D)  $\frac{55}{7}$

28 - JUNE 2022 (cancelled) / Q 3



A company for renting cars published on their website a summary of the amount they won during the past few years from renting cars and trucks.

Year	Amount won in \$ for renting cars	Amount won in \$ for renting trucks
2015	10004.6	7888.3
2016	12456.7	7985.2
2017	14899.9	8050.2
2018	13899.5	9000.5
2019	12003.4	8599.4
2020	13990.1	7995.5

What is the sum of the averages of the amounts won for renting cars and trucks during years 2017 to 2020?

- A. \$8411.4
- B. \$13698.225
- C. \$22109.625
- D. \$25678.725

29 - JUNE 2022 (cancelled) / Q 29



$$k + 2; 2k + 4; 2k + 5; 3k + 5$$

The average of the list above is 36.  
Find  $k$ .

- A. 144
- B. 18
- C. 16
- D. 2

30 - JUNE 2022 (cancelled) / Q 37



The arithmetic mean of the set below is 7.25. What is the median of this set?

$$n + 4; 6; 11; 2n - 1$$

- A. 6
- B. 7
- C. 6.5
- D. 8.5

## ANSWERS OF LESSON ( AVERAGE )

### NON CALCULATOR



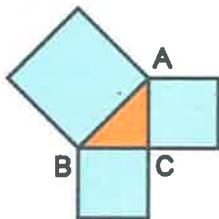
Question	Answer
1	A
2	D
3	B
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	
16	
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29	

### CALCULATOR

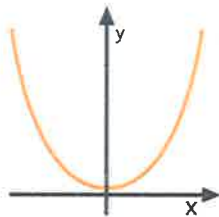


Question	Answer
1	C
2	B
3	D
4	B
5	D
6	D
7	A
8	C
9	A
10	C
11	C
12	B
13	D
14	C
15	C
16	D
17	C
18	A
19	C
20	30
21	15
22	C
23	75
24	55
25	B
26	C
27	B
28	C
29	C
30	C

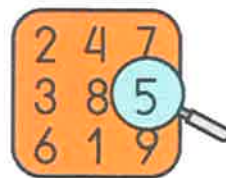
# Probability



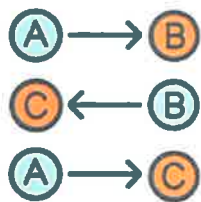
Geometry



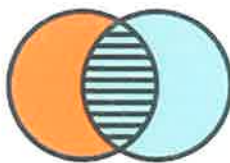
Algebra



Number Theory



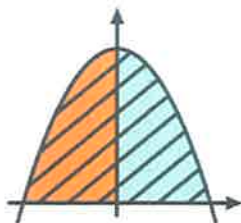
Logic Maths



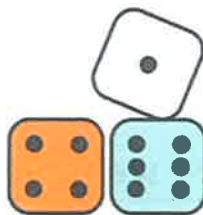
Discrete Maths



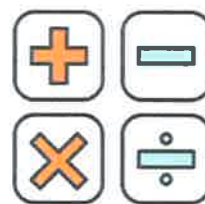
Statistics



Maths analysis



Probability



Elementary Maths

$$\text{probability} = \frac{\text{part}}{\text{total}}$$

$$0 \leq \text{probability} \leq 1$$

**Or****And**

\* *Geometric probability*

$$\frac{\text{area we need it}}{\text{total area}}$$

# *Questions*



1- OCTOBER 2020 Q 8



The table below summarizes the results of a survey about travel destination preferences for a group of 750 university students of 4 different majors.

	History	Math	Audit	IT	Total
Rome	65	35	35	15	150
Paris	75	65	10	25	175
Tokyo	40	115	50	20	225
NYC	70	60	30	40	200
Total	250	275	125	100	750

What fraction of people who prefer Rome or Paris come from an Audit or Math majors?

- A.  $\frac{140}{325}$
- B.  $\frac{65}{17}$
- C.  $\frac{65}{29}$
- D.  $\frac{4}{13}$

2- DECEMBER 2020 Q 36



	Smart phones	Laptops	Tablets	Total
Elementary	150	230	120	500
Intermediate	250	100	80	430
Secondary	300	220	100	620
Total	700	550	300	1550

A school asks each of its 1550 students whether they use a smartphone, a laptop, or a tablet during online learning. The table above summarizes the results. If a student is selected at random, what is the probability that he or she doesn't use a tablet knowing that he or she is not in the secondary section? (Round your answer to the nearest tenth).

3- MARCH 2021 Q 19



In a farm, there are 30 rabbits of two sizes "small and big" and three colors "white, brown, and gray" as shown in the table below.

Color \ Size	White	Brown	Gray
Small	4	4	6
Big	10	2	4

One rabbit is selected at random from this farm.

What is the probability that the selected rabbit is white?

- A.  $\frac{4}{14}$
- B.  $\frac{7}{15}$
- C.  $\frac{1}{30}$
- D.  $\frac{10}{30}$

## 4- MARCH 2021 Q 20



In a farm, there are 30 rabbits of two sizes “small and big” and three colors “white, brown, and gray” as shown in the table below.

Color \ Size	White	Brown	Gray
Small	4	4	6
Big	10	2	4

One rabbit is selected at random from this farm.

Suppose that the selected rabbit is not of white color, what is the probability for this rabbit to be from the big size?

- A.  $\frac{3}{5}$   
 B.  $\frac{3}{7}$   
 C.  $\frac{3}{8}$   
 D.  $\frac{16}{30}$

## 5- MARCH 2021 Q 21



In a bag, there are 12 identical tokens numbered from 1 to 12. A token is drawn at random. What is the probability to obtain an even multiple of 3?

- A.  $\frac{1}{4}$   
 B.  $\frac{1}{3}$   
 C.  $\frac{1}{2}$   
 D.  $\frac{1}{6}$

## 6 - JUNE 2021 Q 14



The table below summarizes the results of a survey about the favorite school subject for a group of 350 students according to their educational stage.

	Primary	Secondary	Tertiary	Total
Math	65	80	30	175
English	35	55	10	100
Science	15	10	25	50
History	10	5	10	25
Total	125	150	75	350

If a secondary student is chosen randomly, what is the probability that he favors Math or Science?

- A.  $\frac{9}{35}$   
 B.  $\frac{25}{18}$   
 C.  $\frac{8}{15}$   
 D.  $\frac{3}{5}$

7- AUGUST 2021 Q 25



	Practice any kind of sports	No sports activity	Total
Under 40	220	40	260
40 and older	100	180	280
Total	320	220	540

The table above shows the distribution of age and sports activity for 540 employees of a company.

If an employee aged under 40 is selected at random, what is the probability that he practices any kind of sports?

- A.  $\frac{2}{13}$
- B.  $\frac{11}{27}$
- C.  $\frac{11}{16}$
- D.  $\frac{11}{13}$

8- AUGUST 2021 Q 29



The table below summarizes students' work placement after graduation, based on the major.

	Work in their field of study	Work in another field	Don't work	Total
Engineering	17,065	10,593	3,867	31,525
Business	18,547	11,753	3,243	33,543
Law	20,372	1,438	542	22,352
Total	55,984	23,784	7,652	87,420

Given a person who works outside his field of study, which of the following is closest to the probability that he majored in business?

- A. 0.35
- B. 0.06
- C. 0.5
- D. 0.13

9- AUGUST 2021 Q 36



A spinner has 2 blue sections, 3 red sections and 5 yellow sections. It is spun twice.

What is the probability of getting different colors?

10- OCTOBER 2021 Q 13



A bag contains 3 green balls, 5 red balls, 8 blue balls, and 4 yellow balls. What is the value of the square of the probability of choosing a yellow or a red ball from the bag?

- A. 0.2025
- B. 0.45
- C. 0.671
- D. 0.9

12- DECEMBER 2021 Q 18



A box contains 7 identical balls, three red, two green and two blue. Three balls are drawn randomly and successively one after the other without replacing the ball in the box. What is the probability to get exactly one ball of each color?

- A.  $\frac{2}{35}$
- B.  $\frac{12}{343}$
- C.  $\frac{72}{343}$
- D.  $\frac{12}{35}$

11- DECEMBER 2021 Q 16



In a bag there are 14 identical tokens numbered from 0 to 13. A token is drawn at random. What is the probability to obtain an odd multiple of 3?

- A.  $\frac{3}{14}$
- B.  $\frac{2}{5}$
- C.  $\frac{1}{7}$
- D.  $\frac{2}{13}$

13- DECEMBER 2021 Q 35



On Mother's Day, a big store put a freezer and a refrigerator on sale. The owner of the store suggests that:

The probability that a person buys a refrigerator is  $\frac{5}{7}$ .

The probability that a person buys a freezer if he buys a refrigerator is  $\frac{2}{5}$ .

The probability that a person buys a freezer if he doesn't buy the refrigerator is 5%.

What is the probability that the person buys the freezer? (Grid in)

14 - MARCH 2022 / Q 21



In a school, there are 80 students distributed into three classes according to the following table:

	First Secondary	Second Secondary	Third Secondary
Females	18	17	5
Males	12	18	10

One student is selected at random from this school.

What is the probability that the selected student is from the second secondary?

- A.  $\frac{17}{35}$
- B.  $\frac{7}{16}$
- C.  $\frac{80}{18}$
- D.  $\frac{18}{35}$

15 - JUNE 2022 (cancelled / Q 6



Amina has a bag of 6 black balls and 4 green balls. Hamad has a bag of 3 black balls and 5 green balls. If one ball is drawn from each bag, what is the probability that one is black and one is green?

- A. 0.225
- B. 0.25
- C. 0.475
- D. 0.525

16- Sample test



Grade	Number of students
10	6
11	18
12	12
Total	36

The table shows the number of students in each grade in North High School's band. If a student is selected at random from the band, what is the probability that the student is in grade 12 ?

- A)  $\frac{1}{6}$
- B)  $\frac{1}{3}$
- C)  $\frac{1}{2}$
- D)  $\frac{2}{3}$

17- Sample test



The entire senior class at a high school voted on the color for their class T-shirt. The results are shown in the table.

Color	Number of votes
Red	123
Yellow	210
Blue	367
Total	700

If a senior is selected at random, what is the probability of selecting a senior who voted for yellow? (Express your answer as a decimal or fraction, not as a percent.)

18- Sample test



The table summarizes the number of public schools in two California counties in 2017.

School	County		Total
	Los Angeles	San Diego	
Elementary	1,395	498	1,893
Middle	422	165	587
High	570	191	761
Total	2,387	854	3,241

A public middle school will be selected at random from the two counties. What is the probability, to the nearest hundredth, of selecting a school in San Diego County?

- A) 0.05
- B) 0.19
- C) 0.28
- D) 0.69

19- Sample test



A forest contains different species of trees. Let  $t$  represent the total number of trees in the forest, let  $h$  represent the number of hickory trees, and let  $k$  represent the number of oak trees. If a tree is selected at random from the forest, which expression represents the probability of selecting a tree that is neither hickory nor oak?

- A)  $\frac{h + k}{t}$
- B)  $\frac{t - h - k}{t}$
- C)  $\frac{h + k - t}{t}$
- D)  $\frac{t + h + k}{t}$

20- Sample test



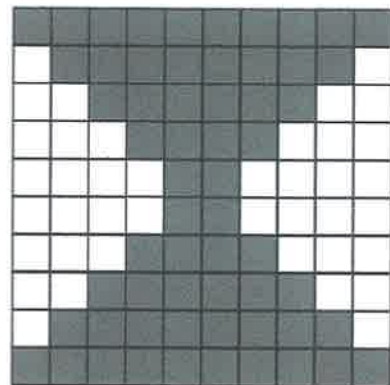
A school choir has 42 members: 8 freshmen, 11 sophomores, 14 juniors, and 9 seniors. If one member of the choir is selected at random to sing a solo, what is the probability of selecting a senior?

- A)  $\frac{1}{9}$
- B)  $\frac{9}{42}$
- C)  $\frac{9}{33}$
- D)  $\frac{33}{42}$

21- Sample test



The figure shown is divided into 100 squares of equal area, where 60 squares are shaded.



If one of these squares is selected at random how much greater is the probability of selecting a shaded square than the probability of selecting a square that is not shaded?

- A) 0.20
- B) 0.40
- C) 0.60
- D) 0.80

22- Sample test



Opinions on the Proposal				
	For	Against	Undecided	Total
County 1	526	980	95	1,601
County 2	667	386	91	1,144
Total	1,193	1,366	186	2,745

The table shows the results of a poll that was used to determine support for a county proposal. The results are categorized by county and opinion. If one person who responded to the poll is selected at random, which of the following statements results in the greatest value?

- A) The probability that the person is undecided, given that the person is from County 1
- B) The probability that the person is undecided, given that the person is from County 2
- C) The probability that the person is from County 1, given that the person is undecided
- D) The probability that the person is from County 2, given that the person is undecided

23- OCTOBER 2021 Q 6



In a village, 25% of the residents own a German Shepherd, 45% own a Swiss Shepherd, and 35% do not own a dog. Which of the following statement(s) is/are correct?

- I. 11% of the residents own both a German Shepherd and a Swiss Shepherd at the same time.
  - II. If we select a resident randomly, the probability of him having a Swiss Shepherd even though he has a German Shepherd is 0.8.
  - III. If we select a resident randomly, the probability of him having a Swiss Shepherd even though he has a German Shepherd is 0.05.
- A. I only
  - B. III only
  - C. I and II
  - D. II and III

## ANSWERS OF LESSON ( PROBABILITY )

NON CALCULATOR



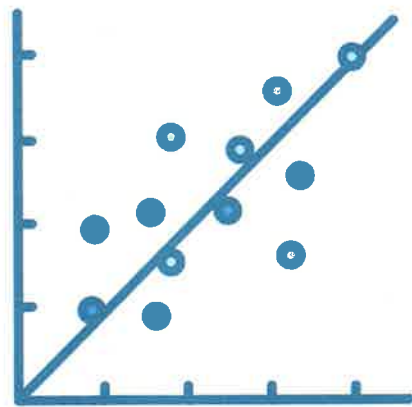
Question	Answer
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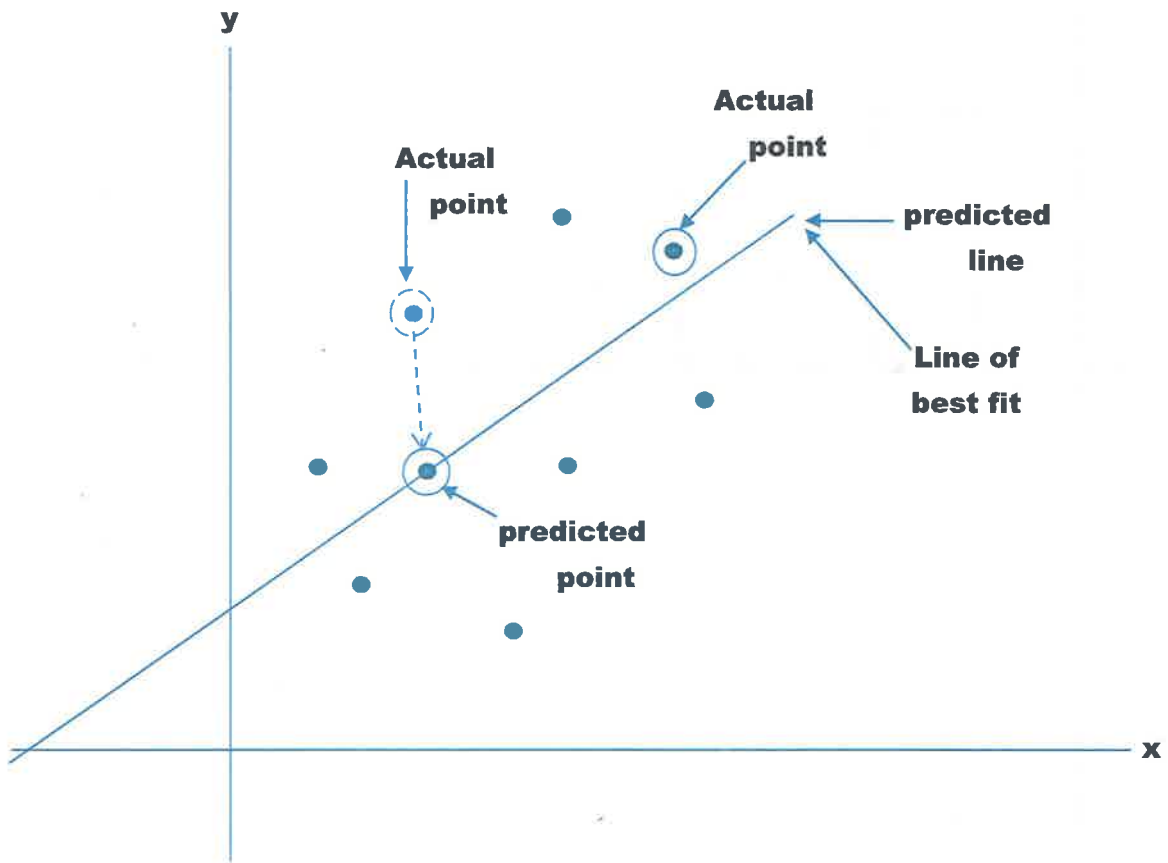
CALCULATOR



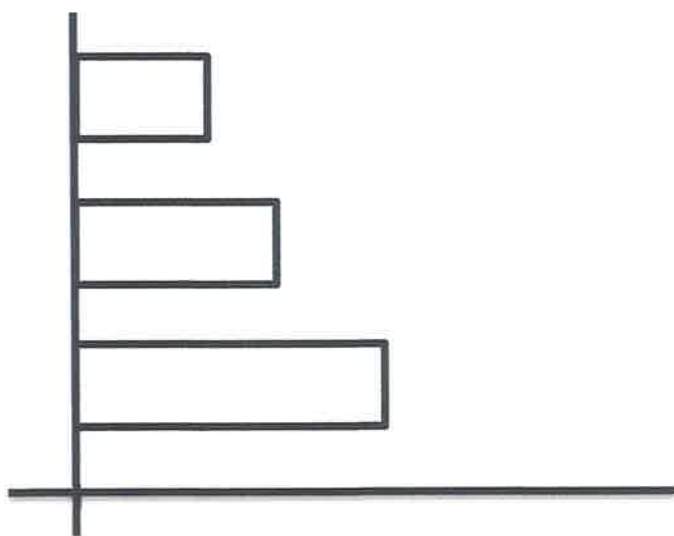
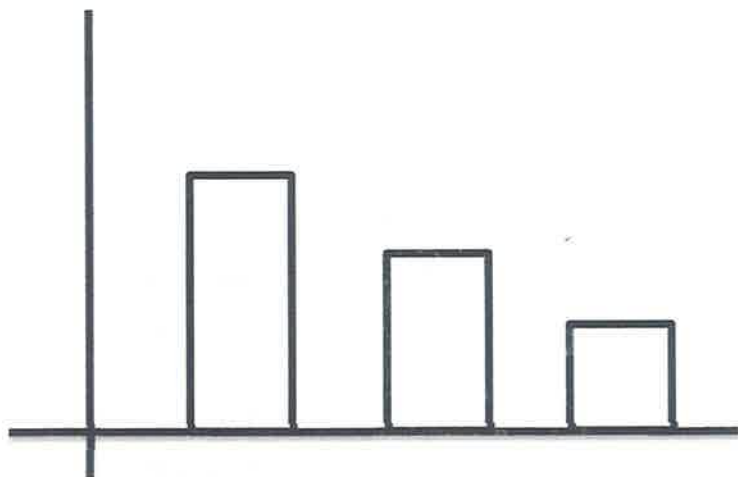
Question	Answer
1	C
2	0.8
3	B
4	C
5	D
6	D
7	D
8	C
9	0.62 OR 31/50
10	A
11	C
12	A
13	0.3 OR 3 /10
14	B
15	D
16	B
17	0.3
18	C
19	B
20	B
21	C
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# Scatter Plot

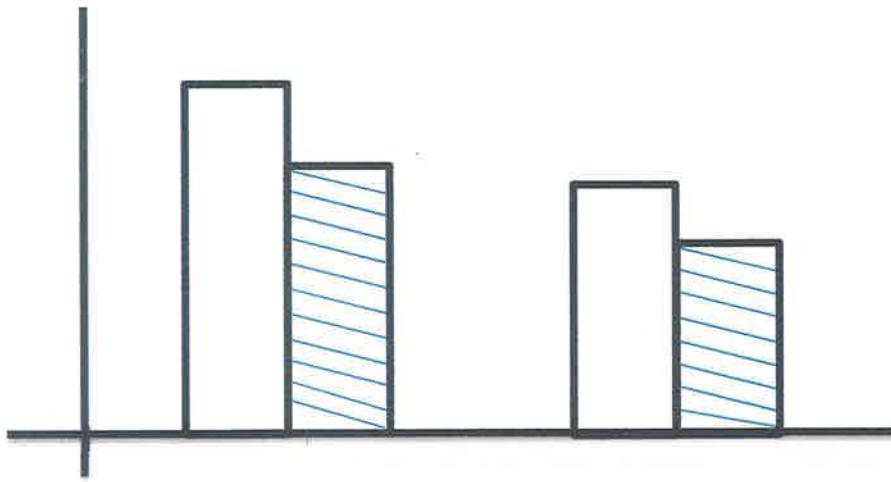




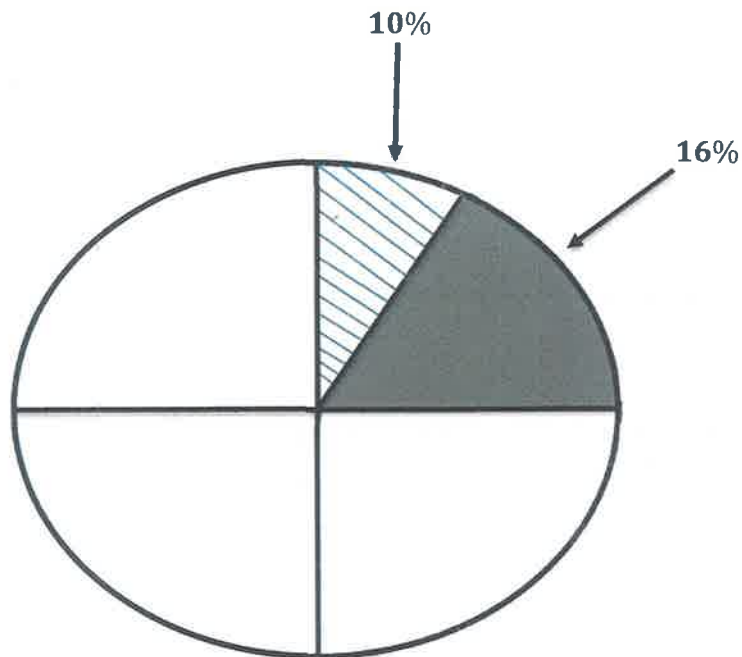
**Bar Graph**



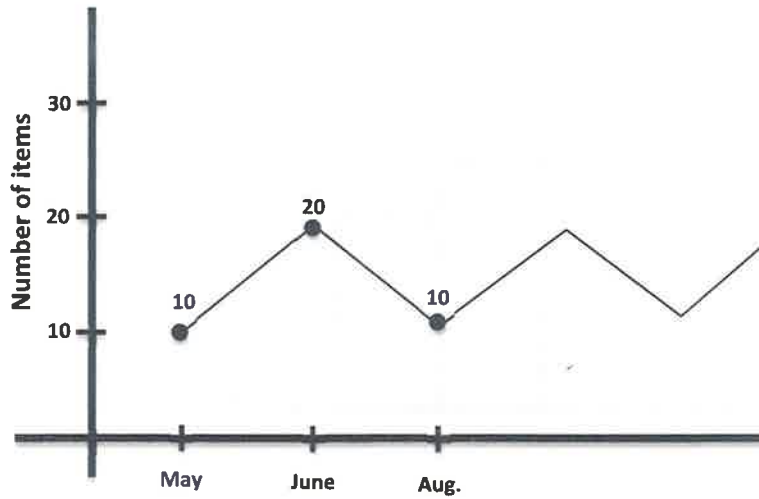
3- Side – by – side graph



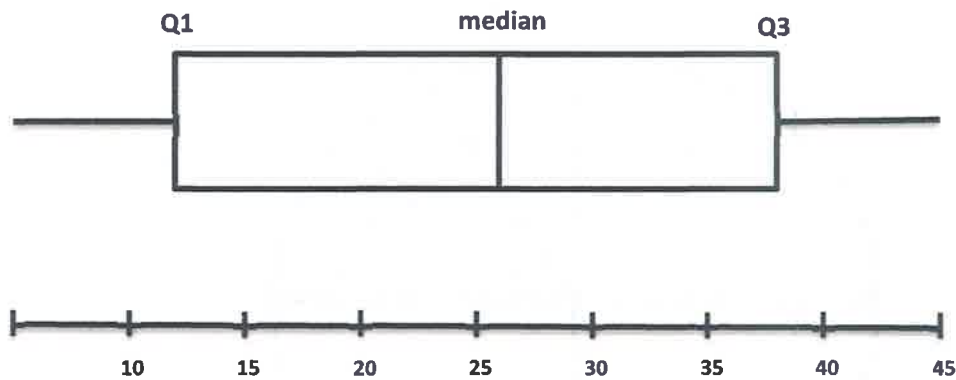
4- pie charter



5- line graph



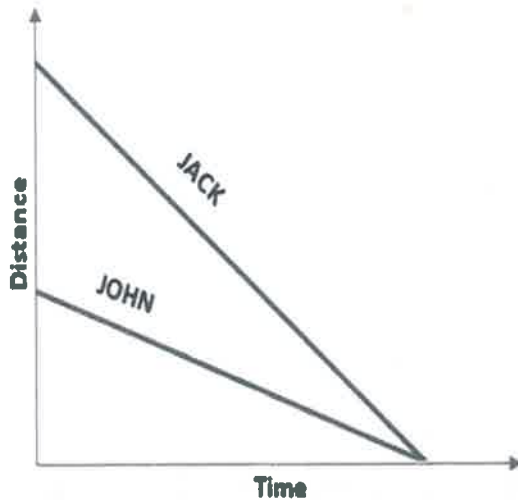
6- Box – Plot graph



# *Questions*



1- OCTOBER 2020 Q 5



Jack and John are meeting at a restaurant. The scheme above represents the drives from their offices to the restaurant. Which of the following statements is true?

- A. It took Jack longer to arrive to the pub since his office is farther away.
- B. It took John longer to arrive to the pub since his office is farther away.
- C. John drove to the pub at a faster speed than Jack.
- D. Jack drove to the pub at a faster speed than John.

2- OCTOBER 2020 Q 7



A scatter plot shows a strong positive correlation between two variables: A graphed on the x-axis and B graphed on the y-axis. Which of the following statements is justified?

- A. The rise in A caused the rise in B.
- B. The rise in B caused the rise in A.
- C. A&B are correlated, but causation is unknown
- D. A&B rise proportionally.

3- AUGUST 2021 Q 11



Sam wants to rent a car. He receives the following offers.

	Fixed amount to be paid	Amount to be paid for each kilometer driven
Offer A	65\$	0.50\$
Offer B	60\$	0.52\$
Offer C	55\$	0.54\$
Offer D	50\$	0.56\$

Which offer is the best if Sam wants to travel 100 km?

- A. Offer A
- B. Offer B
- C. Offer C
- D. Offer D

4- OCTOBER 2021 Q 10



The distance between Giza and Luxor is approximately 500 Km. To travel that distance, Bilal received offers from 4 different taxi companies:

	Fixed Amount (EGP)	Amount per 25 Km (EGP)
Taxi "A"	160	15
Taxi "B"	210	13
Taxi "C"	185	14
Taxi "D"	150	16

Which company gave Bilal the cheapest offer?

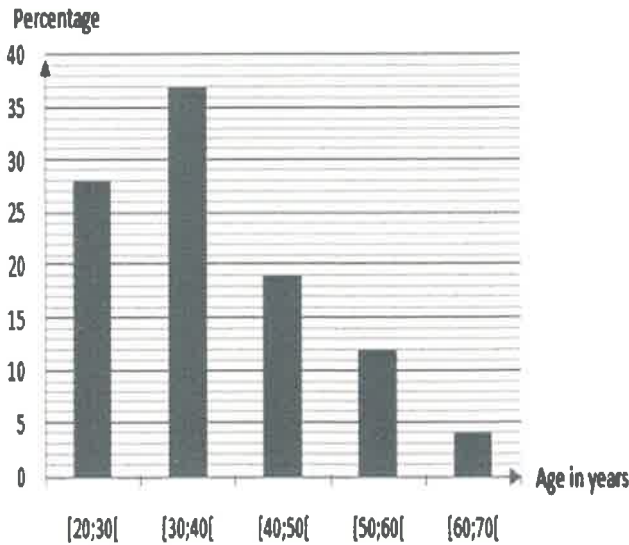
- A. Taxi "A"
- B. Taxi "B"
- C. Taxi "C"
- D. Taxi "D"

1- OCTOBER 2020 Q 19



The bar graph below shows the age distribution of the employees in a multi-branched bank.

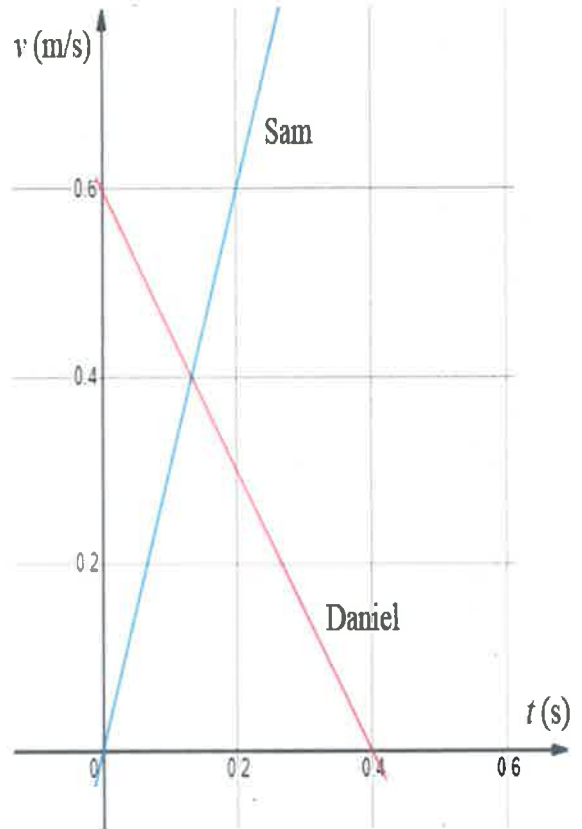
Age distribution of the employees in a company



If 481 employees are aged between 30 and 40, what is the total number of employees in this company?

- A. 1150
- B. 1200
- C. 1550
- D. 1300

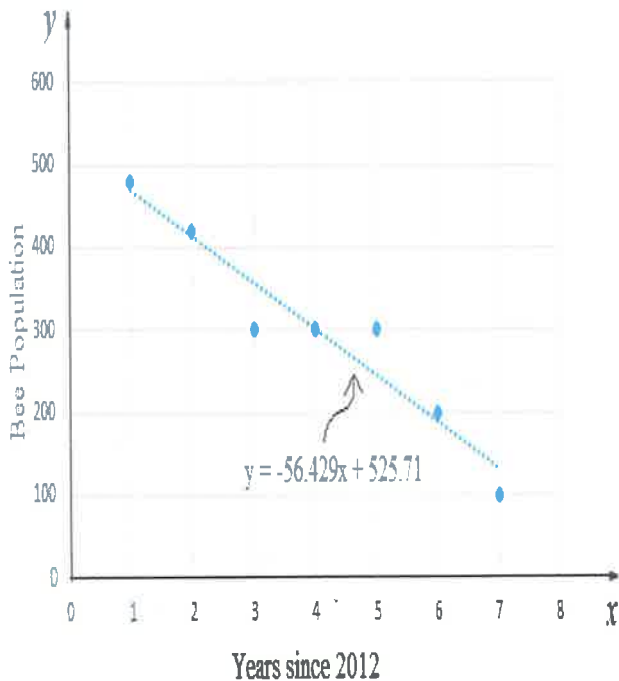
2- DECEMBER 2020 Q 9



The given graph show the speeds  $v$  in meters per second (m/s) of Sam and Daniel, as they do their morning jogs, as a function of time  $t$  in seconds (s). The difference in the speeds of the two boys is how much less at  $t = 0.2s$  than it was initially?

- A. 0 seconds
- B. 0.3 seconds
- C. 0.4 seconds
- D. 0.6 seconds

3- DECEMBER 2020 Q 20

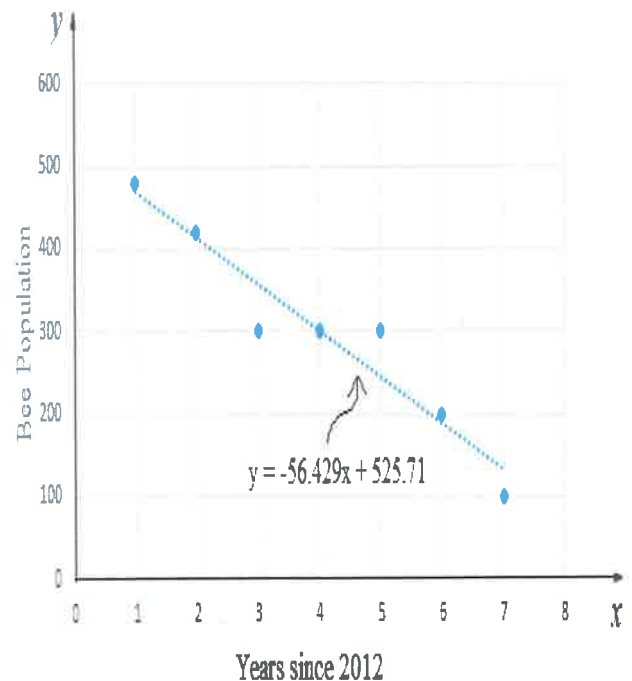


The scatterplot above shows the Bee population in a certain farm for every year since 2012. A line of best fit and its equation are also shown.

Which of the following is the best interpretation of the value  $-56.429$  in the equation of the line of best fit?

- A. The average increase in the number of bees each year.
- B. The average decrease in the number of bees every 525.71 years.
- C. The average decrease in the number of bees each year.
- D. The number of bees present in the beginning.

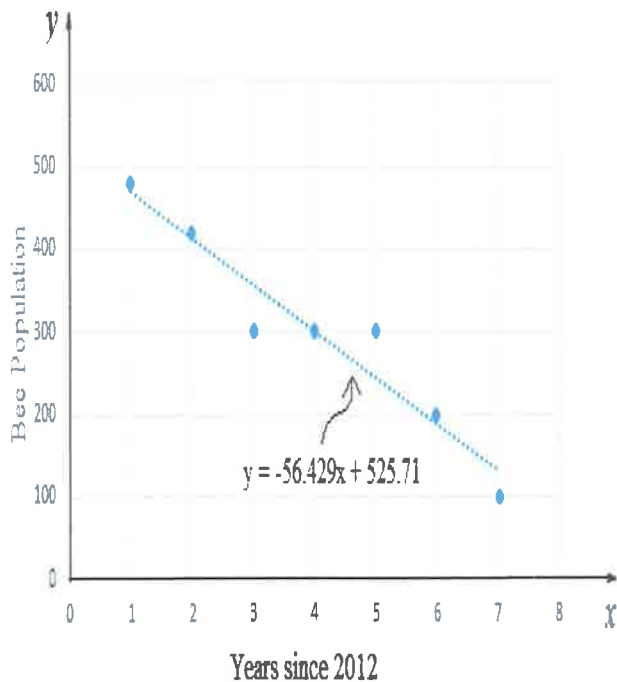
4- DECEMBER 2020 Q 21



Which of the following is closest to the difference in the actual population number of bees and the number predicted by the line of best fit in 2017?

- A. 13
- B. 56
- C. 100
- D. 525

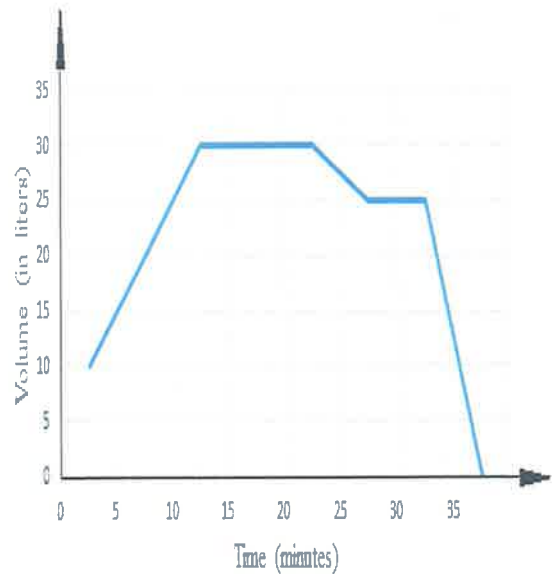
5- DECEMBER 2020 Q 22



According to the line of best fit, in which year is the population of bees most likely predicted to drop to zero?

- A. 2013
- B. 2019
- C. 2021
- D. 2023

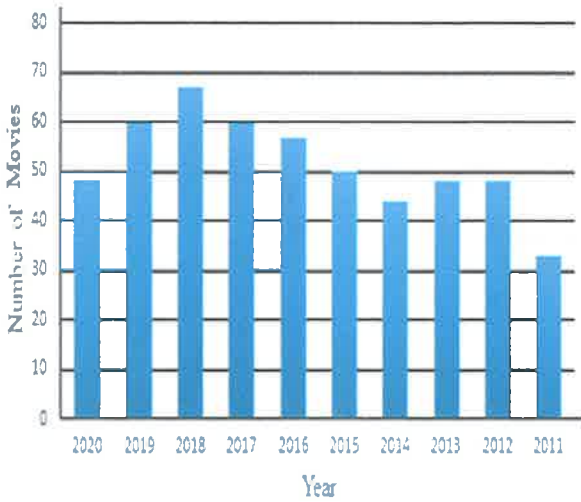
6- DECEMBER 2020 Q 23



The graph above represents the volume of oil in a certain container over the course of about 37.5 minutes. The container has a small hole through which oil leaks occasionally, and so a certain amount is occasionally added by the owner. Which of the following statements about the situation can be true?

- A. Oil is not leaking from the container after 30 minutes.
- B. Oil is being added to the container at the same rate at which it is leaking between 12.5 and 22.5 minutes.
- C. Oil is leaking from the container without any amount being added between 27.5 and 32.5 minutes.
- D. The rate at which oil is added is the same at which oil is leaking between 2.5 and 12.5 minutes.

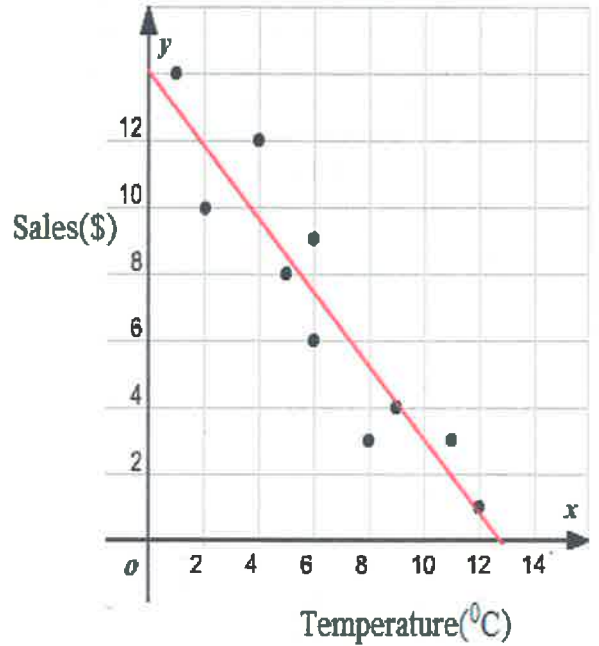
7- DECEMBER 2020 Q 24



The graph above shows the number of action movies made each year from 2011 to 2020. The greatest increase in the number of action movies took place between which two of the following years?

- A. 2011 and 2012
- B. 2012 and 2013
- C. 2017 and 2018
- D. 2019 and 2020

8- DECEMBER 2020 Q 27



The graph above shows the sales in dollars of the local mall at different temperatures in degrees Celsius on a certain day. Which of the following is closest to the equation of the line of best fit?

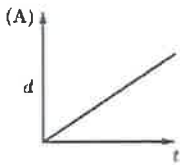
- A.  $y = -1.1x + 14$
- B.  $y = 1.1x$
- C.  $y = -1.1x + 12$
- D.  $y = -1.8x + 14$

9- DECEMBER 2020 Q 28

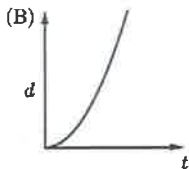


An athlete runs every morning for 2 hours straight. On each day, as he progresses, he gets tired and starts slowing down little by little. Which of the following graphs best depicts the distance  $d$  covered by the athlete starting from home during the 2 hours he runs every morning as a function of time  $t$ ?

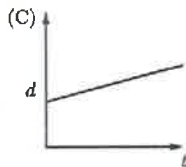
A.



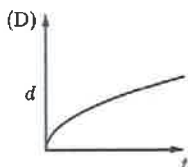
B.



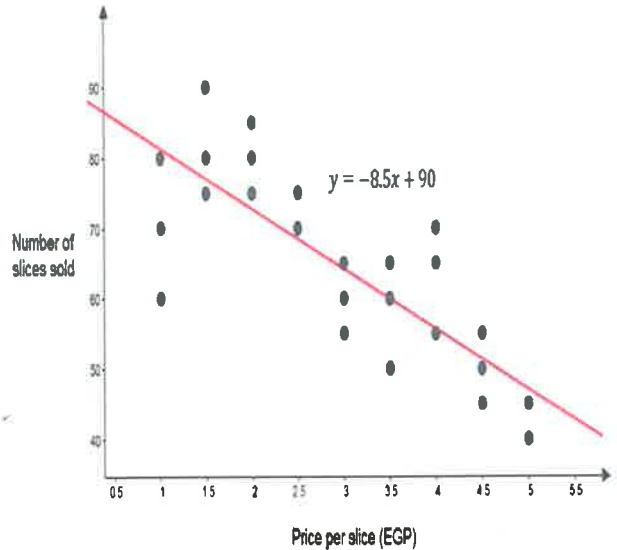
C.



D.



10- MARCH 2021 Q 16

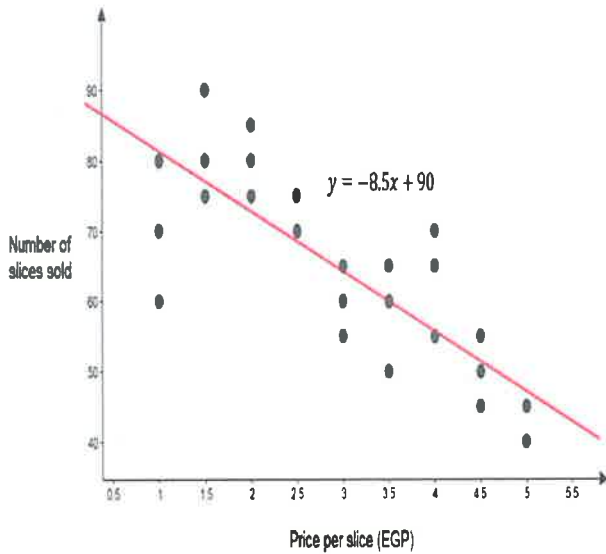


A kiosk sells slices of pizza and sets the price per slice each week. The scatterplot above shows the price and the number of slices sold over 25 weeks, along with the line of best fit and its equation.

How many slices does the kiosk expect to sell in a week when the price of a slice is 4 EGP?

- A. 10.5
- B. 56
- C. 58
- D. 62

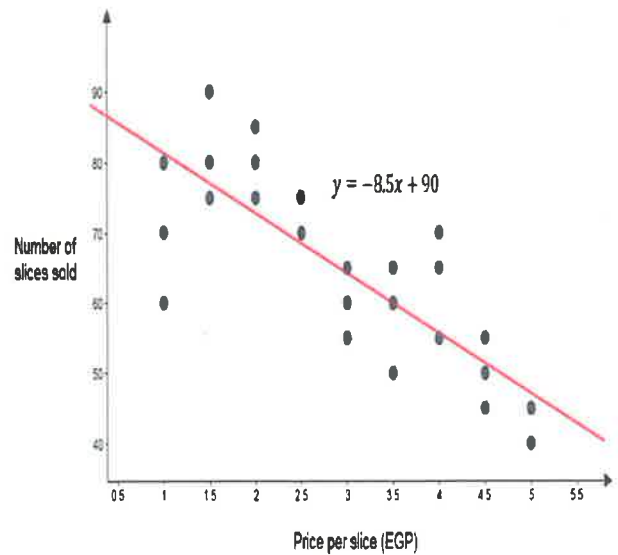
11- MARCH 2021 Q 17



What is the best interpretation of the meaning of the slope of the line of best fit?

- A. If the price of the slice increases by one EGP, the kiosk expects to sell 8.5 more slices of pizza.
- B. If the price of the slice decreases by one EGP, the kiosk expects to sell 8.5 fewer slices of pizza.
- C. If the price of the slice increases by one EGP, the kiosk expects to sell 8.5 fewer slices of pizza.
- D. If the store sells slices for 0 EGP, 90 people would be expected to accept the free slices of pizza.

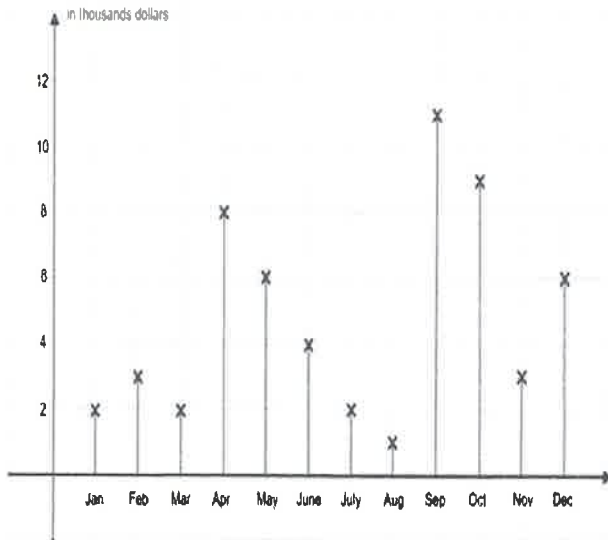
12- MARCH 2021 Q 18



For how many weeks was the number of slices sold smaller than the amount predicted by the line of best fit?

- A. 12
- B. 9
- C. 15
- D. 16

13- MAY 2021 Q 4

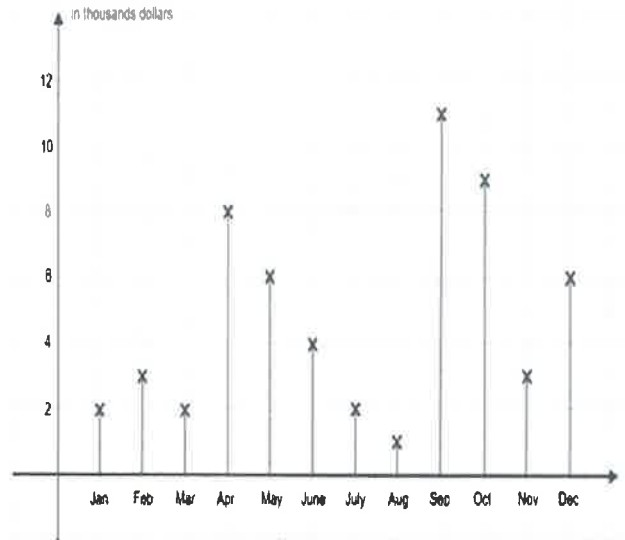


Adam and his fiancée worked as freelance graphic designers all year long during 2019 to save money for their wedding and to buy furniture for their home. Their mixed salary each month, in thousands of dollars, is shown in the graph above.

During September, Adam worked 15 hours per day, while his fiancée worked 11 hours per day. Knowing that each one of them took 4 days off that month, and his fiancée was getting paid \$10.7 per hour, how much was Adam approximately getting paid per hour?

- A. \$16.6
- B. \$17.8
- C. \$20.4
- D. \$36.1

14- MAY 2021 Q 5



Adam and his fiancée worked as freelance graphic designers all year long during 2019 to save money for their wedding and to buy furniture for their home. Their mixed salary each month, in thousands of dollars, is shown in the graph above.

In which quarter of the year did they get the smallest income?

- A. 1<sup>st</sup> quarter
- B. 2<sup>nd</sup> quarter
- C. 3<sup>rd</sup> quarter
- D. 4<sup>th</sup> quarter

15- MAY 2021 Q 28



A football club published on its website the number of entrance tickets sold in 2018 and in 2019.

	Average number of tickets sold at the entrance door per game			Seasonal tickets	
	Male	Female	Child	Male	Female
<b>2018</b>	4521	1254	759	1122	780
<b>2019</b>	4668	1102	884	1088	794

	Ticket revenue from selling them at the entrance door per game (\$)			Seasonal ticket revenue (\$)	
	Male	Female	Child	Male	Female
<b>2018</b>	72336	16552.8	4402.2	78540	47970
<b>2019</b>	79822.8	15428	4420	80512	47640

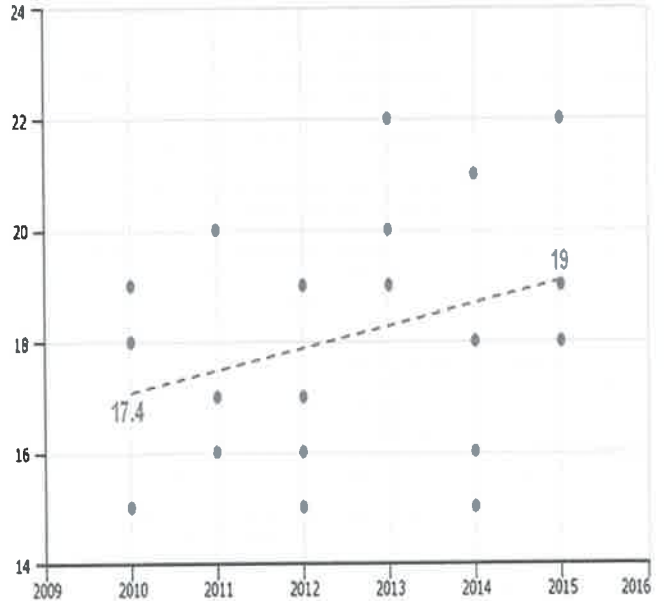
What was the seasonal ticket price for a male person in 2018? How much did it decrease or increase in 2019?

- A. It costed \$70 in 2018, and it decreased by \$4 the next year.
- B. It costed \$74 in 2018, and it increased by \$4 the next year.
- C. It costed \$70 in 2018, and it increased by \$4 the next year.
- D. It costed \$74 in 2018, and it decreased by \$4 the next year.

16- MAY 2021 Q 34



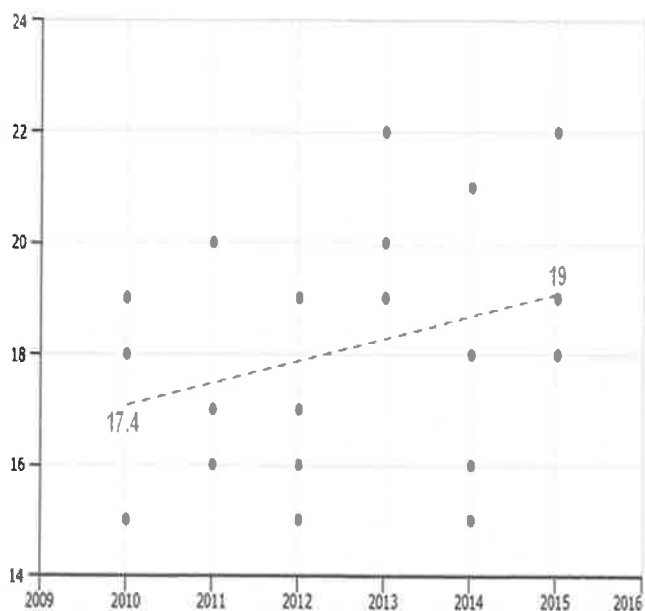
The scatterplot below shows how many laptops for different companies were repaired



by a computer engineer between years 2010 and 2015.

Based on the line of best fit shown as a dashed line, what is the average yearly increase in the number of repaired laptops rounded to the nearest tenth? (grid-in)

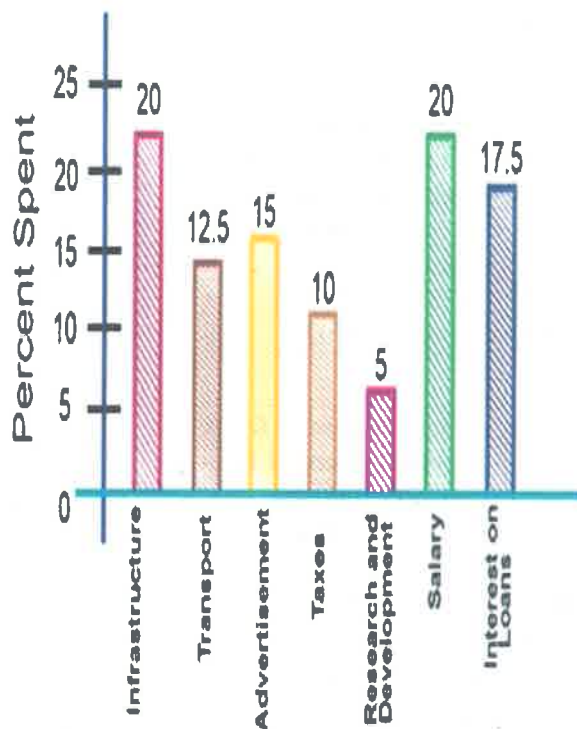
17- MAY 2021 Q 35



by a computer engineer between years 2010 and 2015.

How many laptops were repaired between years 2012 and 2014? (grid-in)

18- JUNE 2021 Q 22



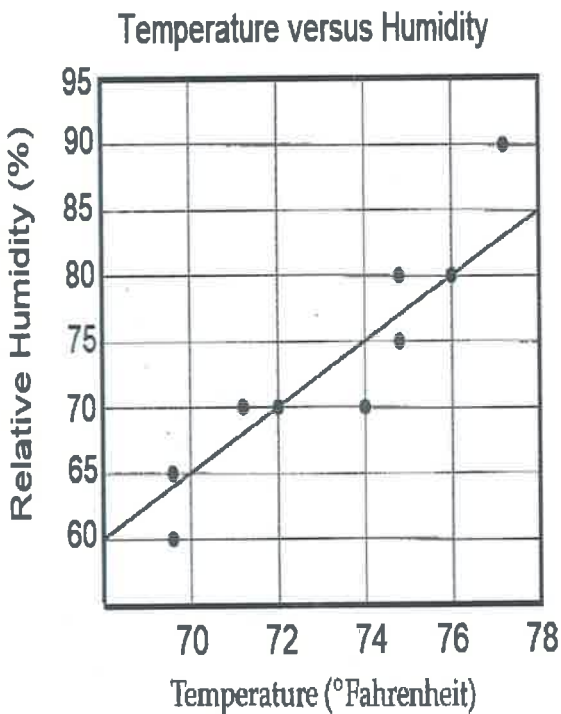
The bar graph above represents the percentage of money spent by a company on different sectors last year. If 200,000 dollars were spent on the transport sector, what was the budget used for salaries?

- A. \$320,000
- B. \$340,000
- C. \$360,000
- D. \$370,000

19- AUGUST 2021 Q 32



Humidity percentage vary according to the temperature. The scatterplot below compares the temperature, in degree Fahrenheit and relative humidity on a certain day, every hour from 12:00 P.M. to 8:00 P.M. The line of best fit is also shown.

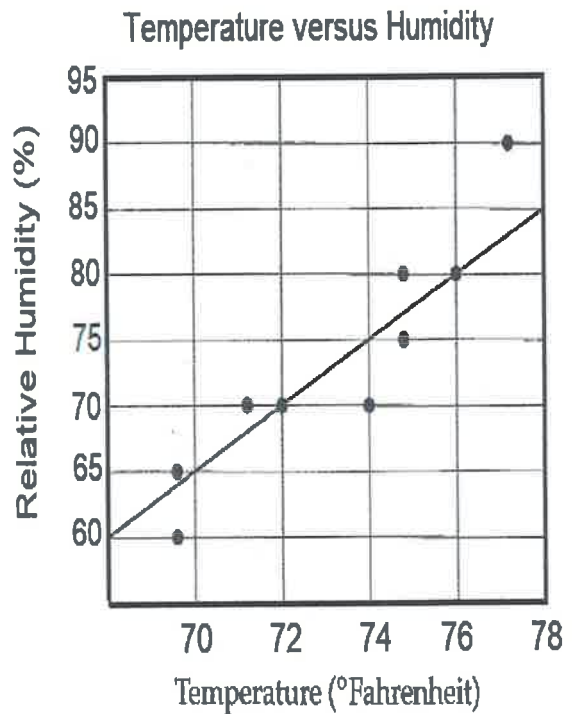


Based on the line of best fit, what is the predicted humidity percentage at a temperature of 74° Fahrenheit?

20- AUGUST 2021 Q 33

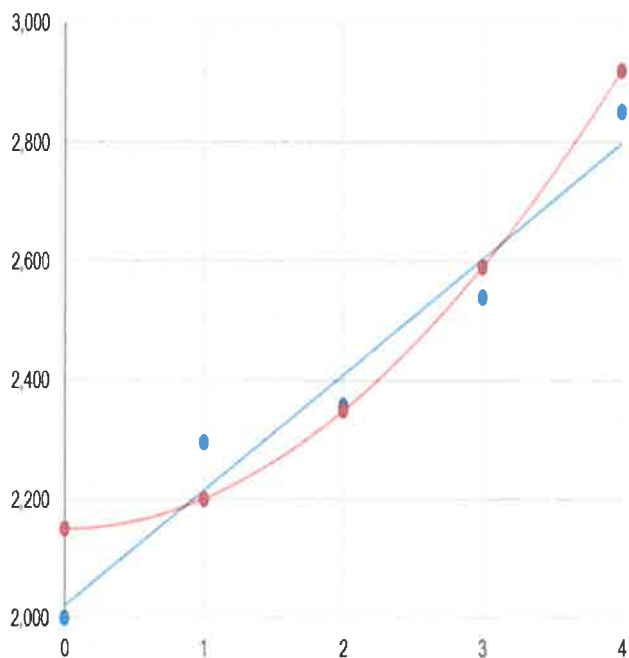


Humidity percentage vary according to the temperature. The scatterplot below compares the temperature, in degree Fahrenheit and relative humidity on a certain day, every hour from 12:00 P.M. to 8:00 P.M. The line of best fit is also shown.



What is the humidity percentage represented by the data point that is farthest from the line of best fit?

21- OCTOBER 2021 Q 11

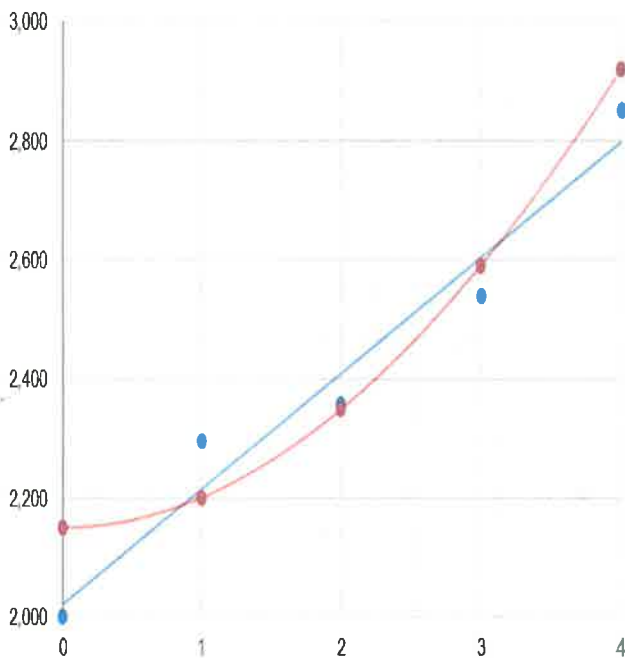


The scatterplot above shows how many boys there are in two different villages and the changes in numbers since year 2011. The cubic curve of best fit, representing the number of boys in village A, has the following equation:  $y = -0.83x^3 + 51.43x^2 + 0.12x + 2149.86$ . The line of best fit, representing the number of boys in village B, has the following equation:  $y = 194.3x + 2020.4$ .

At which date did the two villages have approximately the same number of boys?

- A. At the end of year 2011
- B. 2012
- C. 2013
- D. At the beginning of year 2014

22- OCTOBER 2021 Q 12



The scatterplot above shows how many boys there are in two different villages and the changes in numbers since year 2011. The cubic curve of best fit, representing the number of boys in village A, has the following equation:  $y = -0.83x^3 + 51.43x^2 + 0.12x + 2149.86$ . The line of best fit, representing the number of boys in village B, has the following equation:  $y = 194.3x + 2020.4$ .

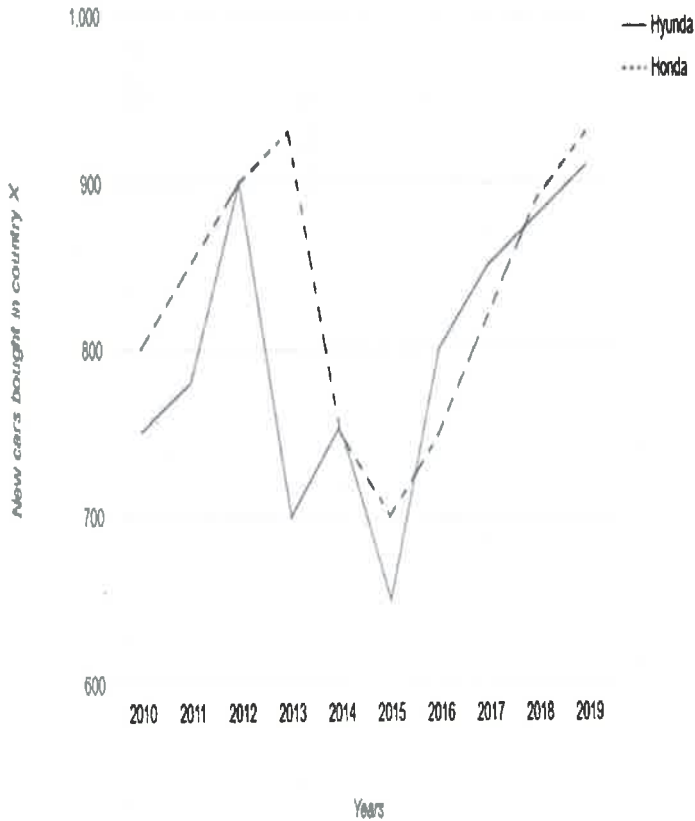
What is the closest difference between the actual number of boys in village B and the number which can be predicted from the line of best fit in 2014?

- A. 13
- B. 26
- C. 53
- D. 100

23- OCTOBER 2021 Q 37



The graph below shows the number of new cars of the two brands Hyundai and Honda, bought by the citizens in country X during years 2010 and 2019.

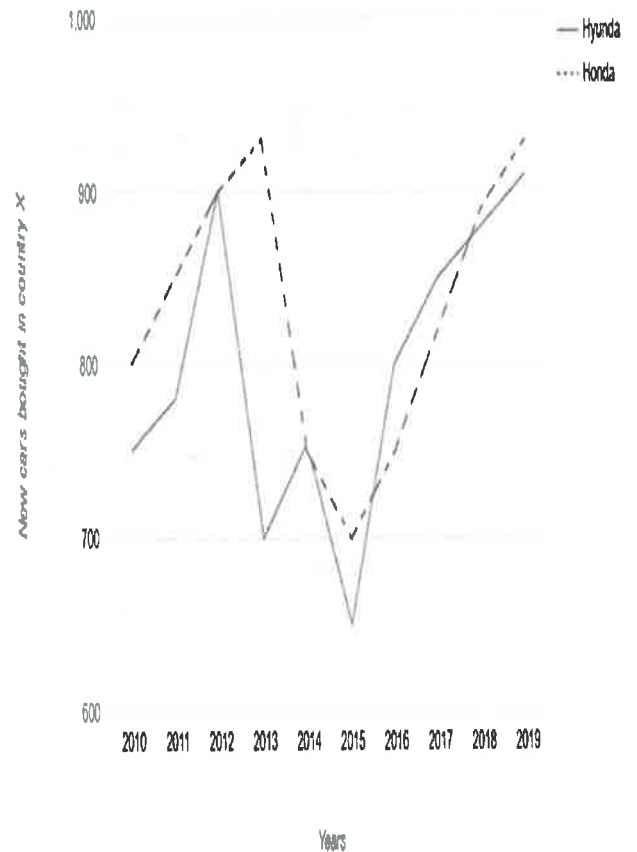


According to the graph, how much was the percent decline of buying a new Honda from 2010 to 2015? (grid-in)

24- OCTOBER 2021 Q 38

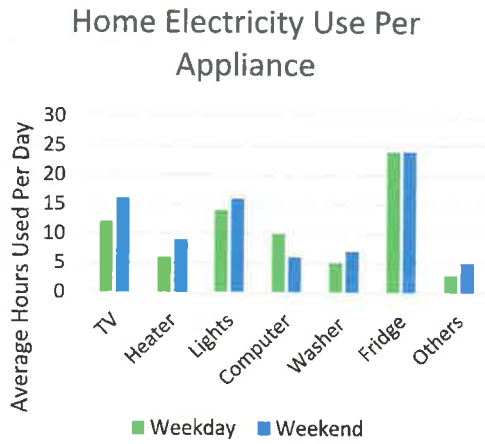


The graph below shows the number of new cars of the two brands Hyundai and Honda, bought by the citizens in country X during years 2010 and 2019.



After the first tie between the number of cars bought of the two brands, how many years did it take Hyundai to sell 50 more cars than Honda in country X? (grid-in)

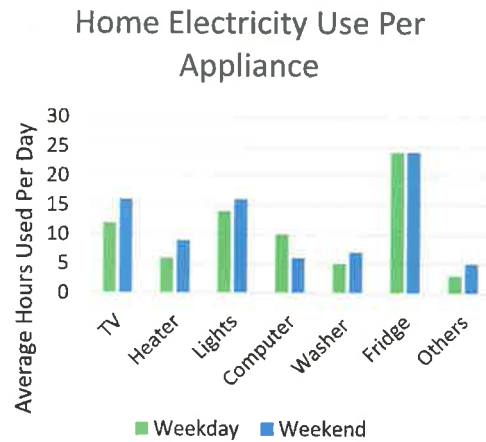
25- DECEMBER 2021 Q 12



What information does the graph above provide?

- A. Average kilowatts used by each appliance in a day
- B. Total electricity per day
- C. Hours appliance used per day
- D. Average hours used in a day by each appliance

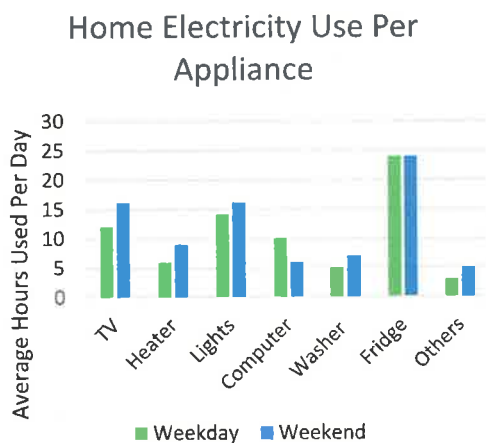
26- DECEMBER 2021 Q 13



Which appliance has more usage on weekdays than on weekends?

- A. TV
- B. Lights
- C. Computer
- D. Fridge

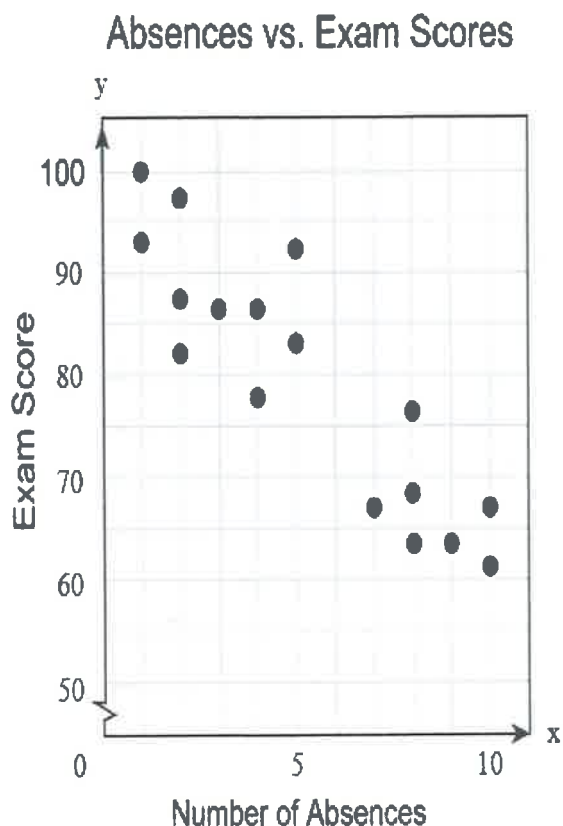
27- DECEMBER 2021 Q 15



Which appliances are used on weekends for an average of at least three hours per day more than on weekdays?

- A. lights and washer
- B. TV, computer and washer
- C. TV and heater
- D. Others

28- DECEMBER 2021 Q 20



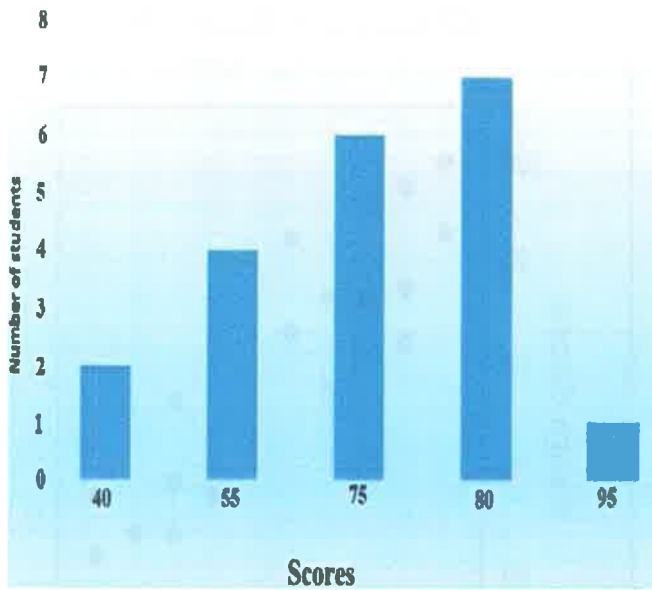
Mrs. Mary made the scatterplot above to show the relationship between the number of absences and a student's final exam score without drawing the line of best fit. Which of the following scores could a student approximately get on the final exam with 6 absences?

- A. 70
- B. 65
- C. 87
- D. 76

29 - MARCH 2022 / Q 35



30 - SAMPLE TEST / Q 11

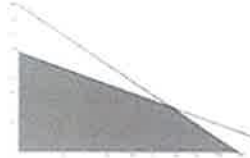


The bar chart above shows the scores of a Math test over 100.

How many students score at least 55?  
(grid-in)

Christopher needs to save \$250 for the new PlayStation he wishes to buy in a week. He went to work in a coffee shop where he is going to be paid \$10 per hour. In addition, he accepted to help his father in carpentering for \$18.5 per hour. However, he cannot work more than 20 hours this week due to his university schedule. Which of the following graphs will show the correct representation of this problem ?

A)



B)



C)



D)



## 31 - SAMPLE TEST / Q 13



The chart below shows how many water bottles were sold by a large mineral water company.

	2010	2012	2014	2016	2018
Bottles of 0.5 L	1,024,987	1,130,187	1,235,387	1,340,587	1,445,787
Bottles of 1.5 L	2,467,000	2,369,500	2,272,000	2,174,500	2,077,000

Assuming that the rate of selling each bottle size will be the same every two years, which of the following statements is correct ?

- I.** Each year, the company sells 48,750 fewer bottles of 1.5 L than the previous year.
- II.** Every two years, the company sells 52,600 more bottles of 0.5 L.
- III.** As the linear graph representing the number of bottles of 0.5 L sold is increasing, the linear graph representing the number of bottles of 1.5 L sold will be constant.

- A)** I only
- B)** II only
- C)** I and III
- D)** II and III

## 32 - SAMPLE TEST / Q 14



The Gross Domestic Product (GDP), is the total value of goods produced in a country while the GDP per capita refer to the GDP of the country divided by its total population. In Egypt, the GDP per capita for 2008, 2016, and 2018 are shown in the table below.

	2008	2016	2018
GDP per capita (\$)	2,270	3,686	2,573

Which of the following could verify the GDP per capita growth in Egypt ?

- A)** The GDP per capita increased by 30.2% from 2008 to 2016 and decreased back again by 62.38% from 2016 to 2018.
- B)** The GDP per capita increased by 62.38% from 2008 to 2016 and decreased back again by 30.2% from 2016 to 2018.
- C)** The GDP per capita increased by 162.38% from 2008 to 2016 and decreased back again by 130.2% from 2016 to 2018.
- D)** The GDP per capita increased by 130.2% from 2008 to 2016 and decreased back again by 162.38% from 2016 to 2018.

33 - JUNE 2022 (cancelled) / Q 5



A company for renting cars published on their website a summary of the amount they won during the past few years from renting cars and trucks.

Year	Amount won in \$ for renting cars	Amount won in \$ for renting trucks
2015	10004.6	7888.3
2016	12456.7	7985.2
2017	14899.9	8050.2
2018	13899.5	9000.5
2019	12003.4	8599.4
2020	13990.1	7995.5

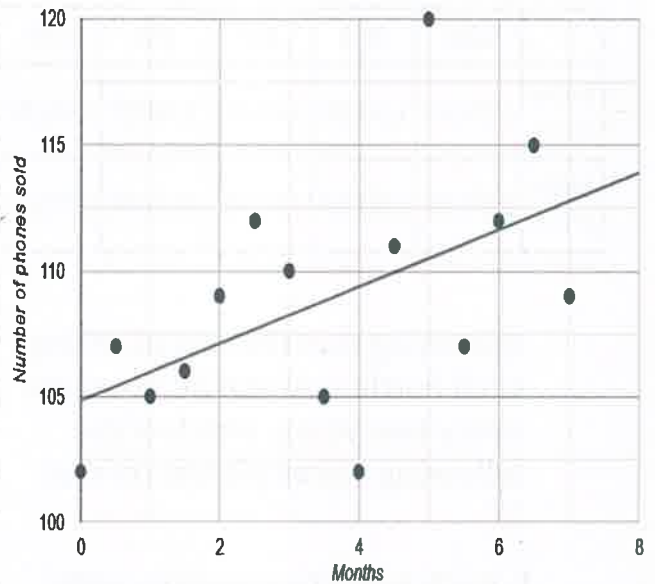
This company has only one employee who works for \$1650 per month. In which year was this company unable to pay his full wage from the amount won from renting cars and trucks?

- A. 2015
- B. 2016
- C. 2019
- D. 2020

34 - JUNE 2022 (cancelled) / Q 11



The scatterplot below shows how many phones were sold by a company during a period of 7 months. The line of best fit represented in the scatterplot passes through points (0, 105) and (7, 112.7).



Giving that abscissa "0" signifies the beginning of the month of January, which of the following statements is/are true?

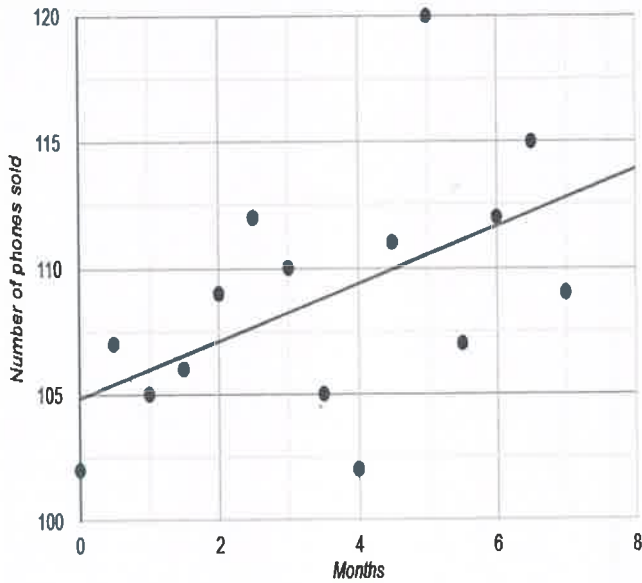
- I. The largest increase in the number of phones sold was between the beginning of May and the beginning of June.
- II. Most of the phones were sold in the first quarter of the year.
- III. The number of phones sold in mid-January is equivalent to the number of phones sold in mid-June.

- A. I only
- B. I and II
- C. I and III
- D. II and III

35 - JUNE 2022 (cancelled) / Q 12



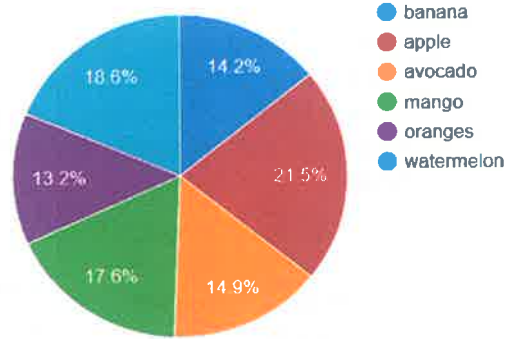
The scatterplot below shows how many phones were sold by a company during a period of 7 months. The line of best fit represented in the scatterplot passes through points (0, 105) and (7, 112.7).



What is the average increase in the number of phones sold?

- A. 0.8
- B. 0.9
- C. 1
- D. 1.1

36 - JUNE 2022 (cancelled) / Q 15



The pie chart above shows the results of a survey that asked 1420 students in a school about their favorite fruit. How many students like mango more than any other fruit? And, approximately how many more students said apple was their favorite fruit than said oranges was their favorite one?

- A. 250 students like mango, and 110 students said apple was their favorite fruit more than said orange was their favorite one.
- B. 250 students like mango, and 118 students said apple was their favorite fruit more than said orange was their favorite one.
- C. 306 students like mango, and 63 students said apple was their favorite fruit more than said orange was their favorite one.
- D. 187 students like mango, and 56 students said apple was their favorite fruit more than said orange was their favorite one.

37 - JUNE 2022 (cancelled) / Q 18



Shahira and Nicole went to the supermarket to buy chocolate. The list of what they bought and the total price paid can be seen in the table below.

	Number of chocolates bought from brand "A"	Number of chocolates bought from brand "B"	Total price paid (in \$)
Shahira	7	3	25.4
Nicole	4	5	24.7

If you went to the same supermarket and bought 1 chocolate from brand "A" and 3 chocolates from brand "B", how much will you pay?

- A. \$5.4
- B. \$7.5
- C. \$10
- D. \$11.6

## ANSWERS OF LESSON ( READING DATA )

NON CALCULATOR

CALCULATOR



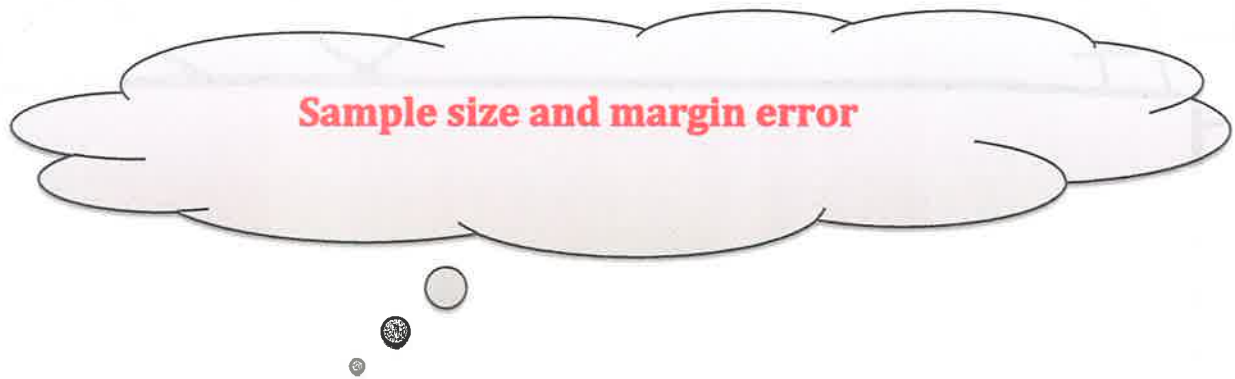
Question	Ans	Question	Answer	Question	Answ
1	D	1	D	30	B
2	C	2	B	31	A
3	D	3	C	32	B
4	A	4	B	33	A
5		5	C	34	C
6		6	B	35	D
7		7	A	36	B
8		8	A	37	D
9		9	D	38	
10		10	B	39	
11		11	C	40	
12		12	A	41	
13		13	C	42	
14		14	A	43	
15		15	C	44	
16		16	0.3 OR 3/10	45	
17		17	198	46	
18		18	A	47	
19		19	75	48	
20		20	90	49	
21		21	C	50	
22		22	C		
23		23	25/2		
24		24	4		
25		25	D		
26		26	C		
27		27	C		
28		28	D		
29		29	18		

**Sample  
Size**

**&**

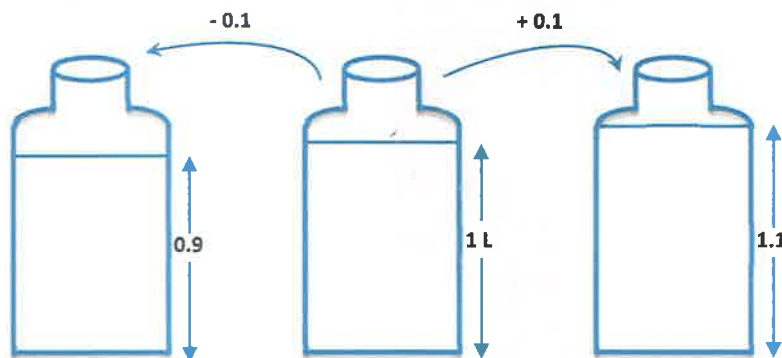
**Margin  
Error**

$$E = z_{\alpha/2} \frac{\sigma}{\sqrt{n}}$$



★ Sample size  $\uparrow$  *increase*  $\Rightarrow$  Margin error  $\downarrow$  *decrease*

★ Sample size  $\downarrow$  *decrease*  $\Rightarrow$  Margin error  $\uparrow$  *incro*



Margin error  $\pm 0.1$

# *Questions*



1- JUNE 2021 Q 5



A researcher selected a random sample of 25 different brands of bottled water and measured the corresponding PH. He found out that the mean PH of the sample was 7.3 with an associated margin of error of 0.25. Which of the following is the best interpretation of the researcher's findings?

- A. Most water bottles in the market have a PH between 7.05 and 7.55
- B. All water bottles in the market have a PH between 7.05 and 7.55
- C. Any PH between 7.05 and 7.55 is a plausible value for the mean PH of the water bottles in the sample
- D. Any PH between 7.05 and 7.55 is a plausible value for the mean PH of the water bottles in the market

1- AUGUST 2021 Q 26



Ryan estimates that there are  $x$  people in a concert.

Bella, who knows the actual number of people who attended the concert,  $y$ , notes that Ryan's estimate is within 50 people of the actual number of people.

Which of the following inequalities represent the relationship between  $x$  and  $y$ ?

- A.  $|x - y| \leq 50$
- B.  $x \leq y + 50$
- C.  $x \geq y - 50$
- D.  $x + y \leq 50$

2- sample question



A sample of students was selected at random from all ninth-grade students in a large school district. The proportion of the students in the sample who were 14 years old was 80%, with an associated margin of error of 5%. Which of the following is NOT a plausible number of 14-year-olds in the 3,601 ninth-grade students in the school district?

- A) 2,750
- B) 2,900
- C) 3,050
- D) 3,200

## 3- sample question



A park ranger asked a random sample of visitors how far they hiked during their visit. Based on the responses, the estimated mean was found to be 4.5 miles, with an associated margin of error of 0.5 miles. Which of the following is the best conclusion from these data?

- A) It is likely that all visitors hiked between 4 and 5 miles.
- B) It is likely that most visitors hiked exactly 4.5 miles.
- C) It is not possible that any visitor hiked less than 3 miles.
- D) It is plausible that the mean distance hiked for all visitors is between 4 and 5 miles.

## 4- sample question



A study estimated that the mean number of times per year each person in the town of Shelton shops at a grocery store is 91, with an associated margin of error of 3. The study also estimated that the mean number of times per year each person in the town of Whitville shops at a grocery store is 95, with an associated margin of error of 4. Based on the study, which of the following is an appropriate conclusion?

- A) The people of Whitville shop at a grocery store more times per person per year than the people of Shelton.
- B) The people of Shelton shop at a grocery store more times per person per year than the people of Whitville.
- C) The people of both towns shop at a grocery store the same number of times per person per year.
- D) There is insufficient information to determine which town's people shop at a grocery store more times per person per year.

## 5- sample question



An analysis of a random sample of a type of laptop computer battery estimated that the mean working time was 4.7 hours with a margin of error of 0.7 hours. Which of the following is the most appropriate conclusion based on this analysis?

- A. This type of laptop computer battery has a mean working time of at least 4.7 hours.
- B. This type of laptop computer battery has a mean working time of at least 5.7 hours.
- C. This type of laptop computer battery has a mean working time of between 4.0 and 5.4 hours.
- D. This type of laptop computer battery has a mean working time of between 0.0 and 0.7 hours.

## 6- sample question



A snack company advertises that their bags of pretzels contain, on average, 1 pound of pretzels. To test this, Sam selected at random 50 bags of pretzels produced by the company and weighed the contents of each bag. Based on his measurements, Sam estimated that the average weight of a bag of pretzels produced by the company is 0.95 pounds, with a margin of error of 0.13 pounds. Which of the following is the most plausible conclusion about the true average weight  $w$ , in pounds, of a bag of pretzels produced by the company?

- A)  $w = 0.95$
- B)  $0.82 \leq w \leq 0.95$
- C)  $0.82 \leq w \leq 1.08$
- D)  $0.95 \leq w \leq 1.08$

## 7- sample question



A sample of students was selected at random from all ninth-grade students in a large school district. The proportion of the students in the sample who were 14 years old was 80%, with an associated margin of error of 5%. Which of the following is NOT a plausible number of 14-year-olds in the 3,601 ninth-grade students in the school district?

- A) 2,750
- B) 2,900
- C) 3,050
- D) 3,200

## 8- sample question



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- D) It is plausible that the mean distance hiked for all visitors is between 4 and 5 miles.

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- D) There is insufficient information to determine which town's people shop at a grocery store more times per person per year.

## 10- sample question



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- A. This type of laptop computer battery has a mean working time of at least 4.7 hours.
- B. This type of laptop computer battery has a mean working time of at least 5.7 hours.
- C. This type of laptop computer battery has a mean working time of between 4.0 and 5.4 hours.
- D. This type of laptop computer battery has a mean working time of between 0.0 and 0.7 hours.

## 11- sample question



A snack company advertises that their bags of pretzels contain, on average, 1 pound of pretzels. To test this, Sam selected at random 50 bags of pretzels produced by the company and weighed the contents of each bag. Based on his measurements, Sam estimated that the average weight of a bag of pretzels produced by the company is 0.95 pounds, with a margin of error of 0.13 pounds. Which of the following is the most plausible conclusion about the true average weight  $w$ , in pounds, of a bag of pretzels produced by the company?

- A)  $w = 0.95$
- B)  $0.82 \leq w \leq 0.95$
- C)  $0.82 \leq w \leq 1.08$
- D)  $0.95 \leq w \leq 1.08$

## ANSWERS OF LESSON ( MARGION ERROR )

**NON CALCULATOR**



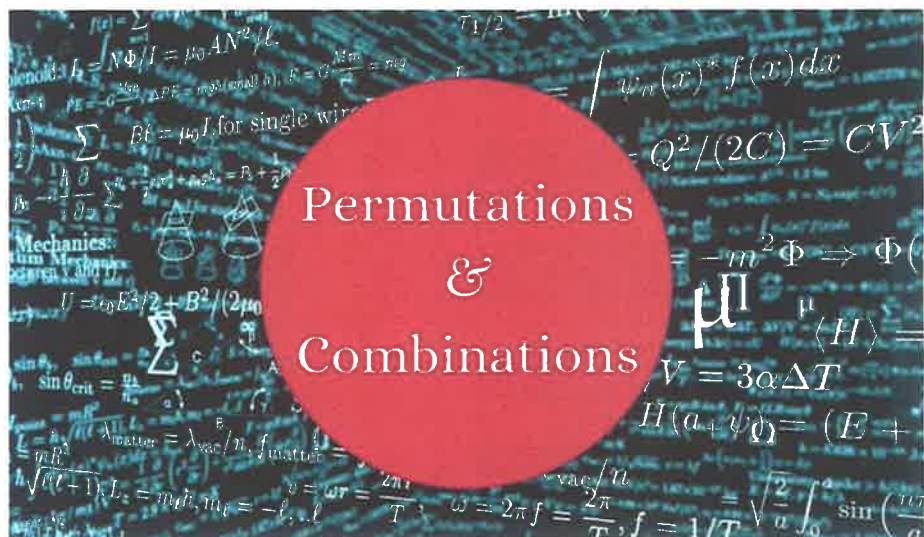
Question	Answer
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**CALCULATOR**



Question	Answer
1	A
2	D
3	D
4	D
5	C
6	C
7	D
8	D
9	D
10	C
11	C
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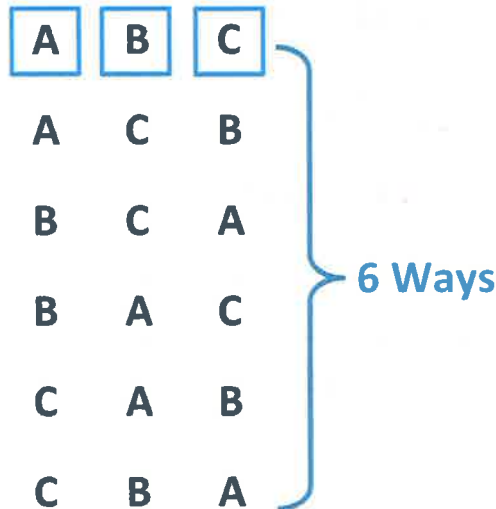
# Permutation & Combination





**A** Permutation with arrangement

Find the number of way that  
3 persons can set in 3 spaces



We Can Solve it

$$\boxed{3 P 3 = 6}$$

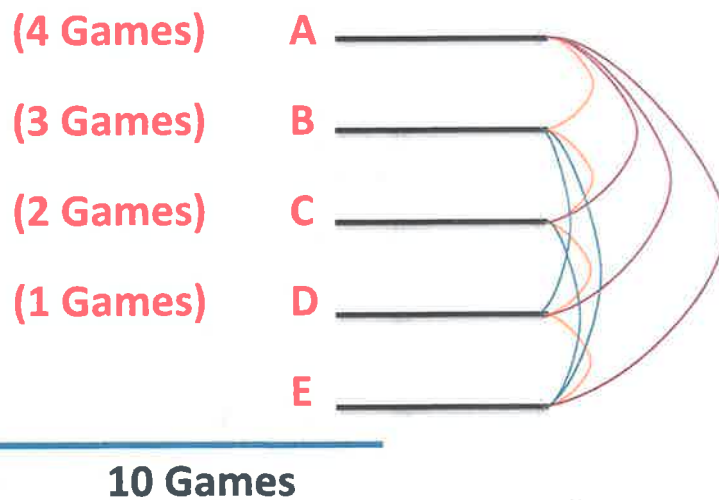
Or

$$\boxed{3} \times \boxed{2} \times \boxed{1} = 6$$

Shift  
X

### Combination (With Out arrangement)

5 Teams ..... Play a soccer games  
 Each team with play with the other.  
 How Many games will be played.



Or

$${}^{10}C_2$$

↓  
Shift

$$\left( \frac{\div}{\div} \right)$$

# *Questions*



## 1 - MAY 2021 Q 20



Raymond went to the bookstore and bought 8 greeting cards to send them to his friends. However, he decided to send cards to only 5 of his friends. In how many ways can this be done?

- A. 40
- B. 56
- C. 960
- D. 6,720

## 2 - DECEMBER 2021 Q 19



Consider  $k$  points on the plane where no three points are collinear. How many straight lines can be drawn using these points?

- A.  $\frac{k(k-2)}{2}$
- B.  $\frac{k(k-1)}{2}$
- C.  $k(k-1)$
- D.  $\frac{k}{2!}$

## 3 - MARCH 2022 / Q 9



A lobby in a hotel offers 12 choices of fresh juices, 7 choices of smoothies, and 4 choices of milk shakes. A customer can choose to drink just one course, or two different courses, or all three courses. Assuming all choices are available, how many different possible drinks does the hotel offer?

- A. 368
- B. 128
- C. 519
- D. 412

## 4 - MARCH 2022 / Q 20



In how many ways can first, second, and third place be awarded to 15 people?

- A. 252
- B. 302
- C. 455
- D. 2730

## 5- Sample test



John wants to buy a new laptop. In the shop, they suggested the following different types of laptops: Lenovo, Dell, Asus, Apple, and Acer. In addition, one of the following processors can be chosen for each type: intel core i4, intel core i5, intel core i6, and intel core i7. When making a decision, how many ways can John choose his preferable laptop ?

A) 4

B) 5

C) 9

D) 20

## 6- Sample test



In an examination there are three multiple choice questions and each question has 4 choices out of which only one is correct. If all the questions are compulsory, then number of ways in which a student can fail to get all answers correct, is

A 11

B 12

C 27

D 63

## 7- Sample test



A college offers 7 courses in the morning and 5 in the evening. Find possible number of choices with the student who want to study one course in the morning and one in the evening.

A 35

B 12

C 49

D 25

## 8- Sample test



A college offers 7 courses in the morning and 5 in the evening, to others. The number of ways a student can select exactly one course, either in the morning or in the evening

A 27

B 15

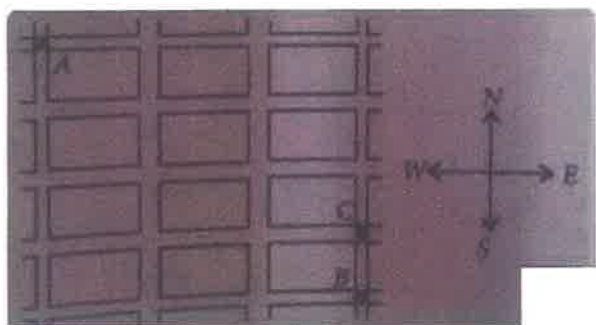
C 12

D 35

### 9- Sample test



The adjoining figure is a map of part of a city: the small rectangles are blocks and the spaces in between streets. Each morning a student walks from intersection A to intersection B, always walking along streets shown, always going east or south. For variety, at each intersection where he has a choice, he choose with probability  $\frac{1}{2}$  (independent of all other choices) whether to go east or south. Find the probability that, on any given morning, he walks through intersection C.



- A  $\frac{11}{23}$
- B  $\frac{1}{2}$
- C  $\frac{4}{7}$
- D None of these

### 10- Sample test



A committee will be selected from a group of 12 women and 18 men. The committee will consist of 5 women and 5 men. Which of the following expressions gives the number of different committees that could be selected from these 30 people?

- F.  ${}_{30}P_{10}$
- G.  $({}_{12}P_5)({}_{18}P_5)$
- H.  ${}_{30}C_{10}$
- J.  $({}_{12}C_5)({}_{18}C_5)$

### 11- Sample test



The mayor of Westbrook is deciding how to assign the 6 council members to the row of seats below.



From how many different arrangements can she choose?

- F. 21
- G. 36
- H. 64
- J. 720

## 12- Sample test



Audrey will take biology, algebra, and Spanish next year. Audrey will have 1 of the 3 teachers who teach biology, 1 of the 4 teachers who teach algebra, and 1 of the 2 teachers who teach Spanish. From among these 9 teachers, how many possibilities are there for Audrey's 3 teachers for the 3 classes?

- A. 9
- B. 18
- C. 24
- D. 72

## 13- Sample test



In the school cafeteria, students choose their lunch from 4 sandwiches, 2 soups, 2 salads, and 2 drinks. How many different lunches are possible for a student who chooses exactly 1 sandwich, 1 soup, 1 salad, and 1 drink?

- F. 32
- G. 4
- H. 10
- J. 16

## 14- Sample test



In a window display at a flower shop, there are 3 spots for 1 plant each. To fill these 3 spots, Adam has 7 plants to select from, each of a different type. Selecting from the 7 plants, Adam can make how many possible display arrangements with 1 plant in each spot?

(Note: The positions of the unselected plants do not matter.)

- F. 3
- G. 7
- H. 18
- J. 210

## 15- Sample test



A dinner combination at Nassif's Family Restaurant contains exactly 1 appetizer, 1 main course, and 1 dessert. How many different dinner combinations are possible when choosing from 5 appetizers, 4 main courses, and 5 desserts?

- A. 14
- B. 40
- C. 45
- D. 100

## 16- Sample test



Six plants, each of a different plant type, are to be arranged on a display shelf's 6 spots. If each spot must have a plant, in how many different arrangements can the plants be placed?

- F. 6
- G. 21
- H. 30
- J. 720

## 17- Sample test



Three friends will run a race. If there are no ties, in how many distinct orders can these 3 friends finish the race?

- F. 2
- G. 3
- H. 4
- J. 6

## 18- Sample test



At a chess tournament, each person played exactly 1 game with every other person. Twenty-eight games were played. How many people played in the tournament?

- F. 7
- G. 8
- H. 14
- J. 28

## 19- Sample test



Casey and 3 friends are snow sledding on a 4-person toboggan like the one shown in the figure below. Each time all 4 of them go down the hill on the toboggan, they sit in a different order, from front to back. What is the maximum number of times they can go down the hill without sitting in the same order twice?



- A. 256
- B. 64
- C. 24
- D. 16

## 20- Sample test



Jack has a blue sweatshirt, a black sweatshirt, and a tan sweatshirt. He also has a pair of blue pants, a pair of black pants, and a pair of tan pants. How many different sweatshirt-pants combinations does Jack have with exactly 1 sweatshirt and 1 pair of pants in each combination?

- F. 1
- G. 3
- H. 6
- J. 9

## ANSWERS OF LESSON ( PERMUTATION & COMBINATION )

### NON CALCULATOR



Question	Answer
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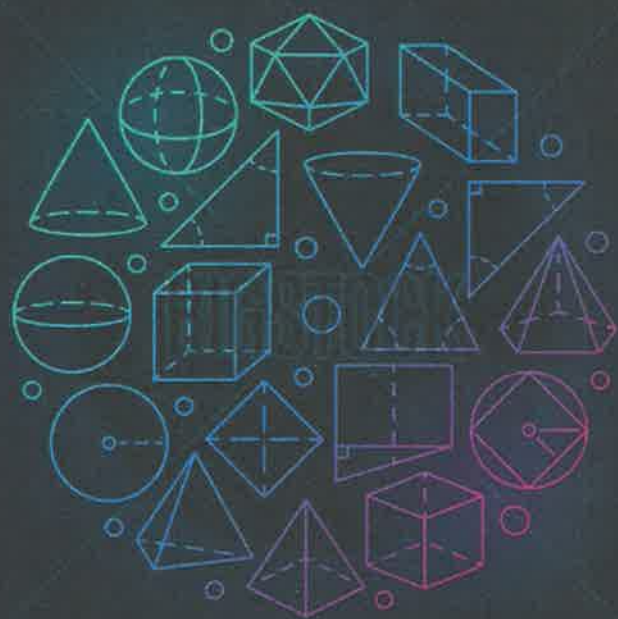
### CALCULATOR



Question	Answer
1	D
2	B
3	C
4	D
5	D
6	D
7	A
8	C
9	D
10	J
11	J
12	C
13	F
14	J
15	D
16	J
17	J
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19	C
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# Geometry

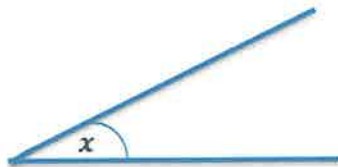
## 1



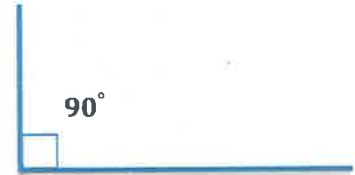
1 Angles.



Straight angle  
 $x = 180$



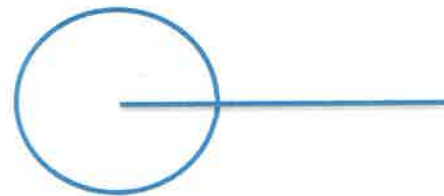
$0 < x < 90$   
acute



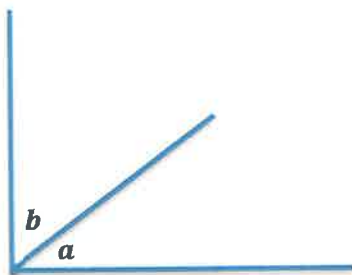
Right  
 $x = 90$



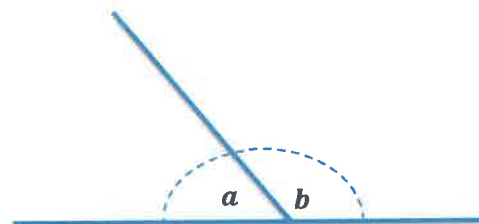
$90 < x < 180$   
obtuse



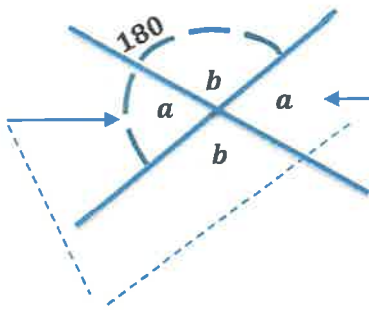
Full circle  
 $x = 360$



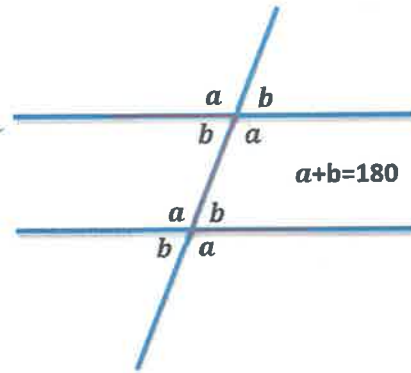
$a + b = 90^\circ$   
Componentry Angle



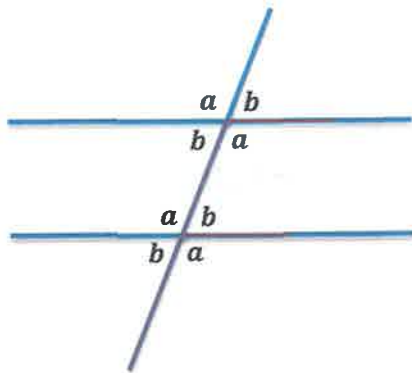
$a + b = 180^\circ$   
supplementary  
Angle



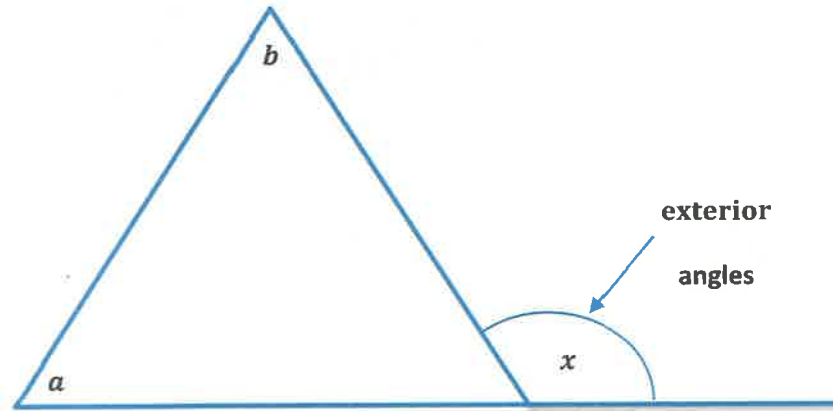
Vertical opp.  
angles



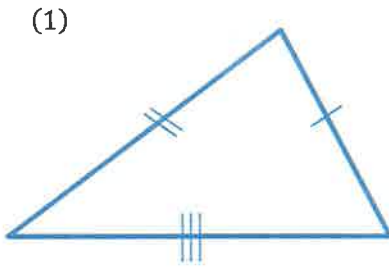
*z shape*



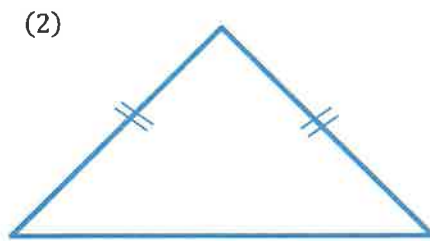
*F shape*



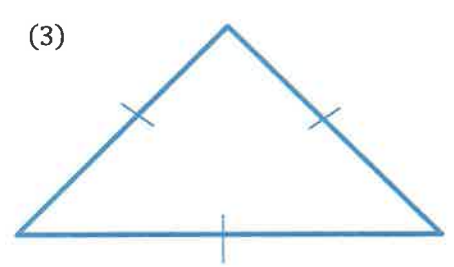
**Triangle**



Scalene Triangle  
No equal side  
no equal angles



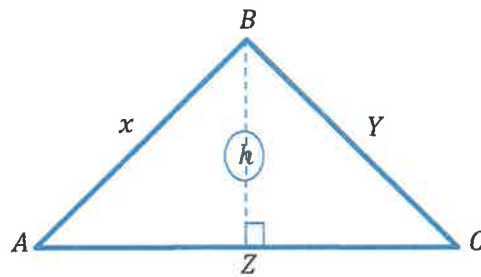
Isosceles Triangle  
Two equal side  
Two equal angles



Equilateral  
all equal side  
all equal angles  
= 60°



For any triangle:



$$\text{Area} = \frac{1}{2} b \times h$$

$$A = \frac{1}{2} z \times h$$

---


$$\text{Perimeter} = x + y + z$$

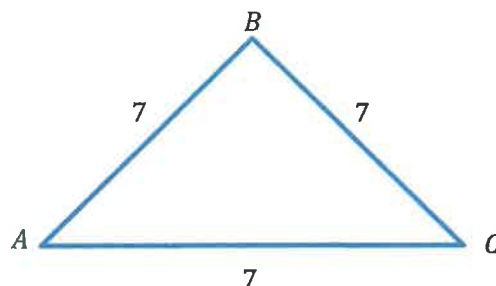
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$$\text{Sum of interior angles} = 180^\circ$$

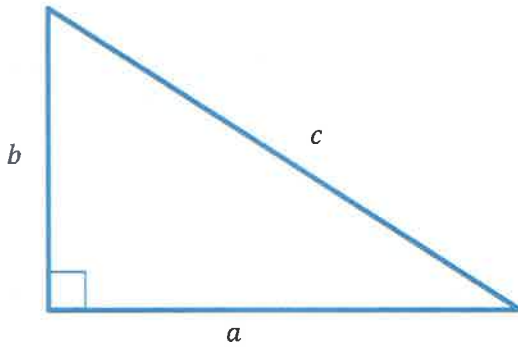


$$\text{Area of an equilateral triangles} = \frac{s^2\sqrt{3}}{4}$$

$$A = \frac{7^2\sqrt{3}}{4}$$



# Pythagorean theorem



$$c^2 = a^2 + b^2$$

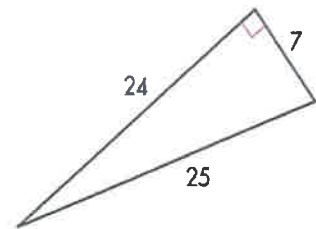
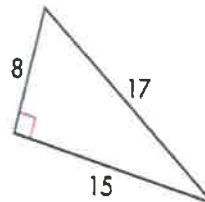
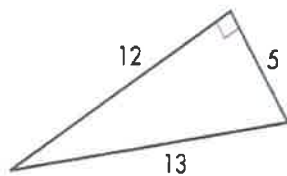
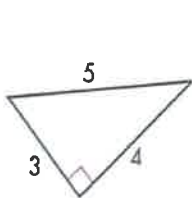
$$c = \sqrt{a^2 + b^2}$$

$$b = \sqrt{c^2 - a^2}$$

$$a = \sqrt{c^2 - b^2}$$

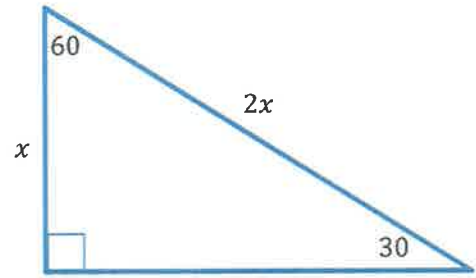
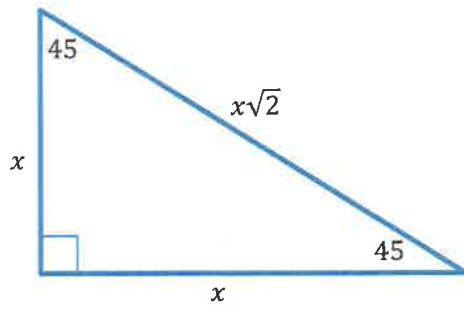
## ●●● | Pythagorean Triples

- Any set of three **whole numbers** that satisfy the Pyth. Thm. are called a Pythagorean Triple. Which of the following are?



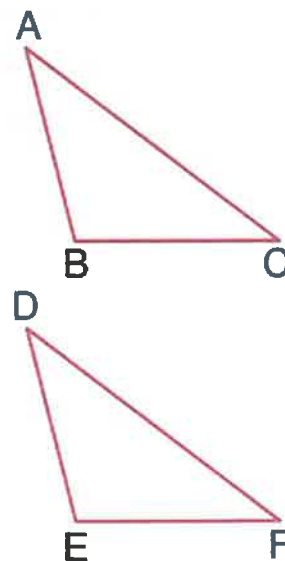
3, 4, 5	5, 12, 13	8, 15, 17	7, 24, 25
6, 8, 10	10, 24, 26	16, 30, 34	14, 48, 50
9, 12, 15	15, 36, 39	24, 45, 51	21, 72, 75
30, 40, 50	50, 120, 130	80, 150, 170	70, 240, 250
3x, 4x, 5x	5x, 12x, 13x	8x, 15x, 17x	7x, 24x, 25x

Special Right Triangles

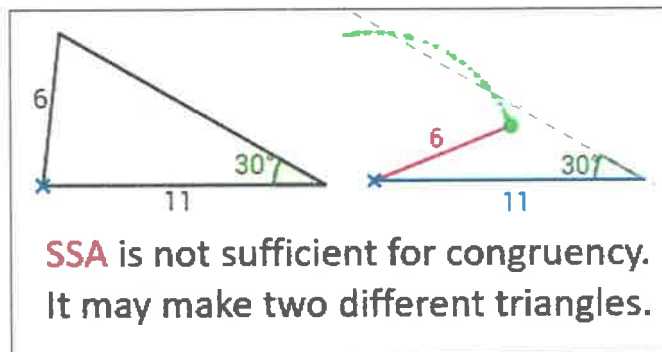
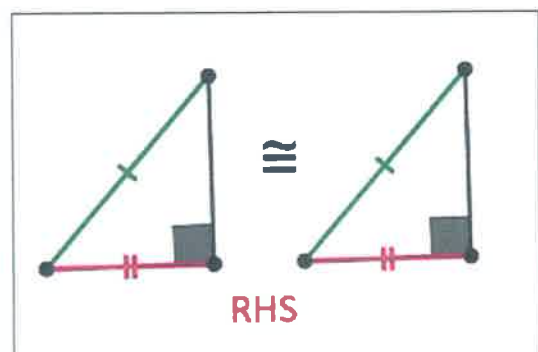
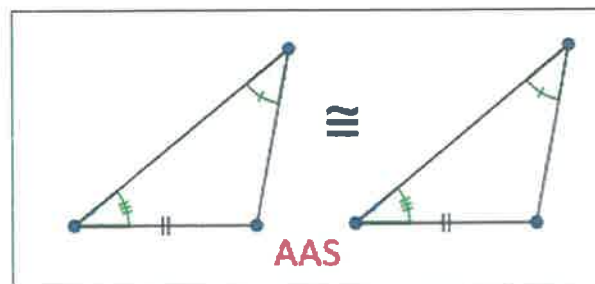
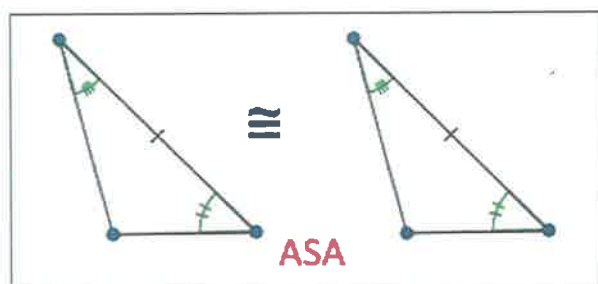
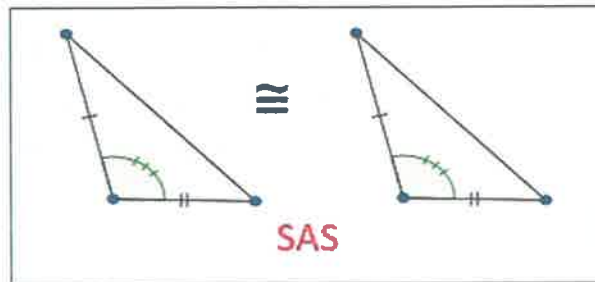
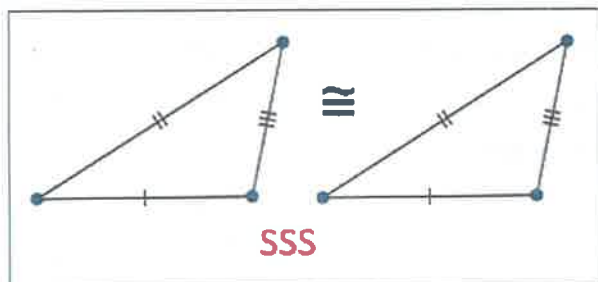


## Definition of Congruent Triangles

- Two triangles are **congruent** if one can be placed on top of the other for a perfect match (they have the same size and shape).
- In the figure,  $\triangle ABC$  is congruent to  $\triangle DEF$ . In symbols:  $\triangle ABC \cong \triangle DEF$ .
- Just as with similar triangles, it is important to get the letters in the correct order. For example, since  $A$  and  $D$  come first, we are saying that when the triangles are made to coincide,  $A$  and  $D$  will coincide.



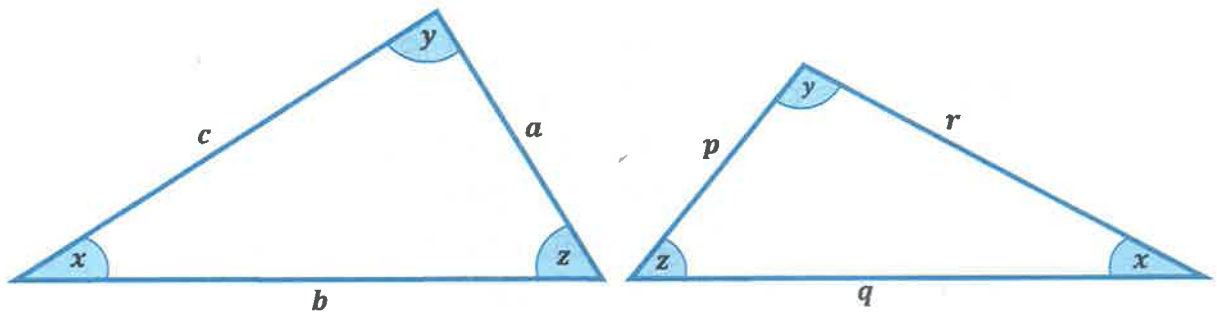
### Rules for Triangle Congruency



## Similar Triangles

- Same shape, but not necessarily the same size.
- Corresponding angles are equal.
- Corresponding sides are in the same ratio.

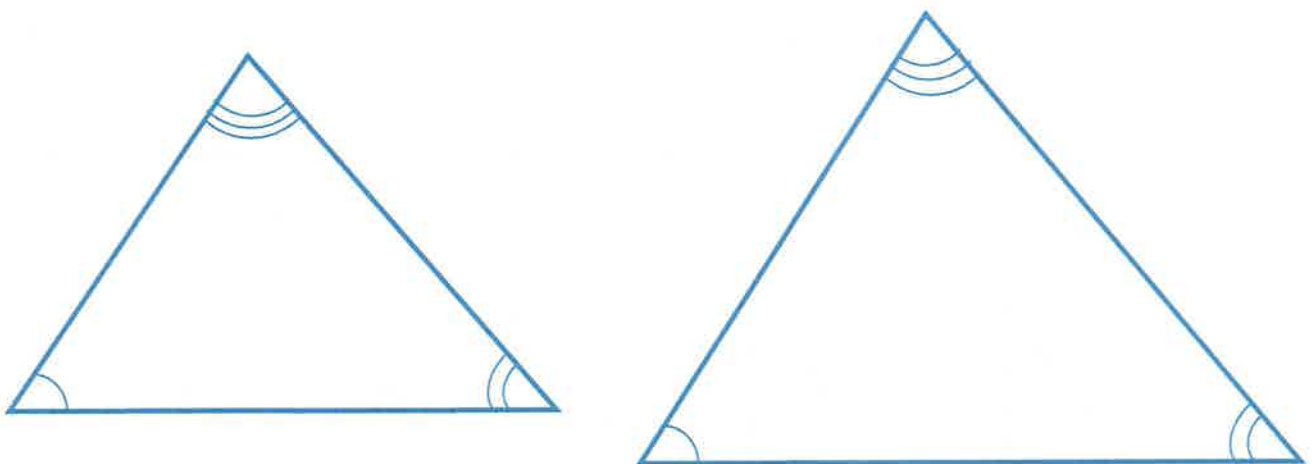
$$\frac{a}{p} = \frac{b}{q} = \frac{c}{r}$$



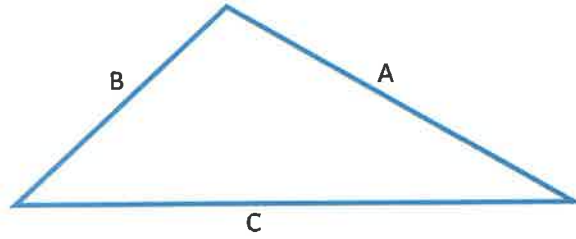
To Test for similar triangles:

- AA – if 2 corresponding angles are equal.
- SSS – if 3 corresponding sides are in the same ratio.
- SAS – Ratio of 2 pairs of corresponding side are equal and their included angles are equal.

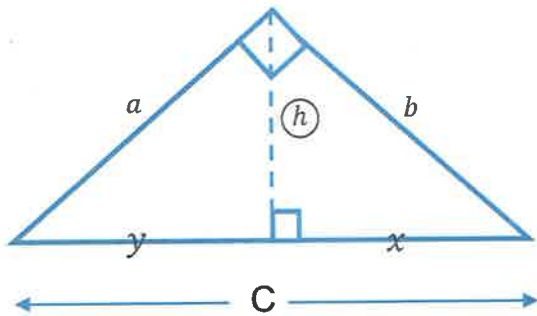
$$\triangle ABC \sim \triangle KLM$$



The Triangle inequality theorem



$$A - B < C < A + B$$



$$h^2 = xy$$

$$h = \frac{ab}{c}$$

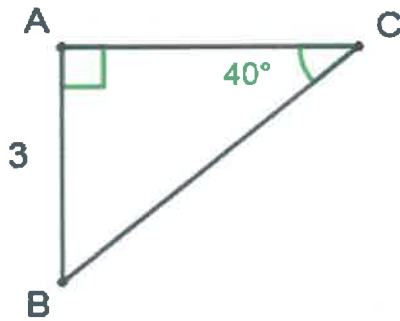
# *Questions*



1- MARCH 2021 Q 14



In the right triangle below, what is the length of BC?



- A.  $3 \sin 40$
- B.  $\frac{\sin 40}{3}$
- C.  $\frac{3}{\sin 40}$
- D.  $3 \cos 40$

2- MARCH 2021 Q 15



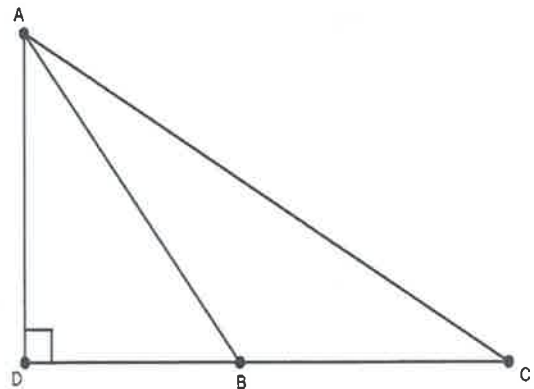
The angles shown above are acute and  $\sin(a^\circ) = \cos(b^\circ)$ . If  $a = 2m - 11$  and  $b = 5m + 10$ , what is the value of  $m$ ? (the figure is not drawn to scale)

- A.  $\frac{181}{7}$
- B. 13
- C. -7
- D.  $\frac{1}{7}$

3- MAY 2021 Q 14



In the figure below,  $AB = 7 \text{ cm}$ ,  $DC = 13 \text{ cm}$  and  $\tan C = \frac{2\sqrt{6}}{13}$ . What is the dimension of segment BC? (The figure is not drawn to scale.)

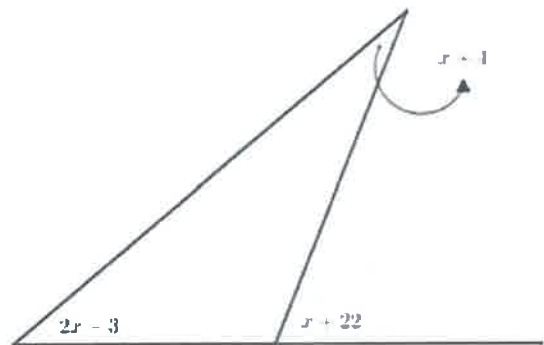


- A. 5 cm
- B. 8 cm
- C. 10 cm
- D. 12 cm

4- MAY 2021 Q 19



Using the figure below, what is the value of  $x$ ? (grid-in)



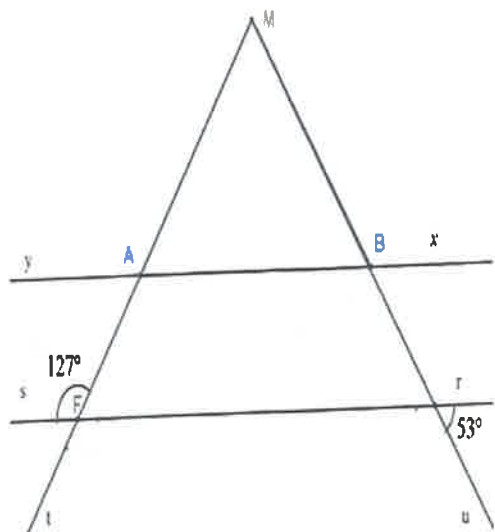
5- JUNE 2021 Q 8



Which of the following angles have the same value of  $\sin 32^\circ$ ?

- A.  $\sin (-32^\circ)$
- B.  $\sin 58^\circ$
- C.  $\cos (-32^\circ)$
- D.  $\cos 58^\circ$

6- JUNE 2021 Q 9



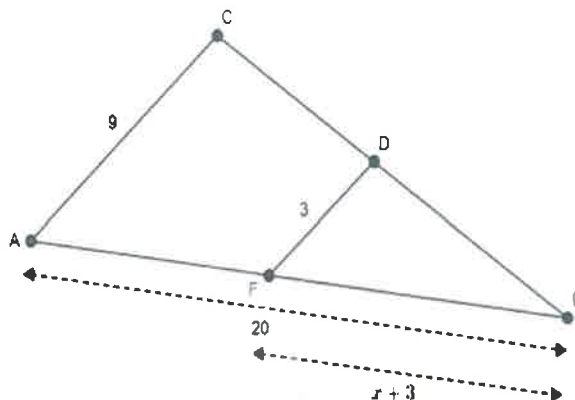
Knowing that lines (xy) and (rs) are parallel, what is the type of triangle ABM? (Figure is not drawn to scale)

- A. Scalene
- B. Isosceles
- C. Equilateral
- D. Right isosceles

7- OCTOBER 2021 Q 9



Using the figure below, what is the value of  $3x - 1$  if  $\overline{AC}$  is parallel to  $\overline{FD}$ ? (figure not drawn to scale)

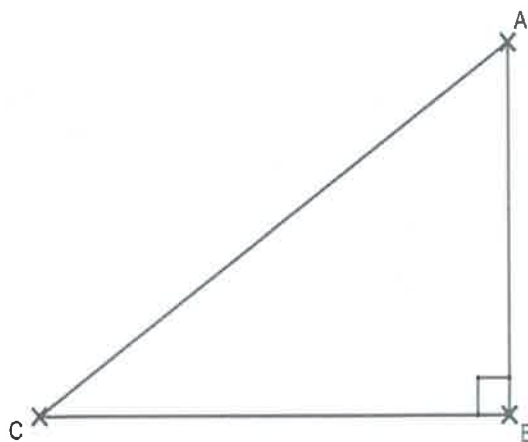


- A.  $\frac{8}{3}$
- B. 8
- C. 10
- D. 32

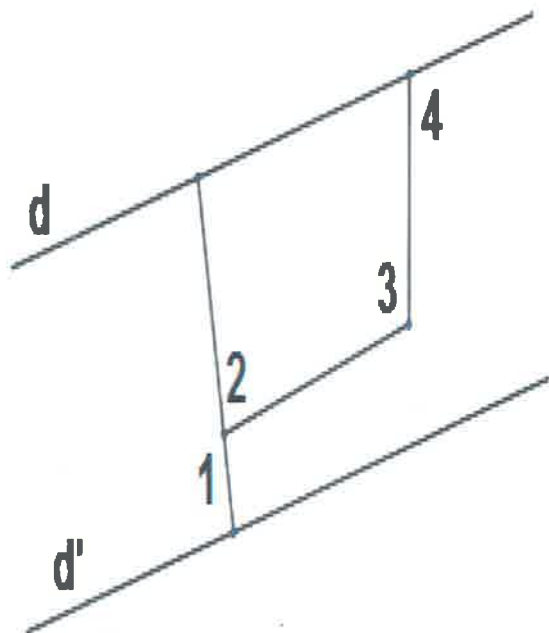
8- OCTOBER 2021 Q 20



In triangle ABC,  $\sin C = 0.5$ .  
What is the measure of  $\angle A$ ?  
(figure not drawn to scale)(Grid-in)



9- DECEMBER 2021 Q 16



In the figure above,  $d$  and  $d'$  are parallel lines,  $\angle 2 = 103^\circ$ ,  $\angle 3 = 107^\circ$  and  $\angle 4 = 97^\circ$ . What is the measure of  $\angle 1$ ? (The figure is not drawn to scale) **(Grid in)**

10 - MARCH 2022 / Q 14



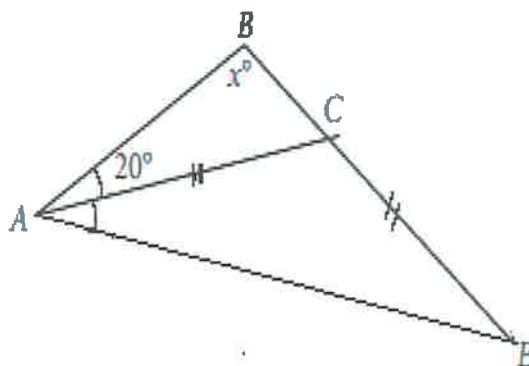
The lengths of two sides of a triangle are 4 and 7. Which of the following represents  $a$ , the possible length of the remaining side?

- A.  $a > 11$
- B.  $3 < a < 11$
- C.  $-3 < a < 11$
- D. impossible

11 - MARCH 2022 / Q 19



Using the figure below, what is the value of  $x$ ? (grid-in)

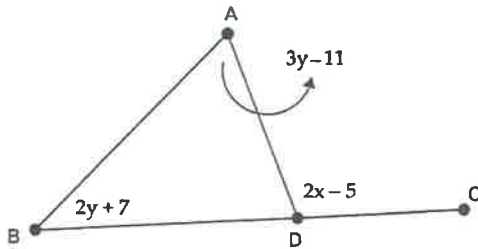


Note: figure not drawn to scale

12 - SAMPLE TEST / Q 9

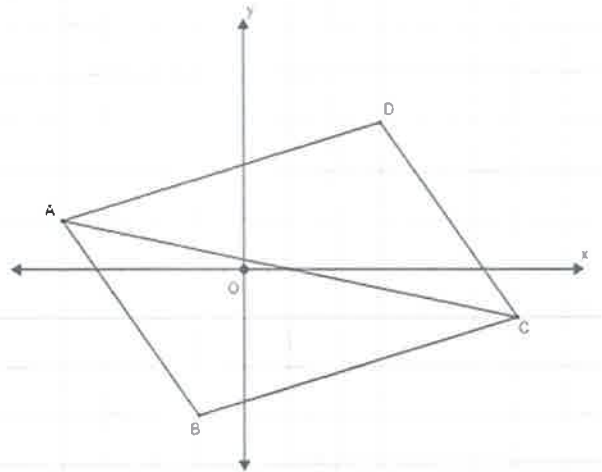


Given the figure below, express  $y$  in terms of  $x$ .



- A)  $y = \frac{1}{5} (2x - 1)$
- B)  $y = 2x + 13$
- C)  $y = 2x - 1$
- D)  $y = \frac{1}{5} (2x + 13)$

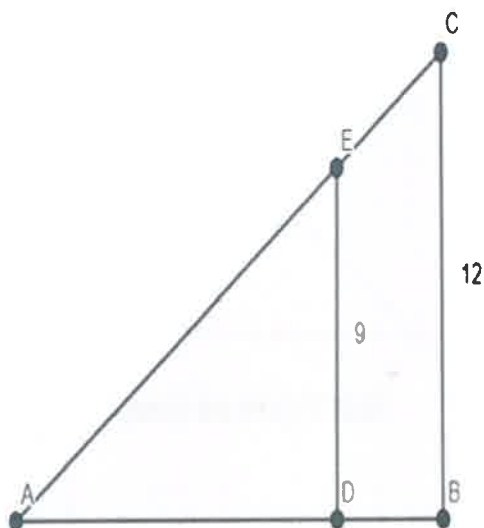
13 - JUNE 2022 ( cancelled ) / Q 17



What is the value of  $AD^2 + DC^2$ ?

- A. 53
- B. 58
- C. 78
- D. 48

1- OCTOBER 2020 Q 30



The right triangles ADE and ABC are similar. If  $AD = \frac{4}{3}ED$ , how long is DB?

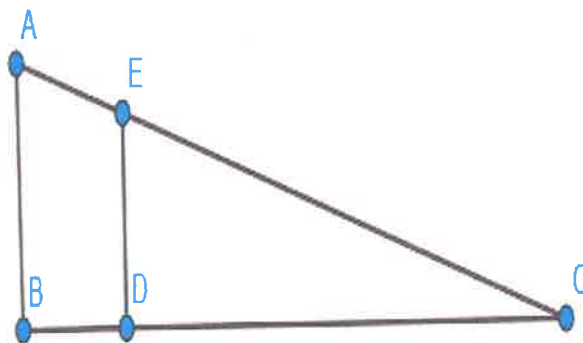
- A. 3
- B. 4
- C. 5
- D. 6

2- OCTOBER 2020 Q 38



A right triangle has an area of  $96 \text{ cm}^2$ . If the shorter leg is 4cm less than the longer leg, what is the length of the hypotenuse?

3- DECEMBER 2020 Q 37



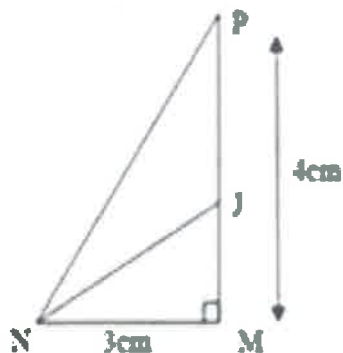
In the given figure, ABC is a triangle right at B, segment ED is parallel to AB,  $BC = 24$ , and  $AC = 26$ . If  $ED = 8$ , what is the length of  $\overline{EC}$  ?

4- MAY 2021 Q 37



If  $\sin a = 2 - \frac{\cos a}{3}$ , what is the value of  $9 \sin a + 3 \cos a$  ? (grid-in)

5- AUGUST 2021 Q 10

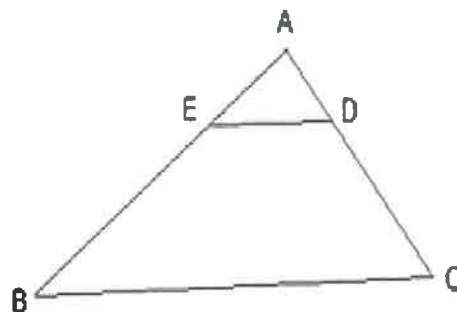


Note: Figure not drawn to scale.

Based on the figure above, what is the area of the triangle MNJ, if the area of the triangle MNJ is double the area of the triangle NJP?

- A.  $2 \text{ cm}^2$
- B.  $3 \text{ cm}^2$
- C.  $4 \text{ cm}^2$
- D.  $5 \text{ cm}^2$

6- AUGUST 2021 Q 20



Note: Figure not drawn to scale.

In the figure above,  $AE = \frac{1}{3} AB$  and

$$AD = \frac{1}{3} AC.$$

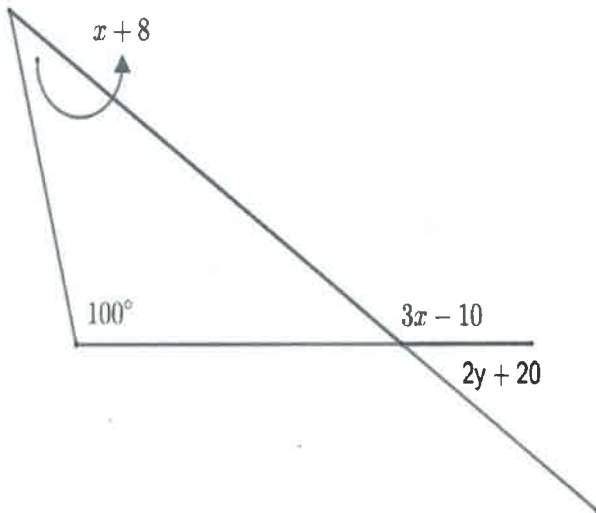
The area of the triangle ABC is how many times the area of the trapezoid EDCB?

- A.  $\frac{9}{8}$
- B.  $\frac{8}{9}$
- C. 3
- D.  $\frac{2}{3}$

7- OCTOBER 2021 Q 17

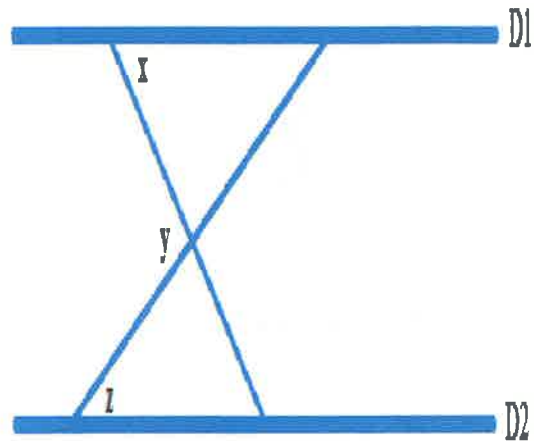


Using the figure below, what is the value of  $y$ ? (figure not drawn to scale)



- A. 80
- B. 59
- C. 3.5
- D. -3.5

8- DECEMBER 2021 Q 30

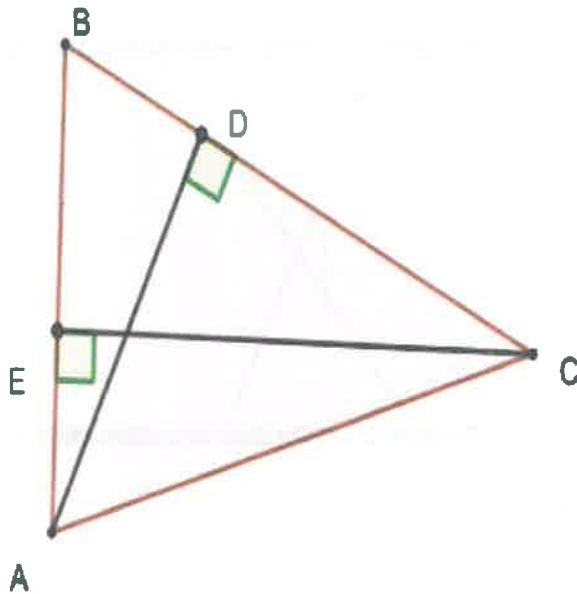


In the figure above,  $D1$  and  $D2$  are two parallel lines.

Which of the following is always true?

- A.  $z = x$
- B.  $z = x - y$
- C.  $x = y - z$
- D.  $x + z + y = 180$

9- DECEMBER 2021 Q 38



In the triangle above,  $\overline{AD} \perp \overline{BC}$  and  $\overline{CE} \perp \overline{BA}$  such that  $BD = 5$ ,  $BE = 6$  and  $AD = 8$ . What is the length of  $\overline{CE}$ ? (The figure is not drawn to scale) (Grid in)

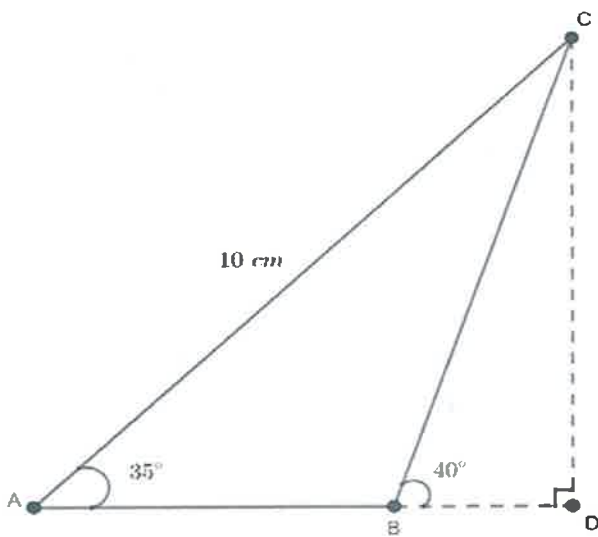
10 - SAMPLE TEST / Q 2



The Flatiron Building in New York City in the United States of America was built in 1902 even though the site was bought in 1857. The design of the building which was created by an American architect, had 21 floors with each floor having a shape of a right triangle such that one of the bases is equal to 180 meters, and the hypotenuse is equal to 195 meters. What is the area of one of the floors ?

- A)  $6750 \text{ m}^2$
- B)  $7312.5 \text{ m}^2$
- C)  $13500 \text{ m}^2$
- D)  $17550 \text{ m}^2$

11 - JUNE 2022 (cancelled) / Q 8



In the figure above, triangle  $BDC$  is right angled at  $D$  with  $m\angle CBD = 40^\circ$ . Given that  $m\angle CAB = 35^\circ$ , and  $AC = 10\text{ cm}$ , what is the length of segment  $AB$ ? (figure not drawn to scale)

- A. 1.36 cm
- B. 5.74 cm
- C. 6.84 cm
- D. 8.19 cm

12 - JUNE 2022 (cancelled) / Q 33



$T$  and  $T'$  are two triangles.  $T$  is a right isosceles triangle of hypotenuse  $9\sqrt{2}$ , and the  $T'$  is a  $30^\circ - 60^\circ - 90^\circ$  triangle, such that the small leg is equivalent to 4. What is the sum of the perimeters of both triangles? (Give your answer to the nearest tenth)

- a. 49.7
- b. 34.5
- c. 54.4
- d. 38.5

## ANSWERS OF LESSON (GEOMETRY 1)

**NON CALCULATOR**



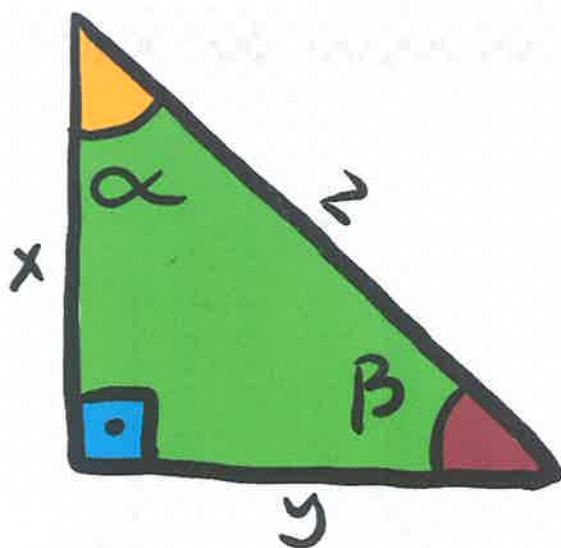
Question	Answer
1	C
2	B
3	B
4	10.5 OR 21/2
5	D
6	B
7	C
8	60
9	67
10	B
11	120
12	A
13	B
14	
15	
16	
17	
18	
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20	
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28	

**CALCULATOR**

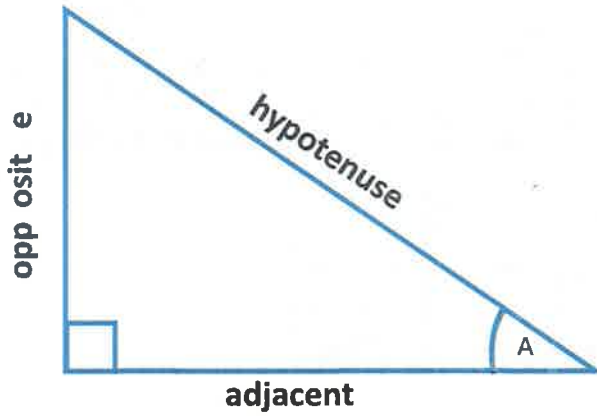


Question	Answer
1	B
2	20
3	20.8
4	18
5	C
6	A
7	D
8	C
9	9.6 OR 48/5
10	A
11	A
12	A
13	
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# Trigonometry Rule



**Trigonometry**



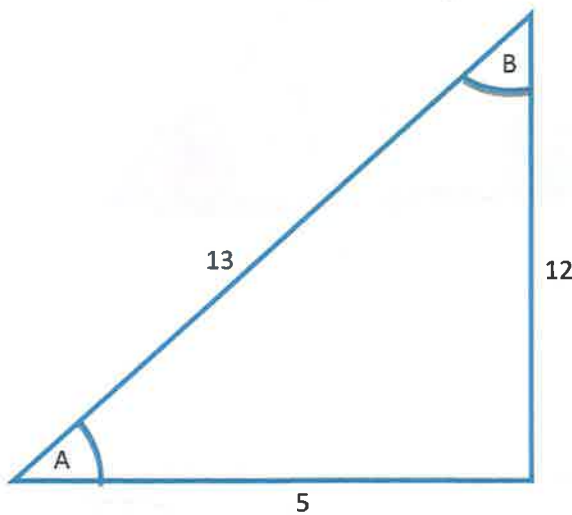
**Soh cah toa**

$$\sin A = \frac{o}{h}$$

$$\cos A = \frac{a}{h}$$

$$\tan A = \frac{o}{a}$$

**Find sin, cos, tan for A, B?**



(A)

$$\begin{array}{l} \text{if } a + b = 90 \\ \text{So } \sin a = \cos b \\ \quad \cos b = \sin a \end{array} \quad \left. \begin{array}{l} \curvearrowright \\ \curvearrowleft \end{array} \right\}$$



(B)

$$\sin x = \cos(90 - x)$$

$$\cos x = \sin(90 - x)$$



(C)

$$\tan x = \frac{\sin x}{\cos x}$$



(D)

$$\sin^2 x + \cos^2 x = 1$$



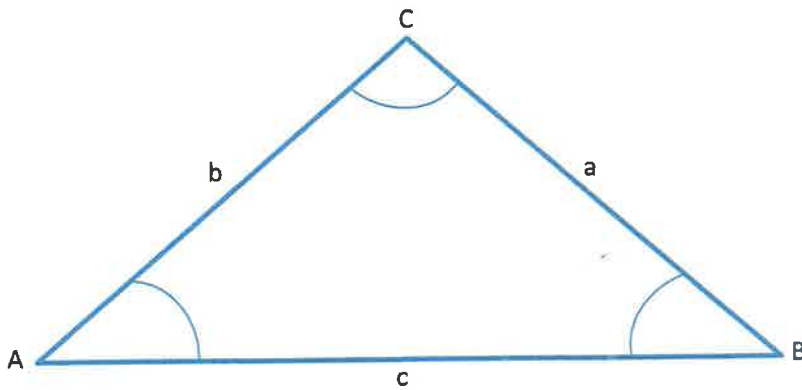
(E)

$$\sin(2a) = 2 \sin(a) \cos(a)$$

$$\cos(2a) = \cos^2(a) - \sin^2(a)$$

$$\tan(2a) = \frac{2 \tan(a)}{1 - \tan^2(a)}$$

**Low of Sines**

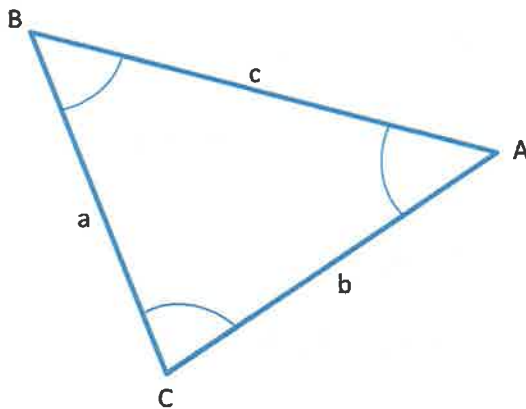


$$\frac{\sin A}{a} = \frac{\sin B}{b} = \frac{\sin c}{c}$$

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin c}$$



**Low of cosines**

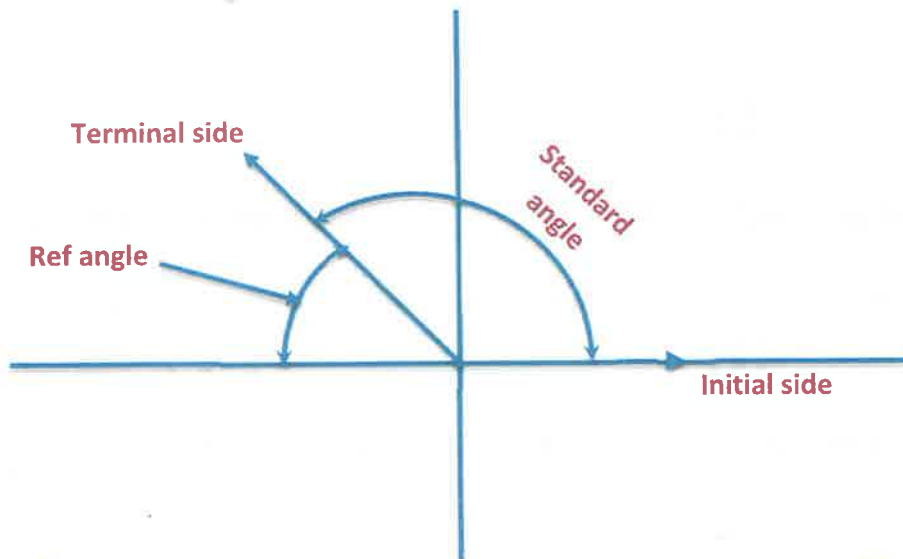


$$a^2 = b^2 + c^2 - 2bc \cos A$$

$$b^2 = a^2 + c^2 - 2ac \cos B$$

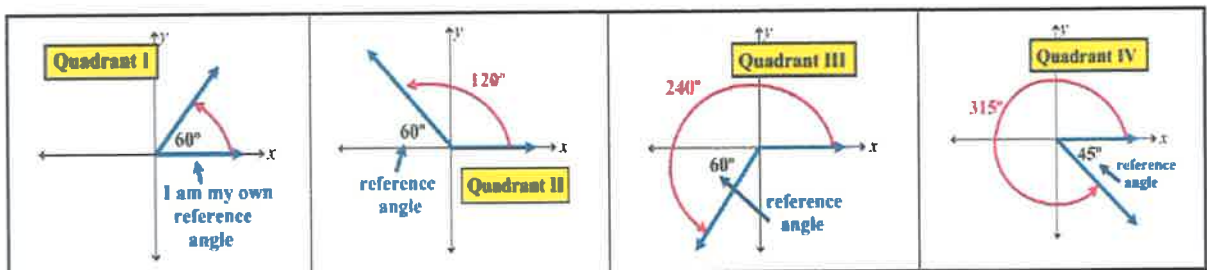
$$c^2 = a^2 + b^2 - 2ab \cos C$$

**Standard position and reference angles**



**The reference angle is measure from terminal side of the original to the x-axis**

**Reference Angles:** Associated with every angle drawn in standard position (except quadrantal angles) there is another angle called the **reference angle**. The reference angle is the **acute angle** (the smallest angle) formed by the terminal side of the given angle and the **x-axis**. Reference angles may appear in all four quadrants. Angles in quadrant I are their own reference angles.

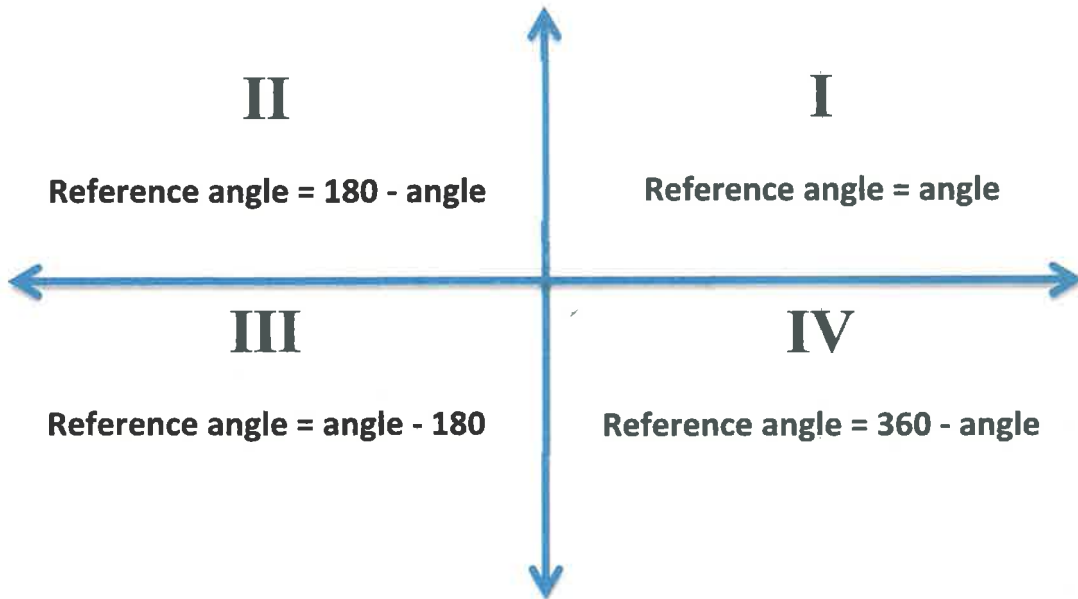


A reference angle is always positive and is always less than  $90^\circ$ .

**Remember:** The reference angle is measured from the terminal side of the original angle "to" the x-axis (not "to" the y-axis).

# Reference Angles

How to Find the reference angle?



### Reference Angle

Standard Angle =  $\theta$

Reference Angle =  $\theta'$

Quadrant II

Quadrant I

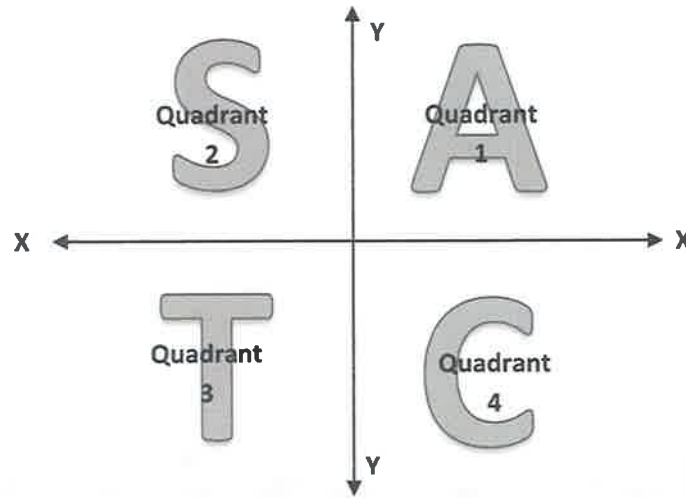
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Quadrant III

Quadrant IV

The Cast Rule (A.S.T.C)

The Cast Rule

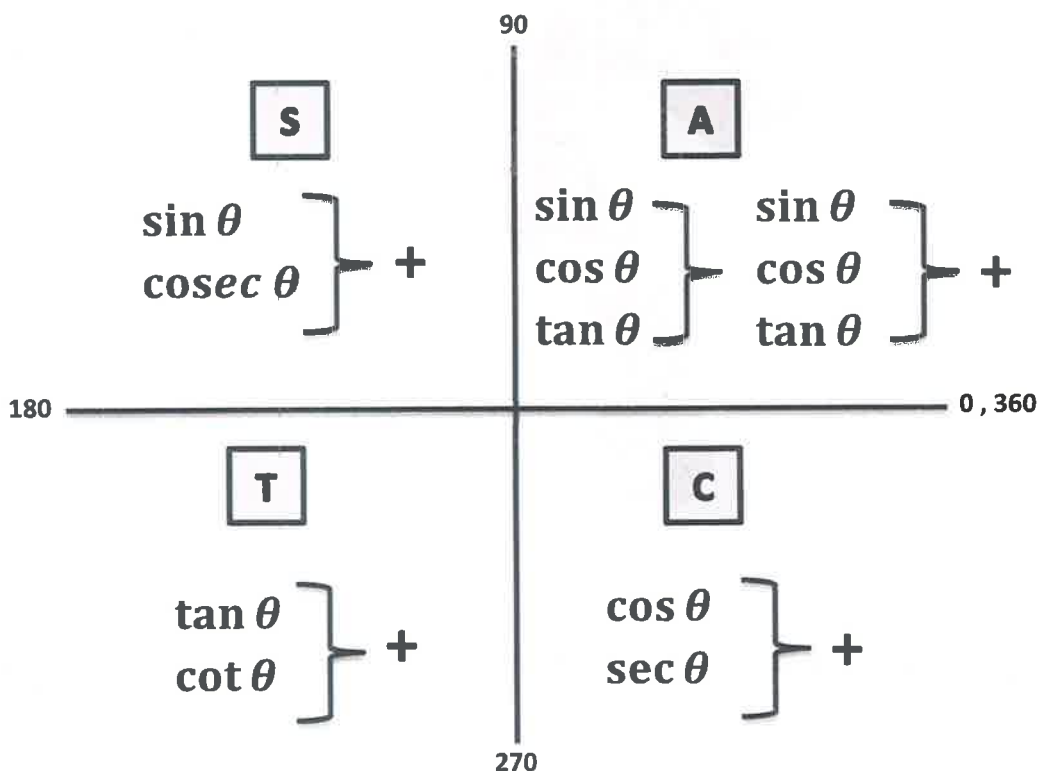


**C** = Quadrant 4 = only cos/sec is positive

**A** = Quadrant 1 = All functions are positive

**S** = Quadrant 2 = only sin/cosec is positive

**T** = Quadrant 3 = only tan/cot is positive



# *Questions*



1- DECEMBER 2020 Q 20



If  $x$  and  $y$  are positive measures of acute angles, and  $\sin(x - 20^\circ) = \cos(y + 12^\circ)$ , what is a possible value of  $x + y$ ? (Disregard the degree sign when gridding in your answer).

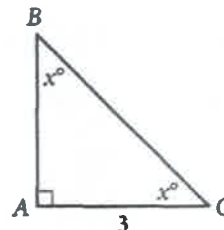
2 - SAMPLE TEST / Q 14



$BMT$  is a right triangle at  $B$  with  $BM = 3.1$  cm and  $TM = 5.2$  cm. What is the value of  $\sin M$ ?

- A) 0.8
- B) 0.74
- C) 0.59
- D) 0.2

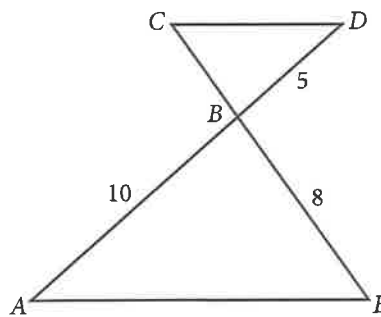
3- Sample test



Triangle  $ABC$  is similar to triangle  $WXY$  (not shown), where  $\angle C$  corresponds to  $\angle Y$ . What is the tangent of  $\angle Y$ ?

- A)  $3\sqrt{2}$
- B) 3
- C) 1
- D)  $\frac{3}{3\sqrt{2}}$

4- Sample test



In the figure above,  $AE \parallel CD$  and segment  $AD$  intersects segment  $CE$  at  $B$ . What is the length of segment  $CE$ ?

5- Sample test



In a right triangle, one angle measures  $x^\circ$ , where

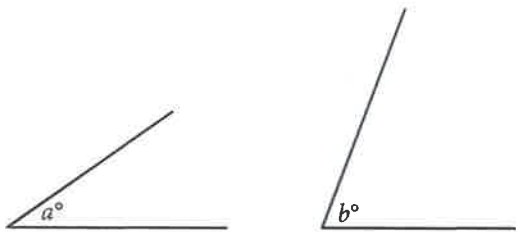
$\sin x^\circ = \frac{4}{5}$ . What is  $\cos(90^\circ - x^\circ)$  ?

6- Sample test



If  $\sin 36^\circ = \cos x^\circ$ , where  $0 < x < 360$ , what is a possible value of  $x$  ?

7- Sample test



Note: Figures not drawn to scale.

The angles shown above are acute and  $\sin(a^\circ) = \cos(b^\circ)$ . If  $a = 4k - 22$  and  $b = 6k - 13$ , what is the value of  $k$  ?

- A) 4.5
- B) 5.5
- C) 12.5
- D) 21.5

8- Sample test



Which of the following is equivalent to  $\tan(x^\circ)$  ?

A)  $\frac{\sin(90^\circ - x^\circ)}{\cos(90^\circ - x^\circ)}$

B)  $\frac{\cos(90^\circ - x^\circ)}{\sin(90^\circ - x^\circ)}$

C)  $-\tan(90^\circ - x^\circ)$

D)  $\sin(x^\circ) - \cos(x^\circ)$

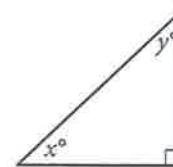
9- Sample test



In a right triangle, one angle measures  $x^\circ$ , where

$\sin x^\circ = \frac{4}{5}$ . What is  $\cos(90^\circ - x^\circ)$  ?

10- Sample test



In the triangle above, the sine of  $x^\circ$  is 0.6. What is the cosine of  $y^\circ$  ?

## 1- OCTOBER 2020 Q 12



If  $\sin A = \cos \frac{7\pi}{3}$ , what is one possible value of  $A$  in radians?

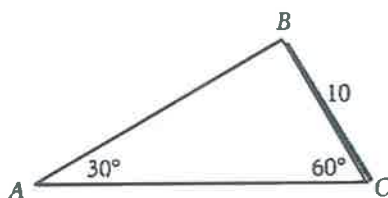
- A.  $\frac{\pi}{2}$
- B.  $\frac{\pi}{3}$
- C.  $\frac{\pi}{4}$
- D.  $\frac{\pi}{6}$

## 2 - MARCH 2022 / Q 37



If  $\cos(x)\sin(x) = \frac{1}{2}$ , what is the value of  $(\cos(x) + \sin(x))^2 + 16 \sin 2x$ ?

## 3- Sample test



In triangle  $ABC$  above, what is the length of  $AB$ ?

- A) 10
- B) 20
- C)  $10\sqrt{3}$
- D)  $\frac{10\sqrt{3}}{3}$

## 4- Sample test



If  $\sin x^\circ = \cos y^\circ$ , where  $0 < x < 90$  and  $0 < y < 90$ , which of the following must be equal to  $y$ ?

- A)  $x$
- B)  $90 - x$
- C)  $180 - x$
- D)  $x + 90$

## 5- Sample test



In a right triangle, the tangent of one of the two acute angles is  $\frac{\sqrt{3}}{3}$ . What is the tangent of the other acute angle?

- A)  $-\frac{\sqrt{3}}{3}$
- B)  $-\frac{3}{\sqrt{3}}$
- C)  $\frac{\sqrt{3}}{3}$
- D)  $\frac{3}{\sqrt{3}}$

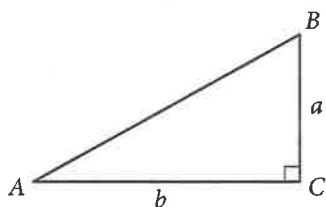
## 6- Sample test



Find the value of  $(\cos x - \sin x)^2$ , if the product  $\cos x \sin x = 0.22$ .

- A 0
- B 0.11
- C 0.44
- D 0.56

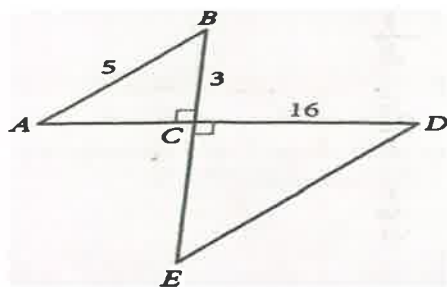
7- Sample test



Given the right triangle  $ABC$  above, which of the following is equal to  $\frac{b}{a}$  ?

- A)  $\sin A$
- B)  $\sin B$
- C)  $\tan A$
- D)  $\tan B$

8- Sample test



Note: Figure not drawn to scale.

In the figure above,  $\triangle ABC$  is congruent to  $\triangle EDC$ . What is the value of  $\sin D$ ?

- A)  $\frac{3}{5}$
- B)  $\frac{4}{5}$
- C)  $\frac{16}{5}$
- D)  $\frac{16}{25}$

9- Sample test



If  $\sin x^\circ = a$ , which of the following must be true for all value of  $x$ ?

- A)  $\cos x^\circ = a$
- B)  $\sin(90^\circ - x^\circ) = a$
- C)  $\cos(90^\circ - x^\circ) = a$
- D)  $\sin(x^2)^\circ = a^2$

10-Sample test



If  $0 \leq \alpha \leq \frac{\pi}{2}$  (where  $\frac{\pi}{2} = 90^\circ$ ) and  $\sin \alpha = 0.618$ , which of the following is correct about the range of  $\alpha$ ?

- A.  $0 < \alpha < \frac{\pi}{8}$
- B.  $\frac{\pi}{8} < \alpha < \frac{\pi}{4}$
- C.  $\frac{\pi}{4} < \alpha < \frac{3\pi}{8}$
- D.  $\frac{3\pi}{8} < \alpha < \frac{\pi}{2}$

## ANSWERS OF LESSON ( TRIGNOMETRY )

### NON CALCULATOR



Question	Answer
1	98
2	A
3	C
4	12
5	4/5
6	54
7	C
8	B
9	4/5
10	0.6
11	
12	
13	
14	
15	
16	
17	
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### CALCULATOR



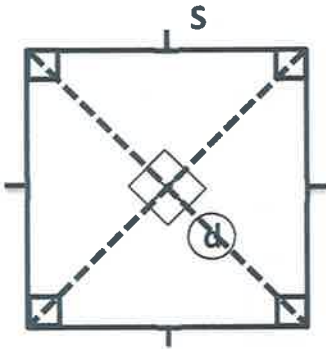
Question	Answer
1	D
2	18
3	C
4	B
5	D
6	D
7	D
8	A
9	C
10	B
11	
12	
13	
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# Geometry

## 2



1) Square



$$A = S^2$$

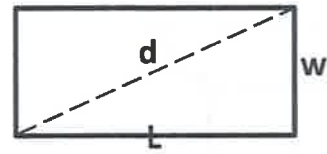
$$A = \frac{1}{2}d^2$$

$$P = 4S$$

$$D = S\sqrt{2}$$

(A) Polygon

2) rectangle

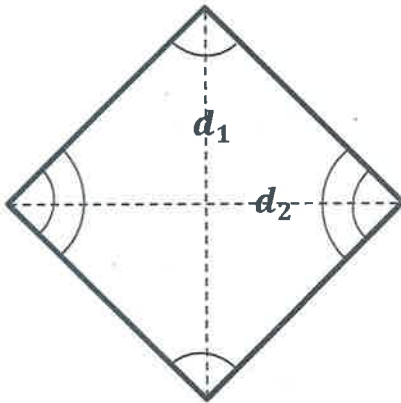


$$A = L \cdot w$$

$$P = 2(L + w)$$

$$d = \sqrt{L^2 + w^2}$$

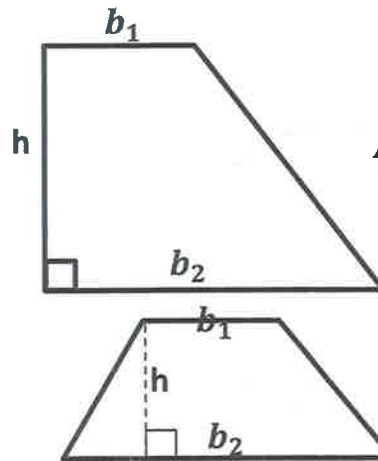
3) Rhombus



$$A = \frac{d_1 \times d_2}{2}$$

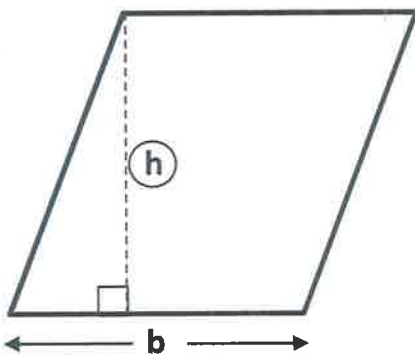
$$P = 4S$$

4) Trapezoid



$$A = \frac{b_1 \times b_2}{2} \times h$$

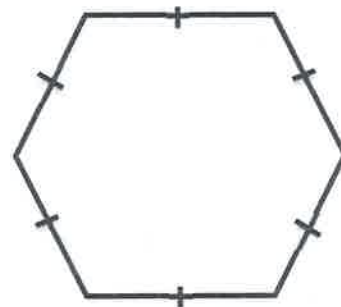
5) Parallelogram



$$A = h \times b$$

$$P = 2(l + w)$$

6) hexagon (Regular)



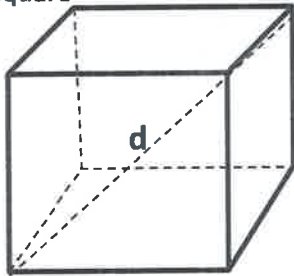
$$A = \frac{6s^2\sqrt{3}}{4}$$

$$P = 6S$$

**Solid Geometry**

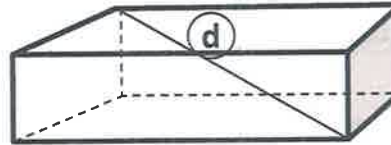
dimension 3

A) Square



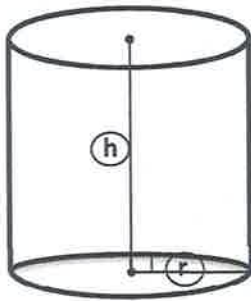
Volume =  $S^3$   
 Surface area =  $6S^2$   
 Diagonal =  $S\sqrt{3}$

B) rectangular (box) , (prism) , (solid)



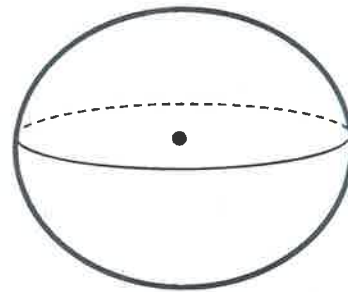
Volume =  $l. w. h$   
 Surface area =  $2[l. w + l. h + h. w]$   
 Diagonal =  $\sqrt{l^2 + w^2 + h^2}$

C) cylinder



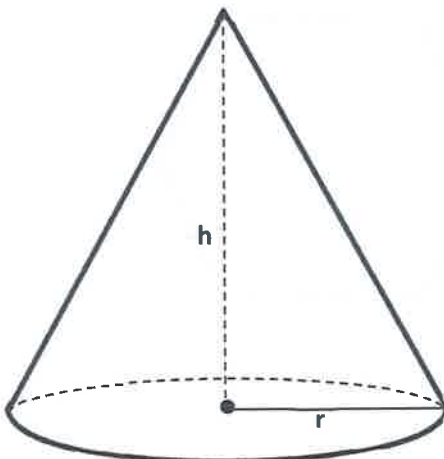
$V = \text{area of base} \times h$   
 $V = \pi r^2 \times h$

D) Sphere



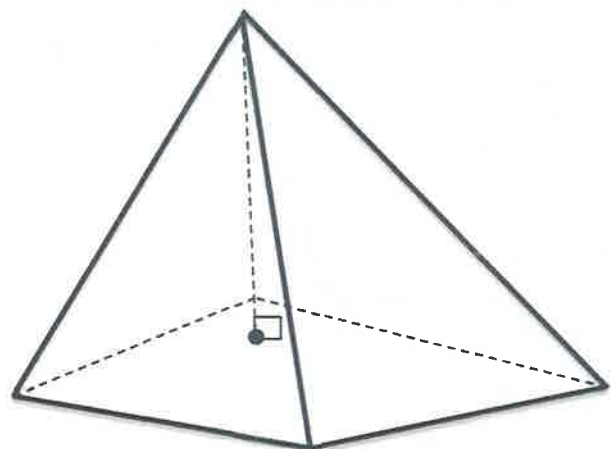
$V = \frac{4}{3} \pi r^3$   
 $S.A = 4\pi r^2$

E) Cone



$V = \frac{1}{3} \pi r^2 \times h$

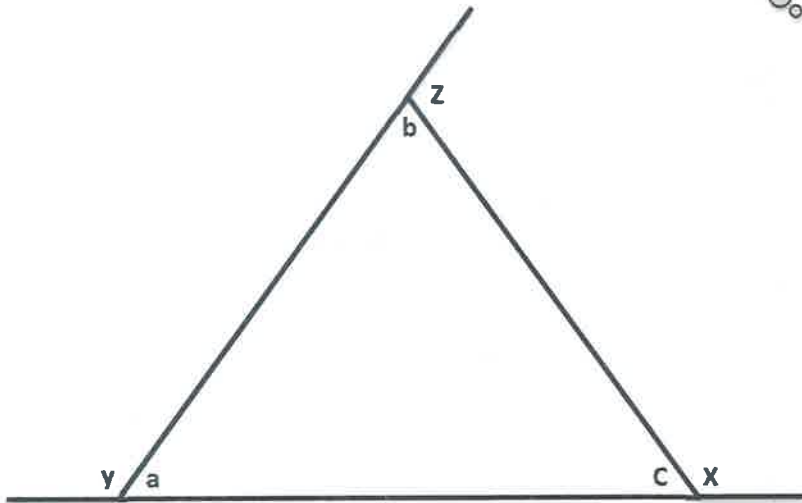
F) Pyramid



$V = \frac{1}{3} l. w. h$



**Interior and exterior angles**



$$x = a + b$$

$$y = b + c$$

$$z = a + c$$

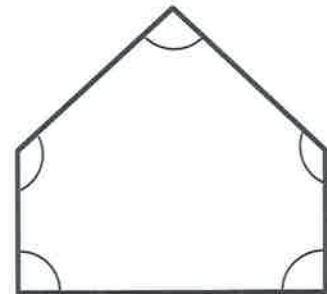
Exterior angle equal to the sum of the two opposite interior angles



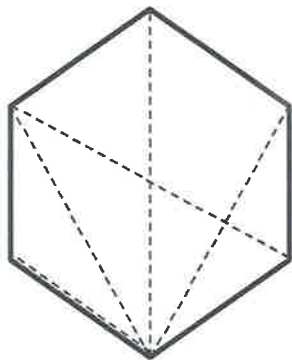
Sum of interior angles for any shape

$$S = (n - 2) \times 180$$

↑  
Number of sides or angles

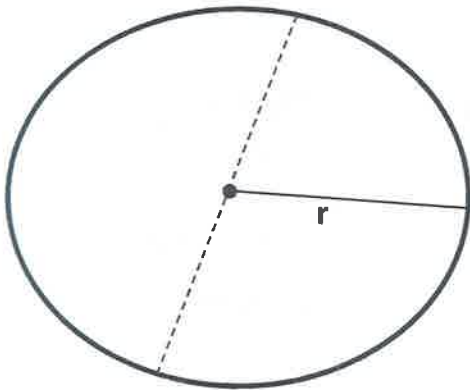


One angle for (regular shape) =  $\frac{(n-2) \times 180}{n}$

Number of diagonal in a polygon

$$D = \frac{n(n-3)}{2}$$

$$D = \frac{6(6-3)}{2} = \frac{6(3)}{2} = \frac{18}{2} = 9 \text{ Diagonals}$$



(r) radius

(d) diameter

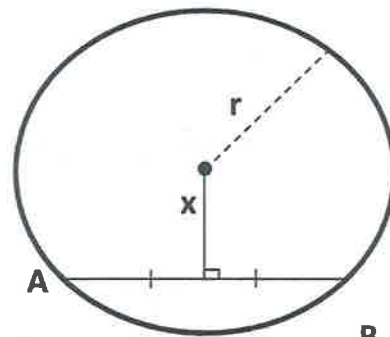
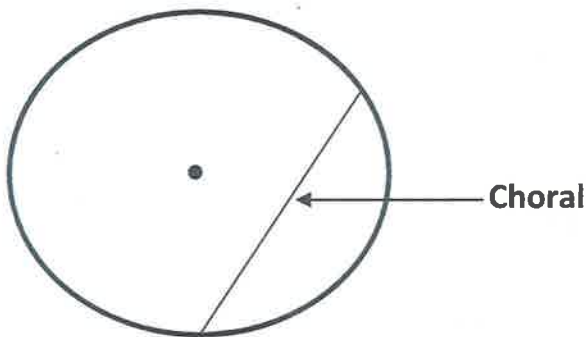
(A) Area

(C) circumference

$$d = 2r$$

$$A = \pi r^2$$

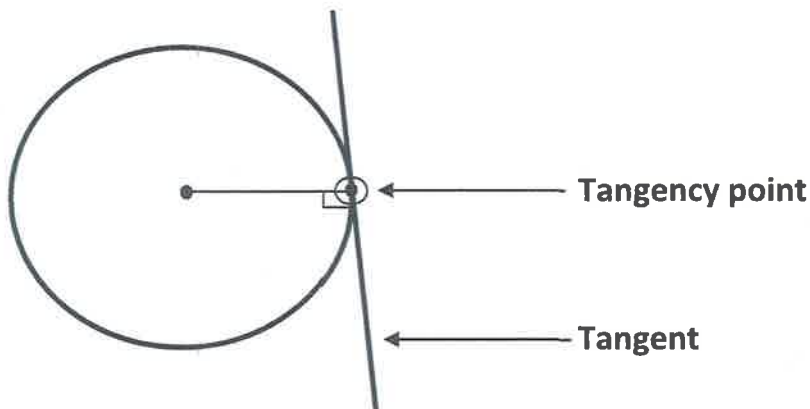
$$C = 2\pi r$$

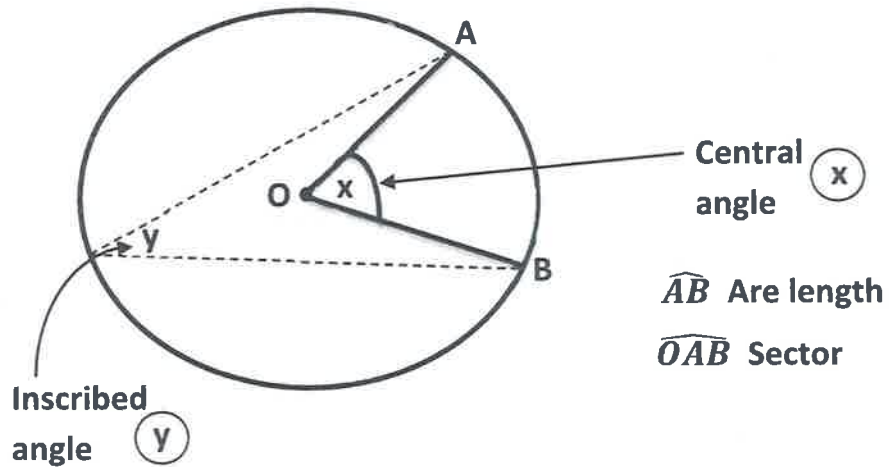


B

(x) distance between center and chord

The length of chord =  $2\sqrt{r^2 - x^2}$





$$x = 2y$$



The measure of arc =  $x^\circ$  (central angle)



The length of arc =  $\frac{x}{360} \times 2\pi r$



Area of sector =  $\frac{x}{360} \times \pi r^2$

From Degree  $\rightarrow$  Radian  
180  $\rightarrow$   $\pi$

Degree  $\rightarrow$  Radian

$$180 \rightarrow \pi$$

$$70 \rightarrow \frac{70\pi}{180} = \frac{7\pi}{18}$$

Radian  $\rightarrow$  Degree

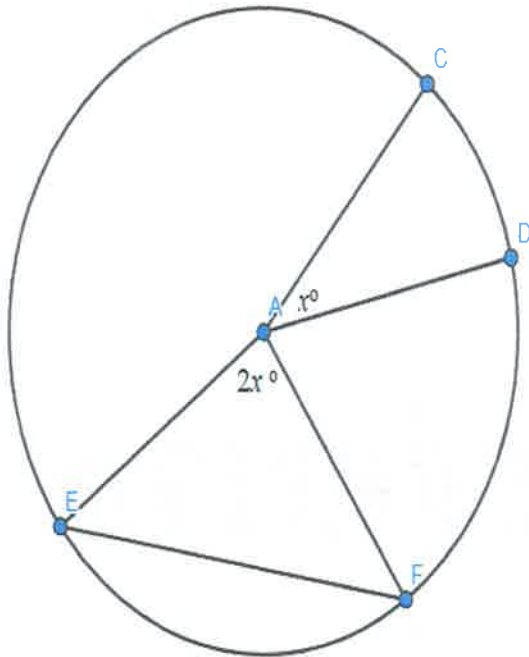
$$\pi \rightarrow 180$$

$$\frac{2\pi}{3} \rightarrow \frac{2(180)}{3}$$

# *Questions*



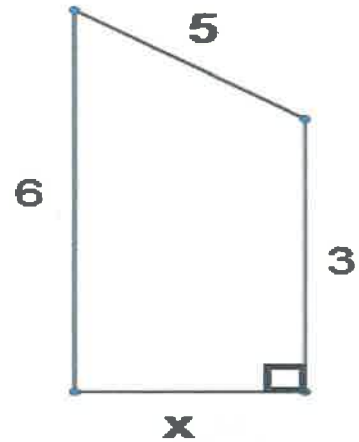
1- DECEMBER 2020 Q 15



In the given figure, A is the center of the circle. C, D, E, and F are points on the circle. If segments AE and EF have the same length, what is the measure of angle  $\angle CAD$  ?

- A.  $15^\circ$
- B.  $25^\circ$
- C.  $30^\circ$
- D.  $60^\circ$

2- MARCH 2021 Q 16



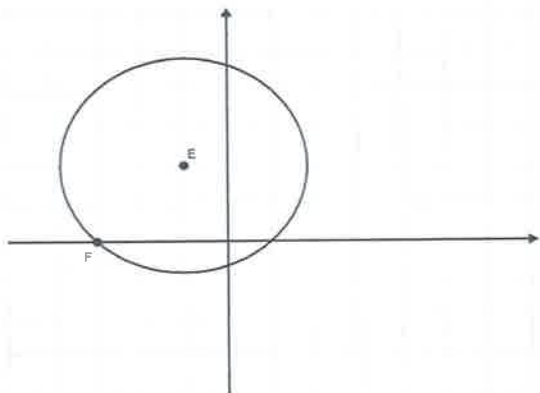
In the right trapezoid above, what is the length of x? (the figure is not drawn to scale)

(Grid in)

3- MAY 2021 Q 8

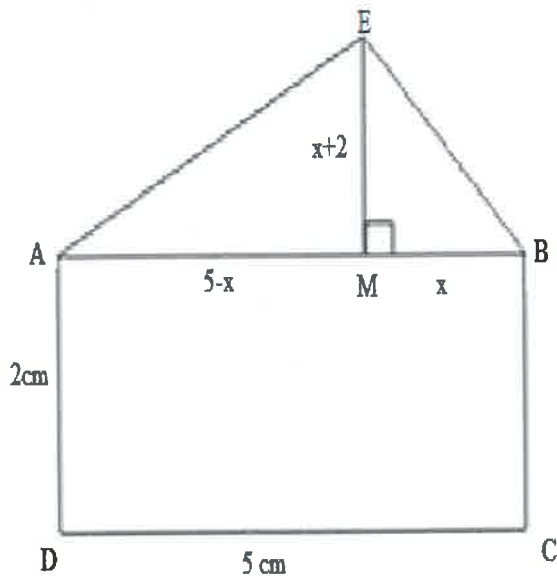


Using the figure below, what is the circumference of the circle with center  $E$  and passing through point  $F$ ?



- A.  $\pi\sqrt{2}$
- B.  $2\pi\sqrt{2}$
- C.  $4\pi\sqrt{2}$
- D.  $4\sqrt{2}$

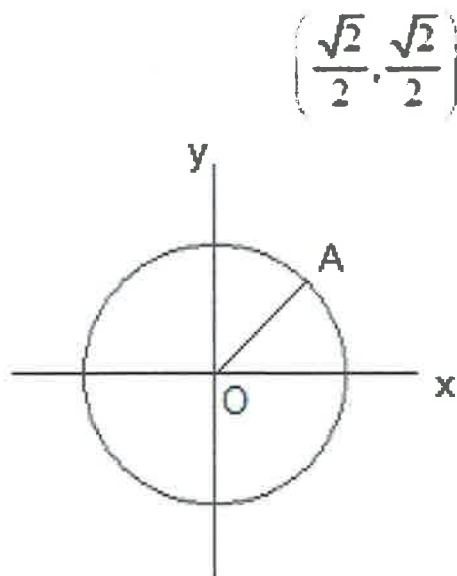
4- AUGUST 2021 Q 15



Knowing that  $x < 5$ , use the figure above to find the set of real numbers  $x$  if twice the area of triangle BME added to 2 times the area of the triangle MEA is less than or equal to triple the area of rectangle ABCD. (the figure is not drawn to scale)

- A.  $x < 4$
- B.  $x \leq 4$
- C.  $x \in [0, 4]$
- D.  $x > 4$

5- AUGUST 2021 Q 17



In the  $xy$ -plane above,  $O$  is the center of the circle and the measure of  $\angle AOx$  is  $\frac{4\pi}{a}$  radians. What is the value of  $a$ ?

6- DECEMBER 2021 Q 15



If  $C$  is a circle of center  $(2,0)$  and radius = 2, then which of the following points is inside the circle?

- A.  $(1,3)$
- B.  $(2,-2)$
- C.  $(3,-1)$
- D.  $(4,0)$

C

7 - MARCH 2022 / Q 8



A circle has a circumference of 400 units.

What is the approximate diameter of the circle?

- A. 127 units
- B. 215 units
- C. 312 units
- D. 200 units

8 - JUNE 2022 ( cancelled ) / Q 20



$\frac{1}{5}\pi$  radians is how much in degrees?

- A.  $36^\circ$
- B.  $288^\circ$
- C.  $72^\circ$
- D.  $112^\circ$

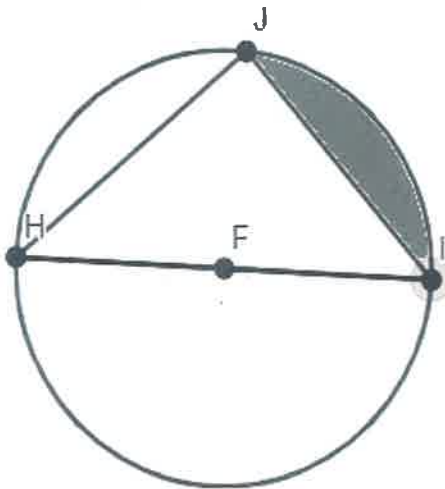
1- OCTOBER 2020 Q 27



A liquid covering 12 cm of the height of a cylindrical glass of diameter 8cm is transferred into another glass shaped as a cone with a diameter of 12 cm. What height of the cone will the liquid cover?

- A. 8 cm
- B. 10 cm
- C. 16 cm
- D. 14 cm

2- DECEMBER 2020 Q 30



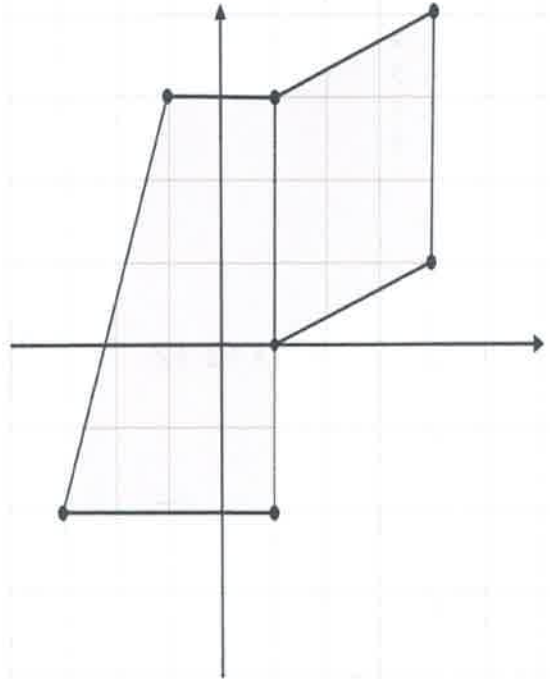
In the given figure, F is the center of the circle, and J,H, and I are points on the circle, and  $FI = 4$  If  $\angle JHI = \angle JIH = 45^\circ$ , what is the area of the shaded region?

- A.  $16\pi - 32$
- B.  $8\pi - 16$
- C.  $4\pi - 8$
- D.  $2\pi - 4$

3- MAY 2021 Q 14



What is the area of the shaded region in the figure below?



- A. 15 square units
- B. 19 square units
- C. 24 square units
- D. 27 square units

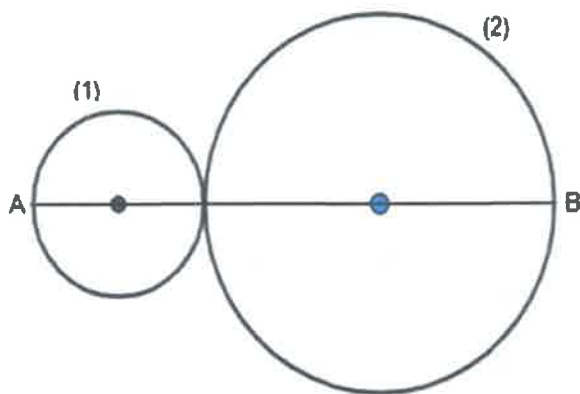
4- JUNE 2021 Q 15



Given a cone whose height is the quadruple of its diameter. If the volume of the cone is  $72\pi$ , what is the diameter of its base?

- A. 4
- B. 5
- C. 6
- D. 9

5- AUGUST 2021 Q 12

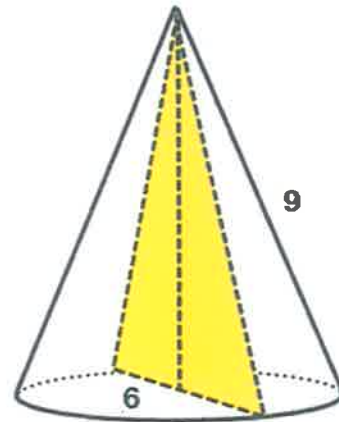


In the figure above, the circles are tangent to each other. The radius of circle (1) is  $R$  and the radius of circle (2) is  $2R$ .

If the sum of their areas is  $100\pi \text{ cm}^2$ , what is the length of  $[AB]$ ?

- A. 100 cm
- B.  $2\sqrt{5}$  cm
- C. 50 cm
- D.  $12\sqrt{5}$  cm

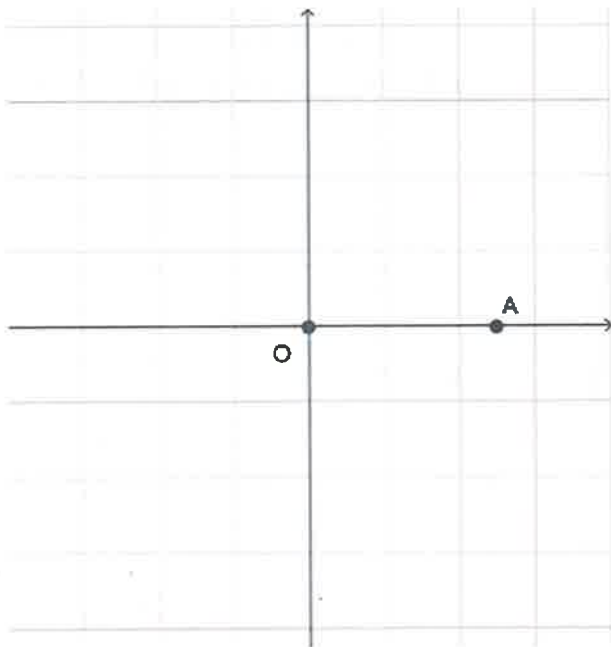
6- DECEMBER 2021 Q 28



What is the area of the cross section perpendicular to the base of the right cone with a diameter of 6? (The figure is not drawn to scale)

- A.  $36\sqrt{2}$
- B.  $6\sqrt{2}$
- C.  $18\sqrt{2}$
- D. 18

7- DECEMBER 2021 Q 29



In the  $xy$ -plane above, if the coordinates of point B are  $(-\sqrt{3}, -\sqrt{3})$ , what is the measure, in radians, of angle AOB?

- A.  $-\frac{\pi}{4}$
- B.  $\frac{3\pi}{4}$
- C.  $\frac{-3\pi}{4}$
- D.  $\frac{4\pi}{5}$

8 - MARCH 2022 / Q 6



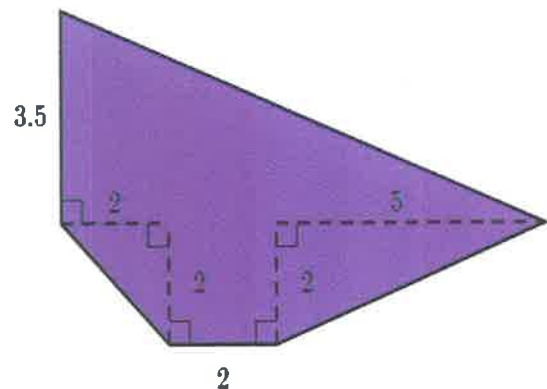
A rectangle is cut into 20 identical squares such that each has an area of  $12.25 \text{ cm}^2$ . Which of the following cannot be a possible value for the perimeter of the rectangle?

- A. 147 cm
- B. 84 cm
- C. 70 cm
- D. 63 cm

9 - MARCH 2022 / Q 14



What is the area of the shaded region in the figure below?



- A. 47.12
- B. 26.75
- C. 14.72
- D. 11.15

## 10 - SAMPLE TEST / Q 22



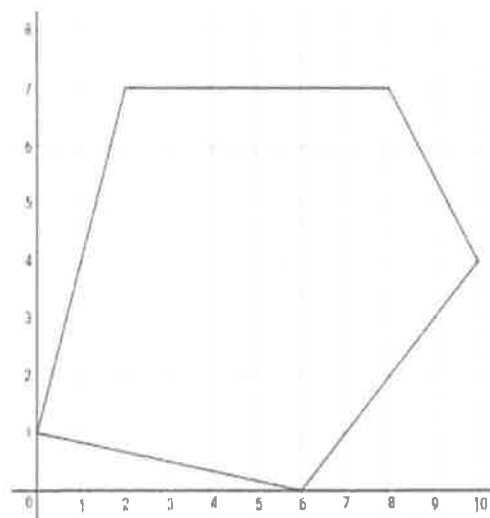
The numerical value of the volume of a cylinder whose height equals  $3.6\text{ cm}$  is equal to the numerical value of the area of a parallelogram whose height equals  $6\text{ cm}$ , and the base equals  $12.2\text{ cm}$ . What is the radius of the base of the cylinder ?

- A)  $1.79\text{ cm}$
- B)  $2.54\text{ cm}$
- C)  $3.23\text{ cm}$
- D)  $6.47\text{ cm}$

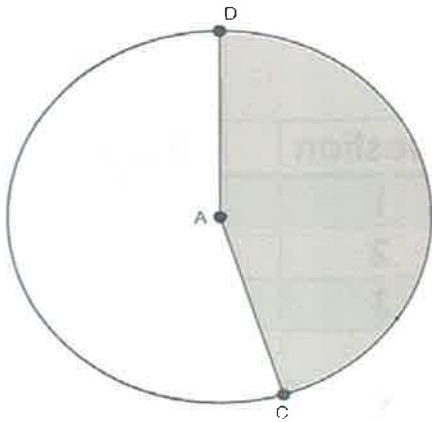
## 11 - SAMPLE TEST / Q 32



What is the area of the polygon in the graph below ?



12 - JUNE 2022 (cancelled ) / Q 38



Sami has a circular land of a radius 6 m. He decided to cultivate a part of this land, which is shown shaded in the figure above. Each 1 m<sup>2</sup> will cost him 79 EGP. Knowing that  $m\angle DAC = 155^\circ$ , how much will Sami pay to cultivate the desired area? (Give your answer to the nearest ones)

- A. 3,847 EGP
- B. 220,410 EGP
- C. 20,752 EGP
- D. 5,248 EGP

13- OCTOBER 2021 Q 16 -



Intensity is the measure of the energy transmitted by a wave. Usually, it depends on the strength and the amplitude of a wave and its unit is Watts per square meters. The formula of intensity is given by  $I = \frac{P}{A}$ , where  $P$  is the power (in Watts), and  $A$  is the area of the cross section (in square meters).

Which of the following cannot be the value of the radius of the circular surface if the intensity of light incident to normal to the surface from a source of 110 W power of light, is greater than  $1.2 \times 10^4 \text{ W/m}^2$  ?

- A. 5.45 cm
- B. 5.35 cm
- C. 5.25 cm
- D. 5.15 cm

## ANSWERS OF LESSON ( GEOMTRY 2 )

### NON CALCULATOR



Question	Answer
1	C
2	4
3	C
4	C
5	16
6	C
7	A
8	A
9	
10	
11	
12	
13	
14	
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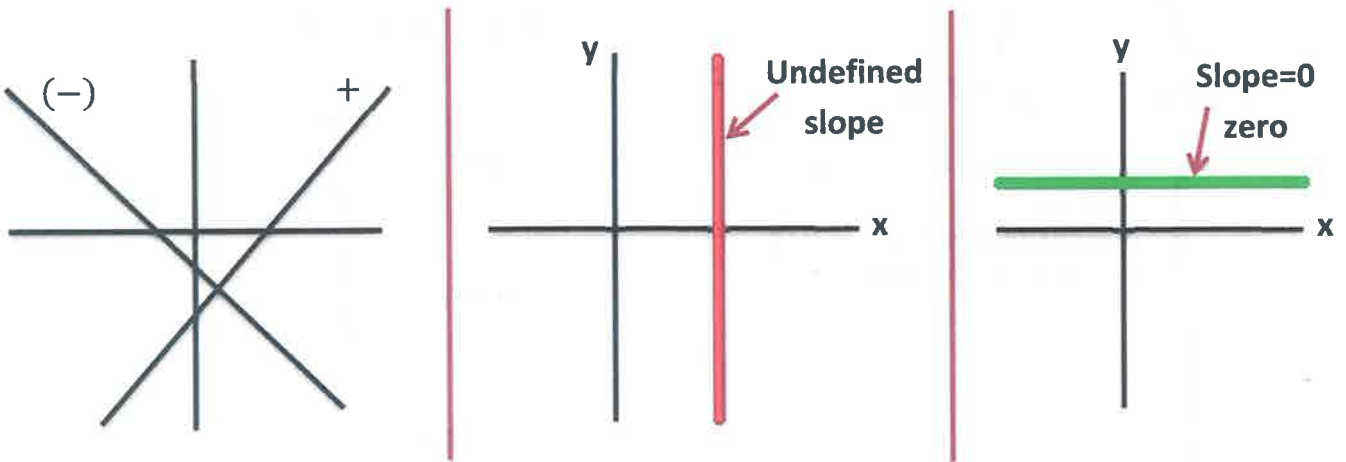
### CALCULATOR



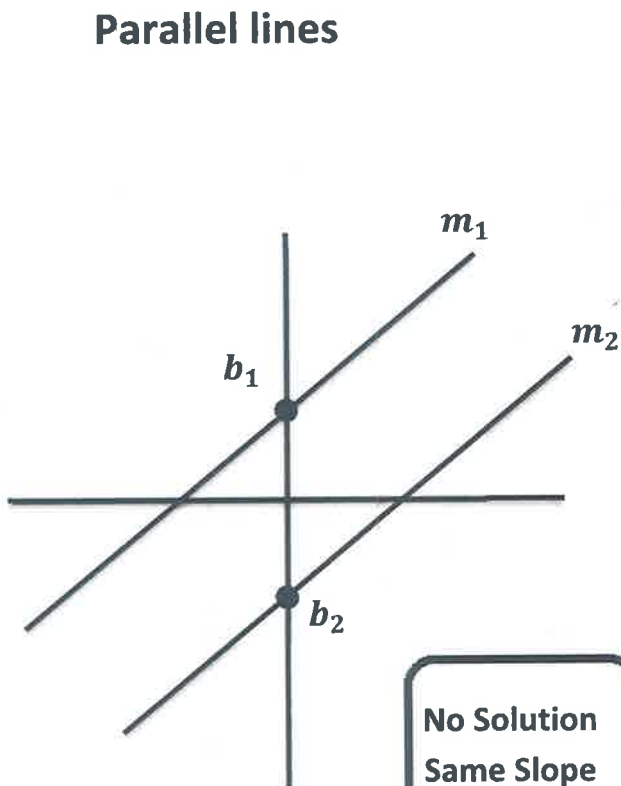
Question	Answer
1	C
2	C
3	C
4	C
5	D
6	C
7	C
8	C
9	B
10	B
11	50
12	A
13	A
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# Properties of Slap

## Slope of lines

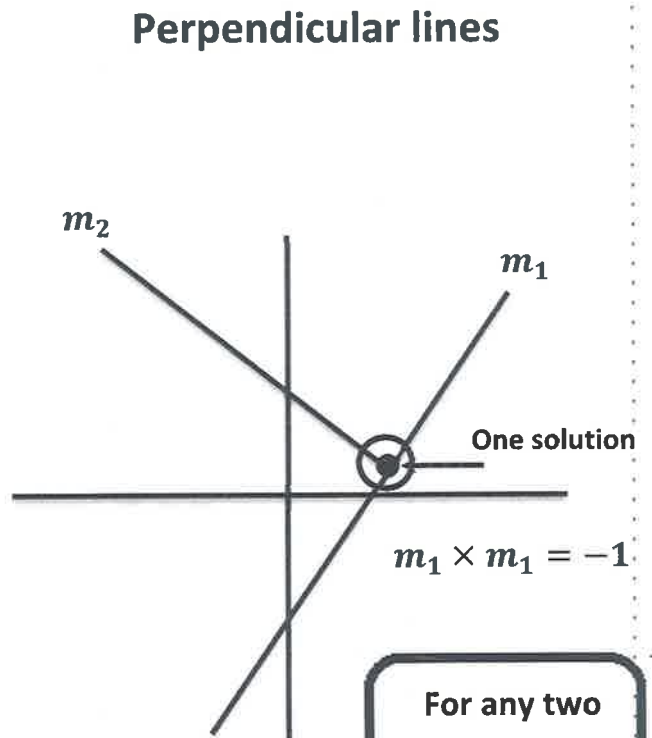


### Parallel lines



**No Solution**  
**Same Slope**  
 $m_1 = m_2$   
 $b_1 \neq b_2$

### Perpendicular lines



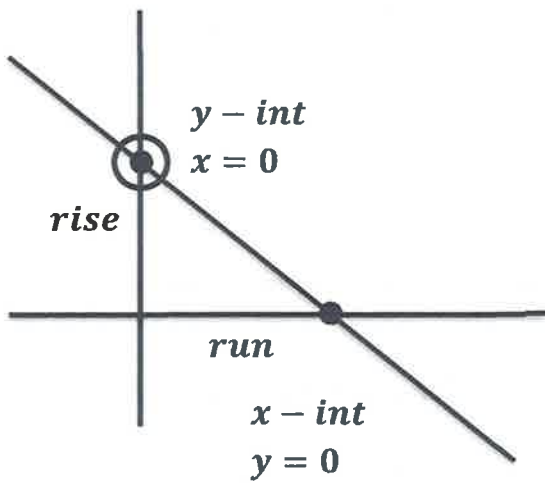
**For any two lines each slope is negative reciprocal of the other.**

**Equation of line**

$$y = mx + b$$

Slope  $\nearrow$   $m$   $\searrow$   $y - \text{int}$   $b$

To find  $x - \text{intercept}$  let  $y = 0$



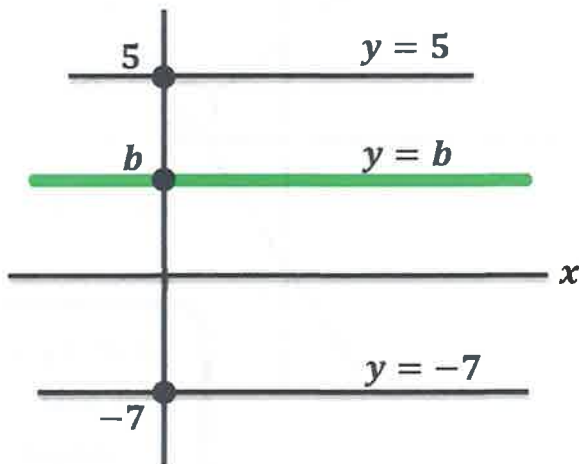
★ General formula

$$ax + by = c$$

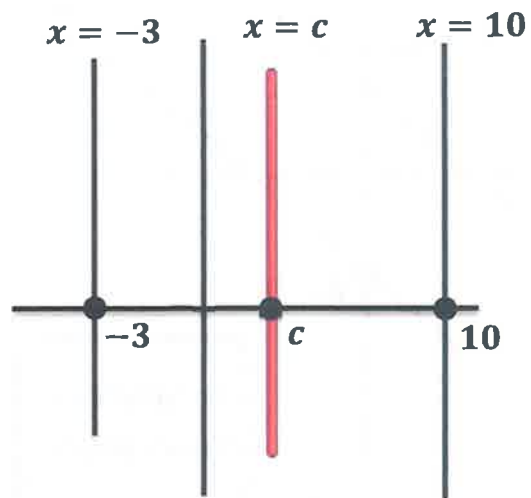
$$\text{slope} = \frac{-a}{b}$$

$$y - \text{int} = \frac{c}{b}$$

$$x - \text{int} = \frac{c}{a}$$

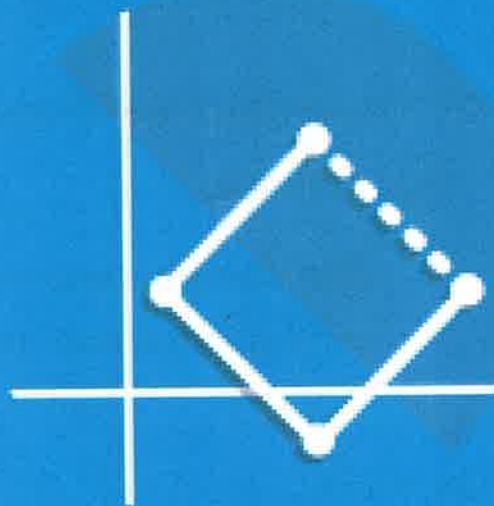


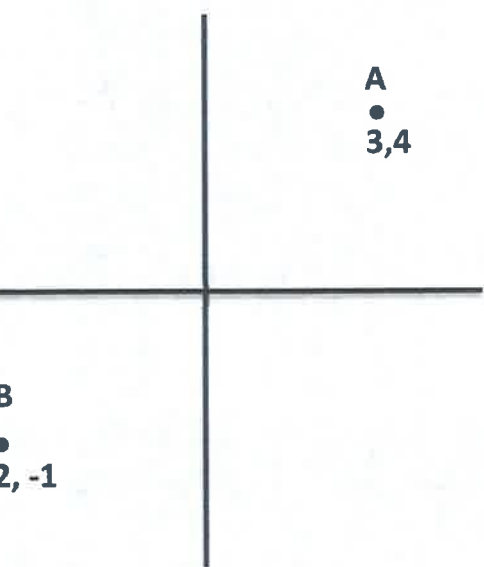
Lines parallel for  $x - \text{axis}$



Lines parallel for  $y - \text{axis}$

# Coordinate Geometry





(1) distance between two points  
(length)

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

(2) Midpoint

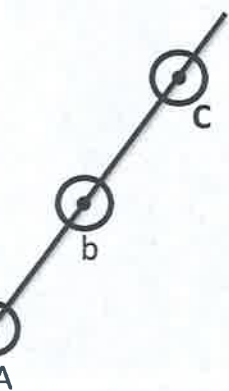
$$\bar{x} = \frac{x_1 + x_2}{2} \quad \& \quad \frac{y_1 + y_2}{2}$$

(3) slope (M)

$$M = \frac{y_2 - y_1}{x_2 - x_1}$$

★ collinear

The slope between any points on the same line. Is the same.



Example :

When line K passes through -  
(3, 4), (5, 7) and (7, h)

Find (h) ?

# *Questions*



## 1- OCTOBER 2020 Q 4



In the  $xy$ -plane, the equation of the line (d) passing through A (1;3) and perpendicular to line  $3x-2y = 6$  is:

- A.  $y = \frac{3}{2}x - \frac{7}{2}$   
 B.  $y = -\frac{3}{2}x + \frac{11}{2}$   
 C.  $y = -\frac{2}{3}x + 3$   
 D.  $y = -\frac{2}{3}x + \frac{11}{3}$

## 2- OCTOBER 2020 Q 16



<b>X</b>	2	5	-3
<b>Y</b>	-1	-7	?

If the values in the table above represent a linear relationship, what is the missing value?

## 3- DECEMBER 2020 Q 1



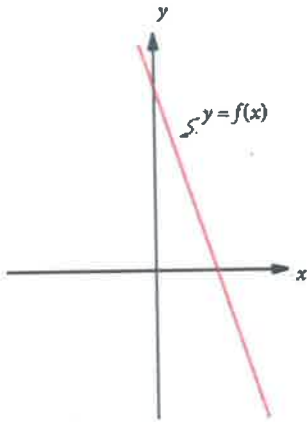
**People who own a smartphone worldwide**

Year	Number of People (in billions)
2016	2.3
2017	2.6
2018	2.9
2019	3.2
2020	3.5

The table above shows the number of people who owned a smartphone from the year 2016 to the year 2020. The number of people  $N$  (in billions) is a linear function of the number of years  $y$  from the year 2016. Which of the following expressions best describes  $N$  in terms of  $y$ ?

- A.  $N = 0.3y$   
 B.  $N = 0.3y + 2016$   
 C.  $N = 0.3y + 2.3$   
 D.  $N = 3.3y + 2.3$

4- DECEMBER 2020 Q 6



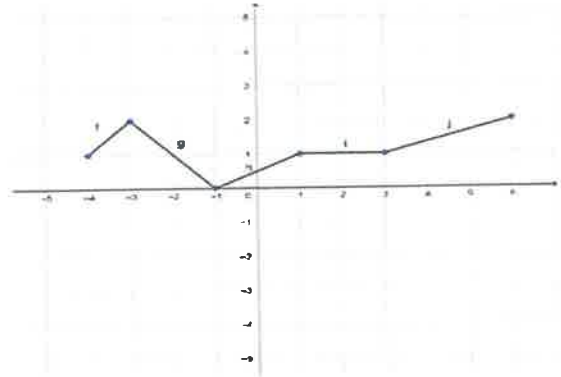
The graph shown above is that of a linear function  $f$  whose expression is given by  $f(x) = cx + d$ , where  $c$  and  $d$  are constants. Which of the following must be true about  $c$  and  $d$ ?

- A.  $c = d$
- B.  $c > d$
- C.  $c < d$
- D.  $c = 0$

5- MARCH 2021 Q 5

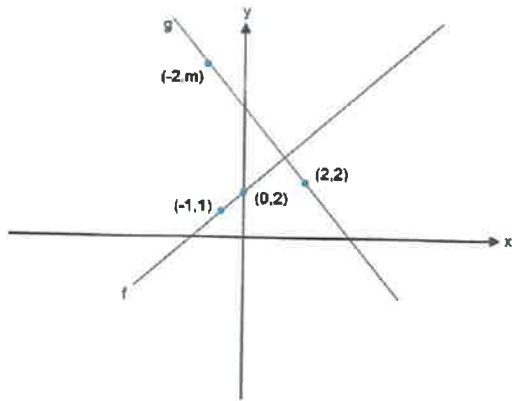


Which of the line segments in the figure below has the largest slope?



- A. f
- B. j
- C. h
- D. i

6- MARCH 2021 Q 7



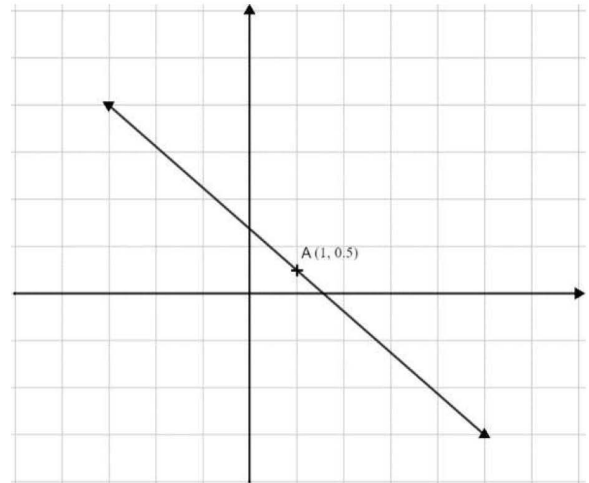
In the  $xy$ -plane above, line  $g$  is perpendicular to line  $f$ . What is the value of  $m$ ? (the figure is not drawn to scale)

- A. 6
- B. -2
- C. 2
- D. 8

7- MAY 2021 Q 6



Questions 6 and 7 refer to the graph below.



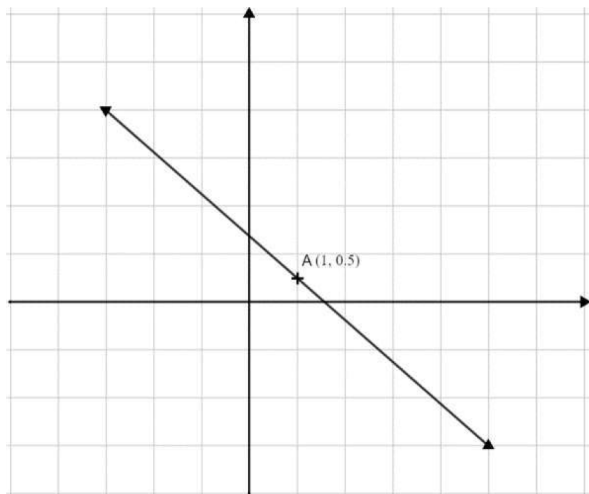
What is the slope of the line shown in the graph?

- A.  $-\frac{1}{2}$
- B.  $-\frac{7}{8}$
- C.  $-\frac{8}{7}$
- D. -2

8- MAY 2021 Q 7



Questions 6 and 7 refer to the graph below.



What is the equation of the line passing through  $A(1, 0.5)$  and perpendicular to the graphed line?

- A.  $y = \frac{1}{2}x$
- B.  $y = 2x - \frac{3}{2}$
- C.  $y = \frac{7}{8}x - \frac{3}{8}$
- D.  $y = \frac{8}{7}x - \frac{9}{14}$

9- JUNE 2021 Q 4



In the  $xy$ -plane, the equation of the line (d) passing through  $A(-1, 4)$  and perpendicular to line  $3x - 2y = 5$  is:

- A.  $y = \frac{3}{2}x + \frac{11}{2}$
- B.  $y = -\frac{3}{2}x + \frac{5}{2}$
- C.  $y = -\frac{2}{3}x + \frac{14}{3}$
- D.  $y = -\frac{2}{3}x + \frac{10}{3}$

10- AUGUST 2021 Q 18



$x$	$f(x)$
1	$m$
2	6
3	$n$

The table above shows some values for the function  $f$ .

If  $f$  is a linear function, what is the value of  $m + n$ ?

11- OCTOBER 2021 Q 6



The equation of a line is  $\frac{2}{x} - \frac{3}{y-1} = 0$ . What is the slope of the line?

- A. 3
- B. 2
- C.  $\frac{3}{2}$
- D.  $\frac{1}{2}$

12 - OCTOBER 2021 Q 15



Which of the following is the equation of the line perpendicular to the line with equation  $2x - 3y = -1$  and passing through the midpoint of segment  $\overline{AB}$  given  $A(2; 7)$  and  $B(-1; 3)$ ?

- A.  $y = \frac{2}{3}x + \frac{14}{3}$
- B.  $y = \frac{2}{3}x + \frac{16}{3}$
- C.  $y = -\frac{3}{2}x + \frac{17}{4}$
- D.  $y = -\frac{3}{2}x + \frac{23}{4}$

13 - DECEMBER 2021 Q19



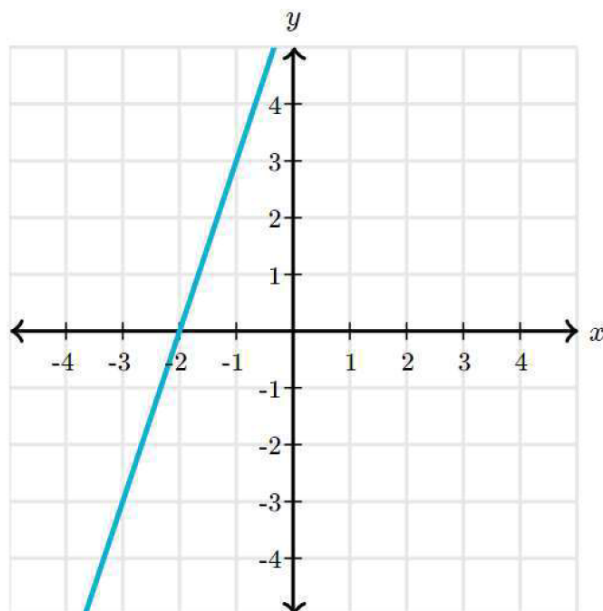
x	y
-4	-9
0	-1
2	3
p	9

If the values in the table above represent a linear relationship between x and y, what is the value of p? (Grid in)

14 - MARCH 2022 / Q 6



What is the slope of the line shown in the graph below?



- A. -3
- B. -1
- C. 3
- D. 1/3

15 - MARCH 2022 / Q 7



What is the equation of the line ( $d_1$ ) passing through  $A(3,4)$  and parallel to the line ( $d$ ) of equation  $y = -2x + 5$ ?

- A.  $y = -2x + 3$
- B.  $y = \frac{1}{2}x + 10$
- C.  $y = -2x + 10$
- D.  $y = 2x$

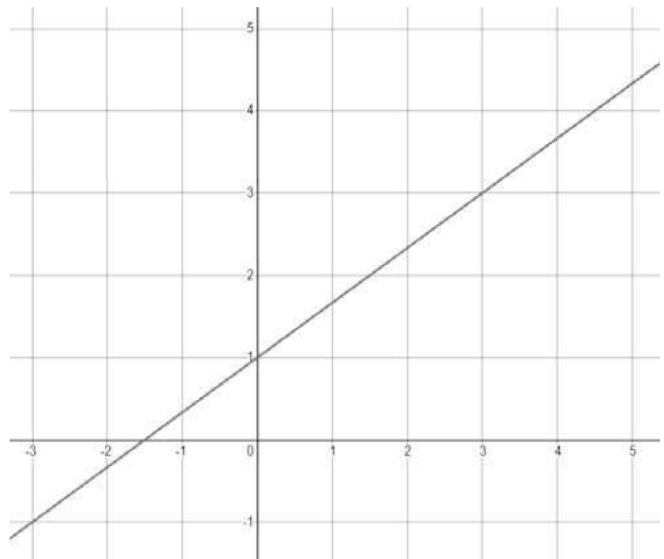
16 - SAMPLE TEST / Q 8



$-3 + x = -2(3y - 5x)$   
 Which of the following equations represents the line perpendicular to the line with the equation above?

- A)  $y = -\frac{3}{2}x + \frac{1}{2}$
- B)  $y = \frac{3}{2}x + \frac{1}{2}$
- C)  $y = \frac{2}{3}x + 2$
- D)  $y = -\frac{2}{3}x + 2$

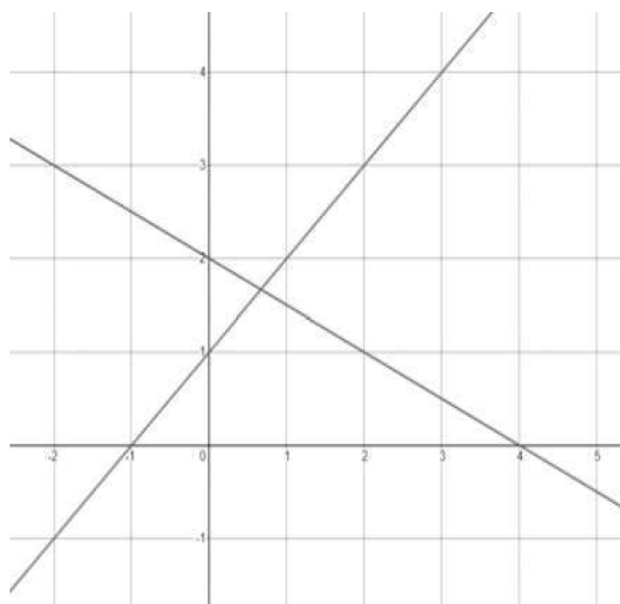
17 - JUNE 2022 ( cancelled ) / Q 2



What is the slope of the line represented in the graph above?

- A. 2
- B.  $\frac{3}{2}$
- C. 1
- D.  $\frac{2}{3}$

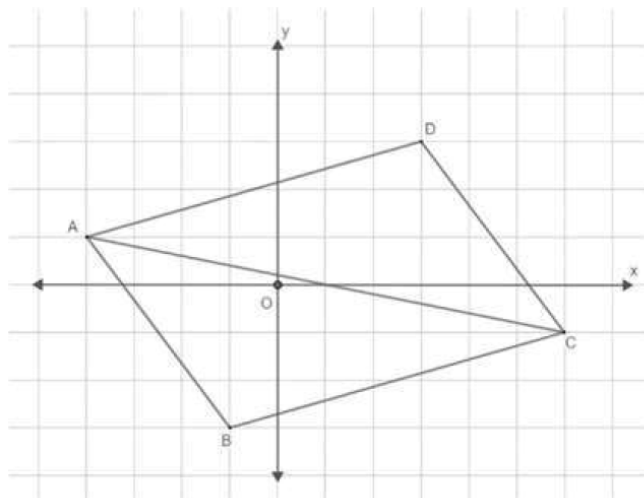
18 - JUNE 2022 ( cancelled ) / Q 12



Which of the systems of equations below is being represented in the graph above?

- A.  $\begin{cases} x + 2y = 4 \\ x - y = 1 \end{cases}$
- B.  $\begin{cases} x + 2y = 4 \\ -x + y = 1 \end{cases}$
- C.  $\begin{cases} x - 2y = 4 \\ x - y = 1 \end{cases}$
- D.  $\begin{cases} x - 2y = 4 \\ -x + y = 1 \end{cases}$

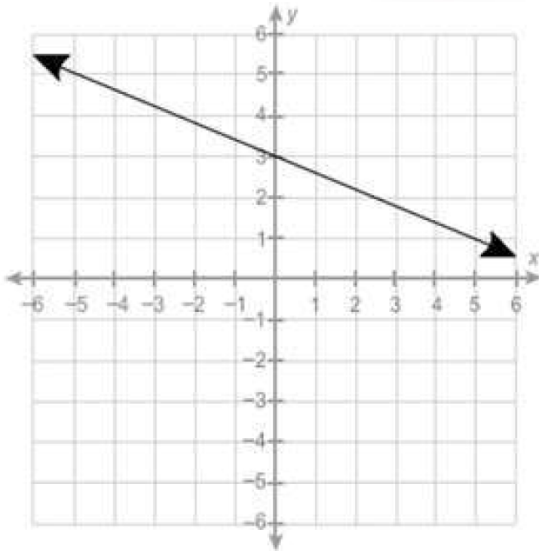
19 - JUNE 2022 ( cancelled ) / Q 18



What is the sum of the slope of  $\overrightarrow{AB}$  and the slope of a line perpendicular to  $\overrightarrow{AC}$  ?

- A.  $\frac{1}{3}$
- B.  $\frac{11}{3}$
- C.  $\frac{-23}{15}$
- D.  $\frac{-5}{8}$

1- OCTOBER 2020 Q 4



The graph shown represents which of the following equations?

- A.  $y = -\frac{2}{5}x - 3$
- B.  $y = \frac{2}{5}x + 3$
- C.  $y = -\frac{2}{5}x + 3$
- D.  $y = -\frac{5}{2}x + 3$

2- OCTOBER 2020 Q 6



A line, *having* a slope of  $-\frac{2}{3}$  passes through the points A (2-k ; 5) and B (-2k ; -1). What is the value of k?

- A. 11
- B. 4
- C. -4
- D. -11

3- DECEMBER 2020 Q 3



The straight line  $m$  has an equation  $y = 3x$ . The point A of coordinates (1,3) is on  $m$ . The line  $p$  is perpendicular to  $m$  at point A. Which of the following points is on  $p$ ?

- A. (3, 9)
- B.  $(5, \frac{5}{3})$
- C. (3, 0)
- D. (0, 0)

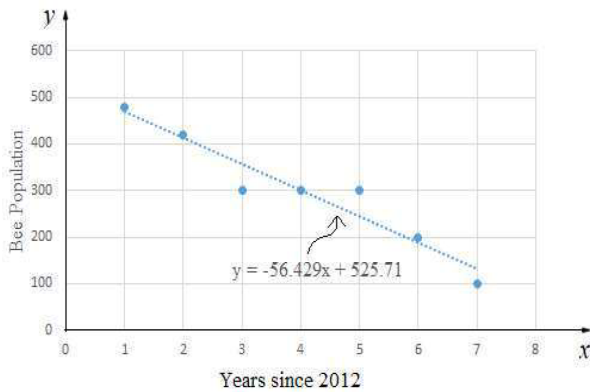
4- DECEMBER 2020 Q 8



The graph  $d$  of a linear function  $f$  has a negative slope. Which of the following may be true about the graph  $n$  of a linear function  $g$  of slope 12?

- I.  $n$  is perpendicular to  $d$ .
  - II.  $n$  is parallel to  $d$ .
  - III.  $n$  passes through the origin (0, 0)
- A. Only I
  - B. Only II
  - C. I and III
  - D. II and III

5- DECEMBER 2020 Q 20

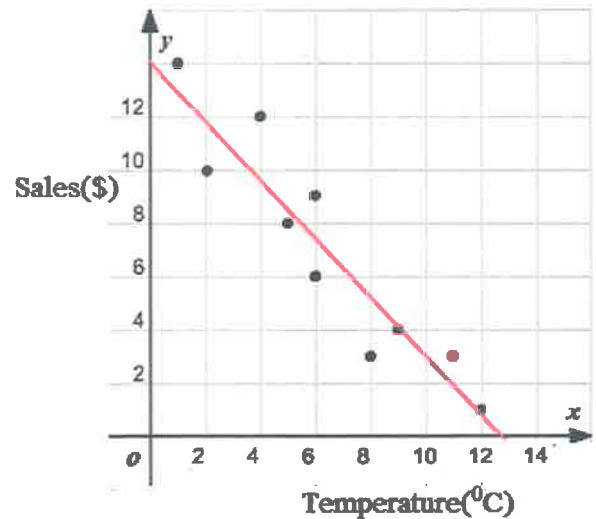


The scatterplot above shows the Bee population in a certain farm for every year since 2012. A line of best fit and its equation are also shown.

Which of the following is the best interpretation of the value  $-56.429$  in the equation of the line of best fit?

- A. The average increase in the number of bees each year.
- B. The average decrease in the number of bees every 525.71 years.
- C. The average decrease in the number of bees each year.
- D. The number of bees present in the beginning.

6- DECEMBER 2020 Q 27



The graph above shows the sales in dollars of the local mall at different temperatures in degrees Celsius on a certain day. Which of the following is closest to the equation of the line of best fit?

- A.  $y = -1.1x + 14$
- B.  $y = 1.1x$
- C.  $y = -1.1x + 12$
- D.  $y = -1.8x + 14$

7- DECEMBER 2020 Q 31

**SPR (Student Produced Responses)**

In a chemistry lab, an apparatus is adjusted to measure the mass of gas released during a chemical reaction. The mass  $M$  (in grams) of gas produced by the chemical reaction at time  $t$  (in seconds) after the reaction starts is given by  $M = 1.61t + 3.95$ . For every 10 seconds, what is the increase in the mass of gas released?

8- MARCH 2021 Q 2



In the  $xy$ -plane, the line determined by the points  $(3, m)$  and  $(m, 12)$  passes through the origin. Which of the following could be the value of  $m$ ?

- A. -6
- B. 9
- C. 1
- D. 0

9- MAY 2021 Q 10



What is the  $x$ -intercept of the line passing through points  $(3, 5)$  and  $(4, -2)$ ?

- A.  $-7$
- B.  $\frac{25}{7}$
- C.  $\frac{26}{7}$
- D. 26

10- MAY 2021 Q 15



$ABCD$  is a parallelogram such that  $A(1, 2)$ ,  $B(4, 4)$ ,  $C(6, 1)$ , and  $D(3, -1)$ . What are the coordinates of  $E$ , the center of the parallelogram?

- A.  $E(1.5, 3.5)$
- B.  $E(4, 1.5)$
- C.  $E(1.5, 4)$
- D.  $E(3.5, 1.5)$

11-MAY 2021 Q 19



Gold is one of the most important items in the world. Its price increases and decreases every day. The average closing price for the past 8 years is shown in the table below.

Year	Average Closing Price (\$)
2020	1,771.9
2019	1,393.34
2018	1,268.93
2017	1,251.92
2016	1,158.86
2015	1,266.06
2014	1,409.51
2013	1,668.86

Supposing that the relation is linear, what is the rate of change between years 2013 and 2019 ?

- A. -45.92
- B. -39.36
- C. 39.36
- D. 45.92

12-MAY 2021 Q 29



A football club published on its website the number of entrance tickets sold in 2018 and in 2019.

	Average number of tickets sold at the entrance door per game			Seasonal tickets	
	Male	Female	Child	Male	Female
2018	4521	1254	759	1122	780
2019	4668	1102	884	1088	794

	Ticket revenue from selling them at the entrance door per game (\$)			Seasonal ticket revenue (\$)	
	Male	Female	Child	Male	Female
2018	72336	16552.8	4402.2	78540	47970
2019	79822.8	15428	4420	80512	47640

Which of the following represents the equation of the line describing the change of the number of seasonal tickets sold for a female person to the revenue obtained from the same category?

- A.  $y = -\frac{165}{7}x + 66355.7$
- B.  $y = \frac{165}{7}x + 66355.7$
- C.  $y = -\frac{165}{7}x - 66355.7$
- D.  $y = \frac{165}{7}x - 66355.7$

13-JUNE 2021 Q 8



Line (A) passes through the points  $(-\frac{5}{3}, 0)$  and  $(0, -\frac{2}{3})$ . Which of the following lines will never intersect with line (A)?

- A.  $y = -\frac{5}{2}x - 1$
- B.  $y = \frac{5}{2}x - 1$
- C.  $y = -\frac{2}{5}x - 1$
- D.  $y = \frac{2}{5}x - 1$

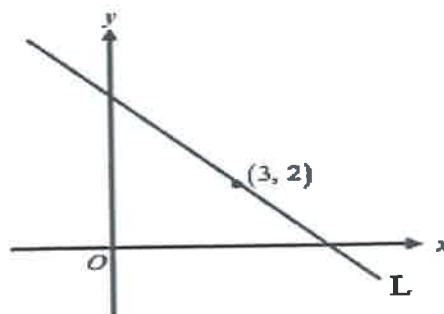
14-JUNE 2021 Q 24



A line, having a slope of  $-\frac{1}{5}$  passes through the points A  $(2; \alpha-3)$  and B  $(2\alpha+1; -4)$ . What is the value of  $\alpha$ ?

- A. -2
- B.  $-\frac{2}{3}$
- C.  $\frac{2}{3}$
- D. 2

15-AUGUST 2021 Q 4

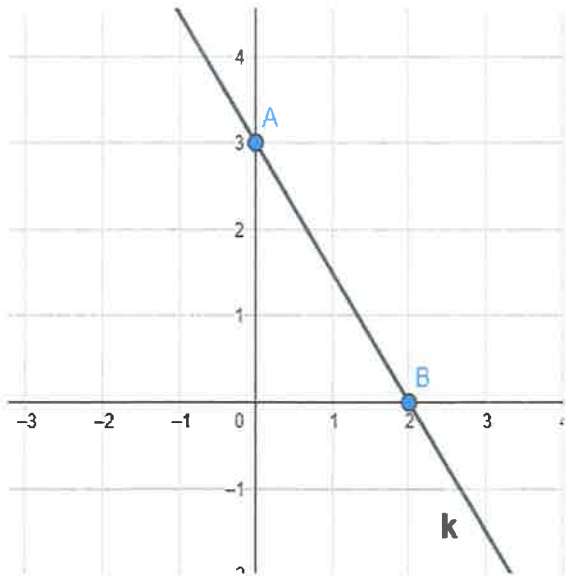


In the  $xy$ -plane above, the equation of line L is  $2mx - 2y + 12 = 0$ , where  $m$  is a constant.

What is the slope (gradient) of L?

- A.  $-\frac{4}{3}$
- B.  $\frac{2}{3}$
- C.  $-\frac{8}{3}$
- D.  $\frac{1}{2}$

16- AUGUST 2021 Q 16



What is the equation of line **d** (not shown) that passes through origin **O** and is perpendicular to line **k** in the figure above?

- A.  $y = \frac{2}{3}x$
- B.  $y = \frac{-3}{2}x$
- C.  $y = \frac{3}{2}x$
- D.  $y = x$

17- AUGUST 2021 Q 17



Line **m** in the  $xy$ -plane passes through the points  $(2a, a^2)$  and  $(2b, b^2)$  with  $a \neq b$ .

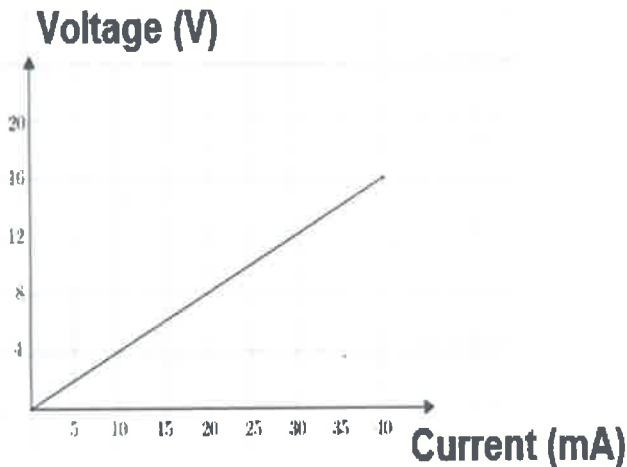
Which of the following is the slope (gradient) of line **m**?

- A.  $\frac{a}{b}$
- B.  $\frac{a+b}{2}$
- C.  $\frac{a^2-b^2}{a+b}$
- D.  $\frac{a-b}{a+b}$

18- OCTOBER 2021 Q 9



The resistance ( $R$ ) of a resistor is expressed by  $R = \frac{U}{I}$  with  $U$  as the voltage in volts ( $V$ ), and  $I$  as the current in amperes ( $A$ ). The linear graph below represents the characteristic current-voltage ( $U$ - $I$ ) of a resistor.



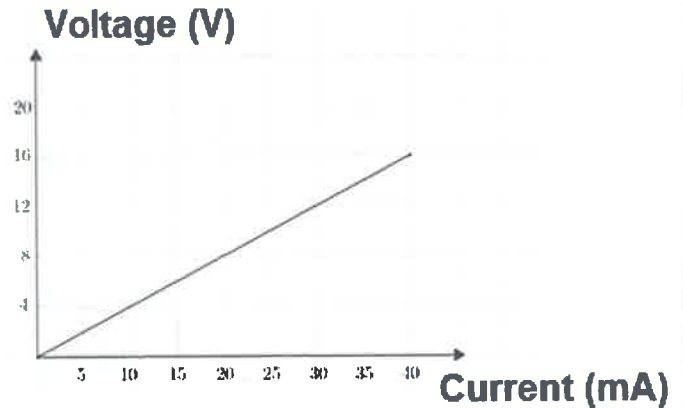
According to the graph, what is the value of the resistance of the resistor?

- A.  $400 \Omega$
- B.  $140 \Omega$
- C.  $4 \Omega$
- D.  $0.4 \Omega$

19- OCTOBER 2021 Q 10



The resistance ( $R$ ) of a resistor is expressed by  $R = \frac{U}{I}$  with  $U$  as the voltage in volts ( $V$ ), and  $I$  as the current in amperes ( $A$ ). The linear graph below represents the characteristic current-voltage ( $U$ - $I$ ) of a resistor.



What is the inverse of the function shown in the graph above?

- A.  $U = 0.4I$
- B.  $U = \frac{I}{400}$
- C.  $U = \frac{I}{4}$
- D.  $U = 400I$

20- OCTOBER 2021 Q 18



Given that  $A(2, 5)$ ,  $B(9, -2)$  and  $J(4, h)$  lie on the same line, what is the value of  $h$ ?

- A. 1
- B. 2
- C. 3
- D. 4

21- OCTOBER 2021 Q 22



Alonso used the table below to graph the sets of ordered pairs shown. What is the type of the graph drawn and which equation best models it?

$x$	-7	-4	-2	1	7
$y$	-11	-5	-1	5	17

- A. Linear function:  $y = 2x + 3$
- B. Linear function:  $y = -2x + 3$
- C. Quadratic function:  $y = x^2 + 4x - 32$
- D. Quadratic function:  $y = -2x^2 - 10x + 17$

22- OCTOBER 2021 Q 24



Given that the two lines  $(d): 2x + ty = -1$  and  $(m): -3x - gy = 2$  are perpendicular, and  $t$  and  $g$  are constants, what is the value of  $-5tg$ ?

- A. -30
- B. -6
- C.  $\frac{3}{2}$
- D. 30

23- DECEMBER 2021 Q 3



$$(d): x + 2y + 2 = 0$$

Which of the equations below could not be a line perpendicular to line  $(d)$  given above?

- A.  $4x - 2y - 2 = 0$
- B.  $2x - y + 3 = 0$
- C.  $2x + y + 1 = 0$
- D.  $6x - 3y = 0$

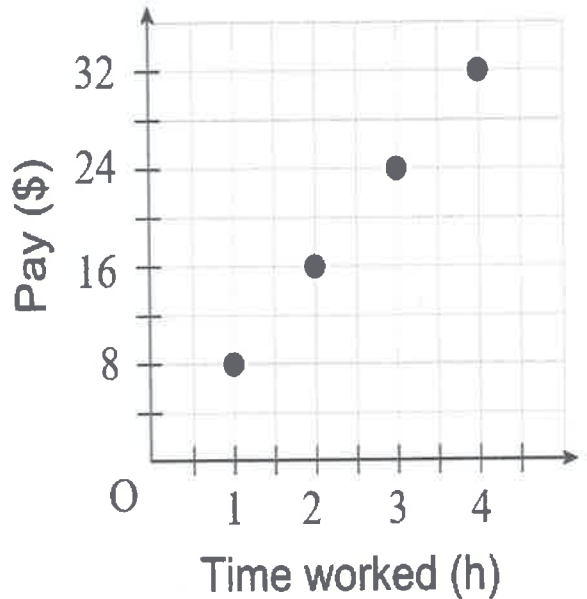
24- DECEMBER 2021 Q 6



If the straight line (d) of equation  $kx + 3y - 1 = 0$  passes through the point  $(-0.5, 1)$ , what is the slope of (d)?

- A. 4
- B.  $\frac{4}{3}$
- C.  $\frac{-4}{3}$
- D.  $\frac{-3}{4}$

25- DECEMBER 2021 Q 7



The graph above shows the amount of money earned by Dana who works at a restaurant based on the number of hours she works every day.

What is the unit rate of Dana's working hour?

- A. \$8/h
- B. \$1/h
- C. 1 h/\$
- D. \$4/h

26 - MARCH 2022 / Q 10



What is the y-intercept of the line passing through points (5;5) and (-5;-1)?

- A. -3
- B. 2
- C. 0
- D. 4

27 - MARCH 2022 / Q 15



$ABCD$  is a parallelogram such that  $A(1;-2)$ ,  $B(1;3)$ ,  $C(-1;3)$ . What are the coordinates of  $D$ , the fourth vertex of the parallelogram?

- A.  $D(-1;2)$
- B.  $D(-2;-1)$
- C.  $D(-1;-2)$
- D.  $D(3;2)$

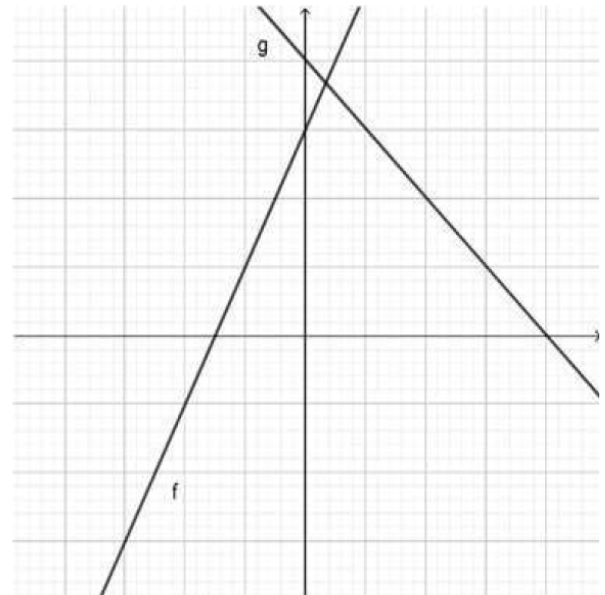
28 - MARCH 2022 / Q 22



In the  $xy$ -plane, the perpendicular lines  $T$  and  $K$  intersect at the point (3,2). If line  $T$  contains the point (2,5), which of the following points is on line  $K$ ?

- A. (5,3)
- B. (-2,1)
- C. (1,2)
- D. (6,3)

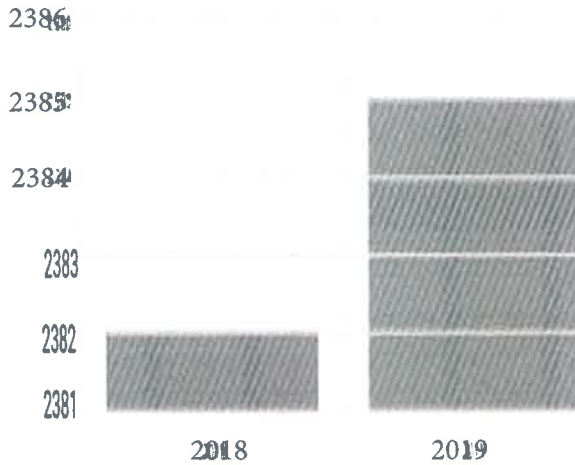
29 - MARCH 2022 / Q 26



In the  $xy$ -plane above, what is the sum of double the slope of  $g$  and triple the slope of a line parallel to  $f$ ?

- A. 6
- B. 4
- C.  $-\frac{4}{3}$
- D. 2

30 - SAMPLE TEST / Q 15



If we assume that the change in number of cars sold by this company is linear, which function will represent this change ?

**A)**  $y = 3000x - 3,672,000$   
(in thousands)

**B)**  $y = 3x - 3,672$  (in thousands)

**C)**  $y = -3000x + 3,672,000$   
(in thousands)

**D)**  $y = -3x + 3,672$  (in thousands)

31 - SAMPLE TEST / Q 18



Given the equations of two lines:  $5x - 3y = -2$  and  $2x - 3ky + 7 = 0$ , what could be the value of  $k$  so that the two lines are perpendicular ?

**A)**  $\frac{6}{15}$

**B)**  $\frac{1}{4}$

**C)**  $-\frac{9}{10}$

**D)**  $-\frac{10}{9}$

## 32 - SAMPLE TEST / Q 29



Ivana is driving her car on a straight highway. The table below shows a linear relation between her position and time.

Time (s)	4	6	8	10	12
Position (m)	9	13	17	21	25

What can you say about the velocity of the data given ?

- A) The velocity increases with time.
- B) The velocity decreases with time.
- C) The velocity is constant.
- D) Nothing can be indicated from the data given.

## 33 - SAMPLE TEST / Q 30



Ivana is driving her car on a straight highway. The table below shows a linear relation between her position and time.

Time (s)	4	6	8	10	12
Position (m)	9	13	17	21	25

If Ivana kept driving with the same rate, what will be her position at  $t = 27$  s ?

- A) 55
- B) 56.25
- C) 57
- D) 61

34 - SAMPLE TEST / Q 34



If point  $F(2 ; y + \frac{1}{12})$  lies on the line passing through  $(9, -2)$  and  $(-3, 5)$ , what is the value of  $y$ ?

35 - JUNE 2022 (cancelled) / Q 2



In the  $xy$ -plane, line  $(m)$  passes through the point  $(2, 5)$  and is perpendicular to the line  $(n)$  that passes through the points  $(4, 7)$  and  $(-2, 3)$ . Which of the following represents the equation of line  $(m)$ ?

- A.  $y = -\frac{3}{2}x + 8$
- B.  $y = -\frac{3}{2}x - 8$
- C.  $y = 2x + 1$
- D.  $y = -\frac{2}{3}x + \frac{19}{3}$

36 - JUNE 2022 (cancelled) / Q 26



What is the sum of the values of the  $x$  and  $y$ -intercepts of the graph of the function

$$f(x) = 2x + 3(x - 5) ?$$

- A.  $-18$
- B.  $-12$
- C.  $12$
- D.  $18$

37 - JUNE 2022 (cancelled) / Q 36



If the distance between points  $A(3, c)$  and  $B(9, -5)$  in a coordinate system is  $3\sqrt{13}$ , and  $A$  is a point in the first quadrant, what is the value of  $\frac{c}{2} + 7$ ?

- A.  $0$
- B.  $4$
- C.  $9$
- D.  $11$

23- OCTOBER 2021 Q 1



If  $f$  is a linear function with  $f(0) = \frac{1}{2}$  and  $f(-3) = -\frac{3}{2}$ , what is the value of  $f(3)$ ?

- A.  $0.5$
- B.  $1.5$
- C.  $2.5$
- D.  $5$

## ANSWERS OF LESSON ( COORDINATE GEOMETRY )

### NON CALCULATOR



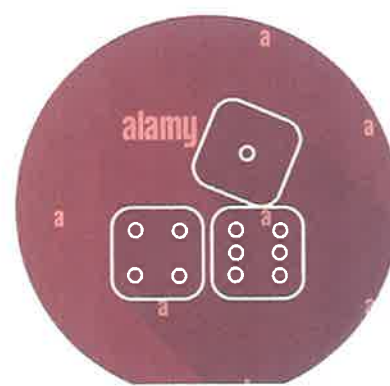
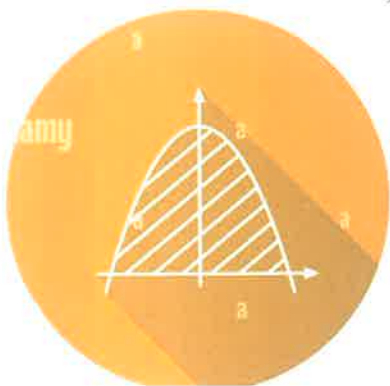
Q	Answer
1	D
2	9
3	C
4	C
5	A
6	A
7	B
8	D
9	D
10	12
11	C
12	D
13	5
14	C
15	C
16	D
17	D
18	B
19	B
20	
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### CALCULATOR



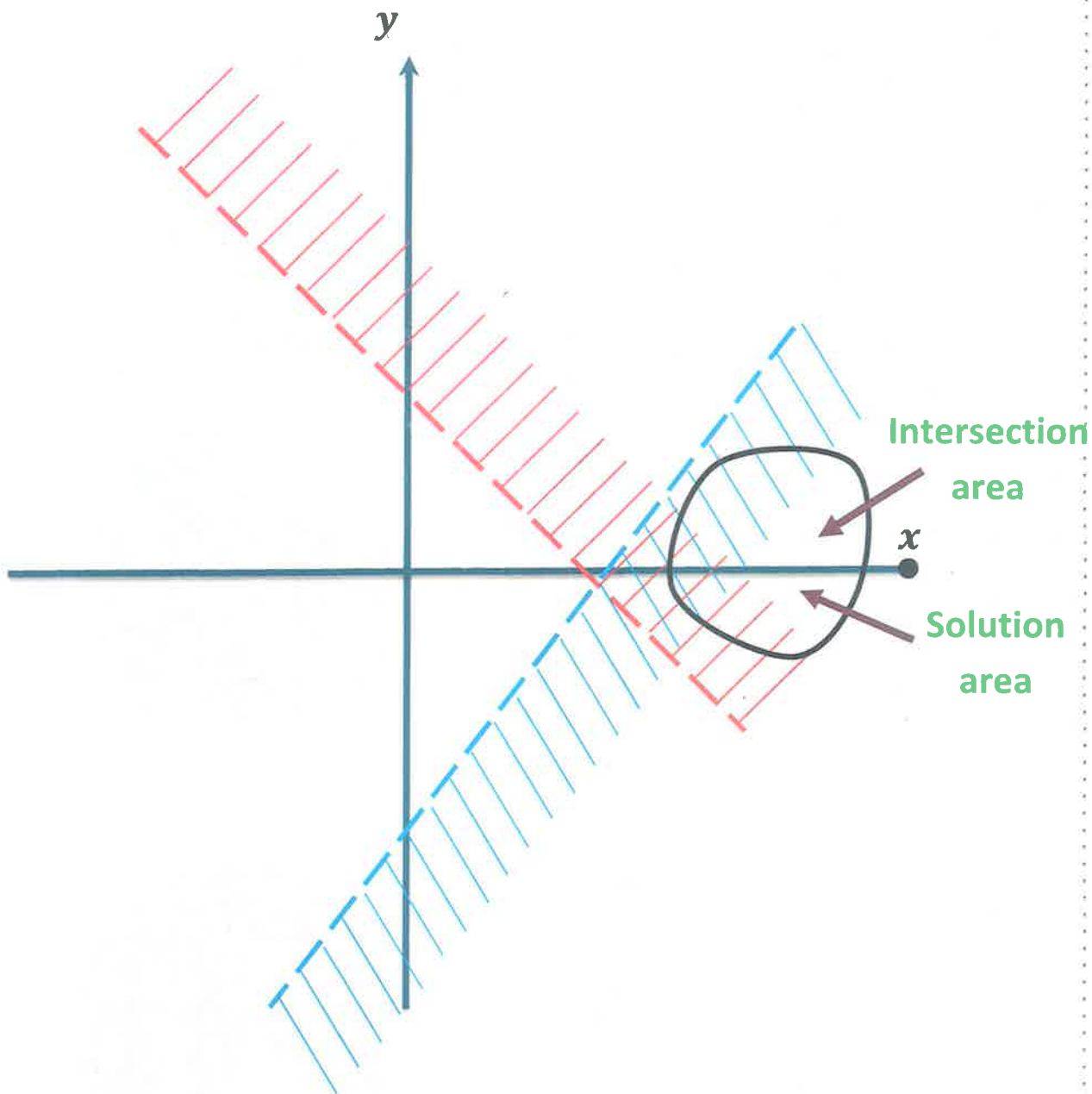
Q	Answer	Q	Answer
1	C	30	B
2	D	31	D
3	B	32	C
4	C	33	A
5	C	34	2
6	A	35	A
7	16.1	36	B
8	A	37	C
9	C	38	C
10	D	39	
11	A	40	
12	A	41	
13	C	42	
14	A	43	
15	A		
16	A		
17	B		
18	A		
19	B		
20	C		
21	A		
22	D		
23	C		
24	C		
25	A		
26	B		
27	C		
28	D		
29	B		

# Coordinate Inequality



$y < 5x - 10$

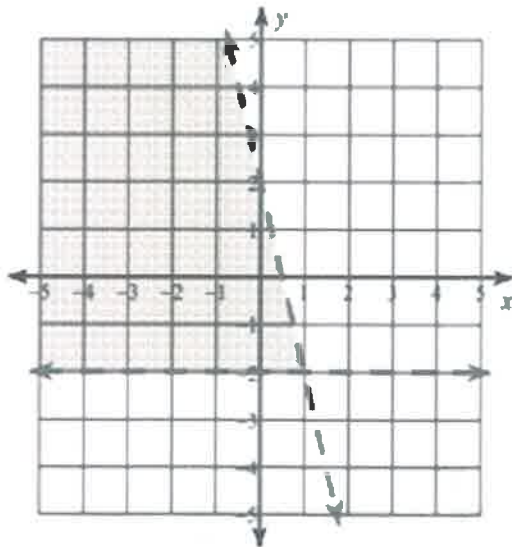
$y \geq -3x + 9$



# *Questions*

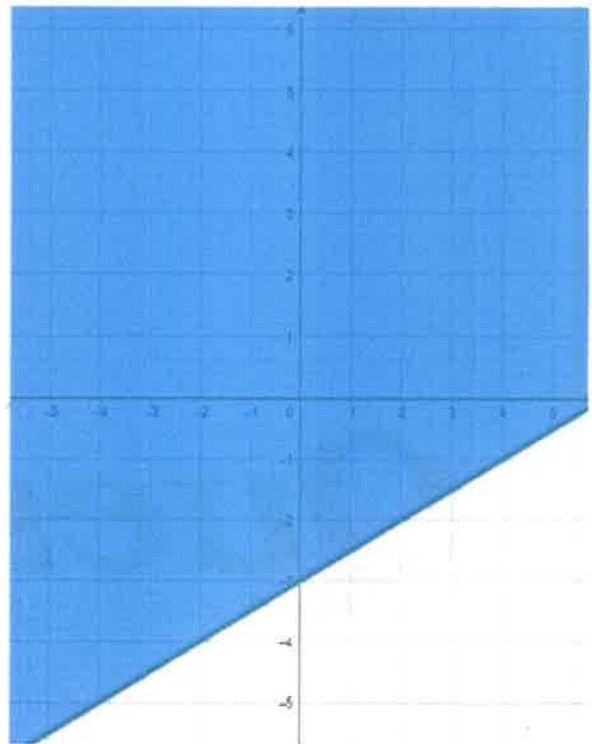


1- OCTOBER 2020 Q 17



In the above graph, the shaded region is the solution of the system  $\begin{cases} 4x + y < 2 \\ y \geq -2 \end{cases}$ . For  $x=0$ , what is the highest integer value of  $y$ ?

2- DECEMBER 2021 Q 7



Which of the inequalities below represents the solution of the shaded region in the figure above?

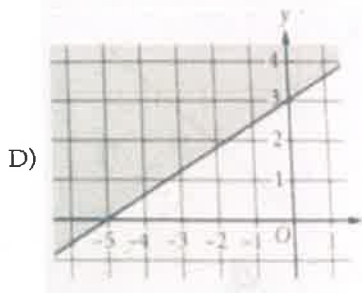
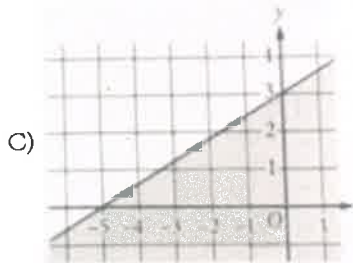
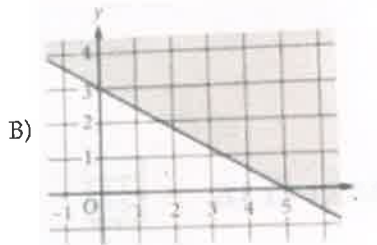
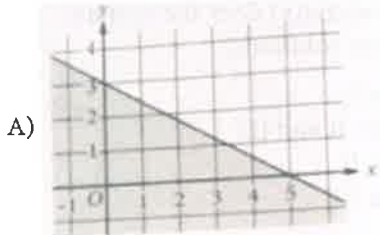
- A.  $-y \leq -0.5x - 3$
- B.  $-y \leq -0.5x + 3$
- C.  $y \geq -0.5x - 3$
- D.  $-y \leq 0.5x + 3$

3- Sample test



$$5y + 3x \leq 15$$

The solution set to the inequality above is represented by the line and shaded region of the graph in which of the following  $xy$ -planes?



4- Sample test



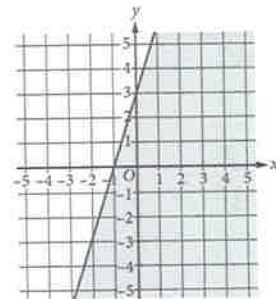
$$y \geq -2x + 11$$

$$y > 3x - 9$$

In the  $xy$ -plane, point A is contained in the graph of the solution set of the system of inequalities above. Which of the following could be the coordinates of point A ?

- A. (2, 1)
- B. (4, 1)
- C. (4, 5)
- D. (6, 6)

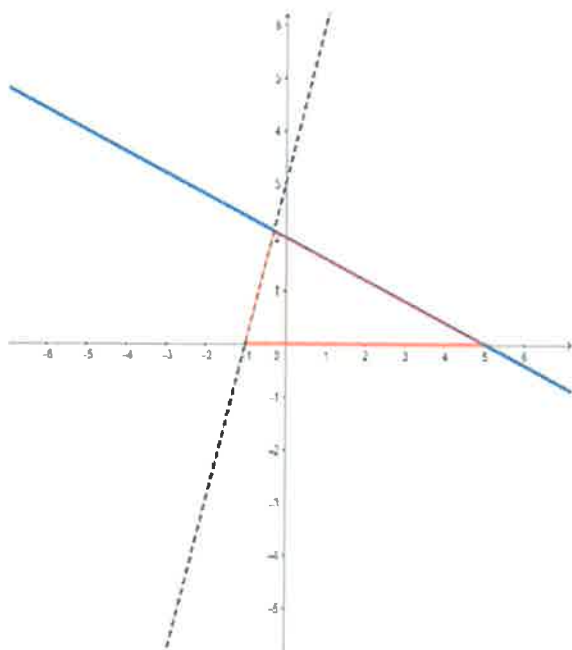
5- Sample test



The shaded region shown represents the solutions to which inequality?

- A)  $3x - y \leq -3$
- B)  $3x - y \geq -3$
- C)  $3x + y \leq 3$
- D)  $3x + y \geq 3$

1- MARCH 2021 Q1



Which of the following is a system of inequalities whose solution is the set of points that belong to the shaded area in the figure above?

- A.  $x > 0$   
 $y > \frac{-2}{5}x + 2$   
 $y < 3x + 3$
- B.  $y \geq 0$   
 $y \leq \frac{-2}{5}x + 2$   
 $y < 3x + 3$
- C.  $y < 0$   
 $y > \frac{-2}{5}x + 2$   
 $y \geq 3x + 3$
- D.  $y \geq 0$   
 $y \geq \frac{-2}{5}x + 2$   
 $y < 3x + 3$

2 - JUNE 2021 Q 23

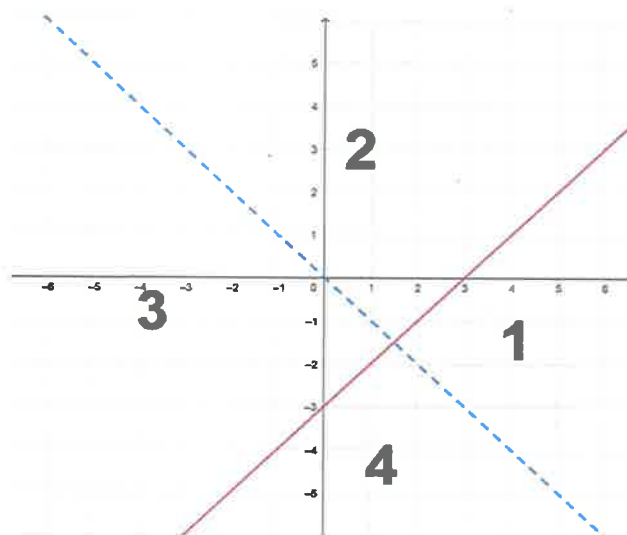


$$\begin{cases} y \leq 3x - 2 \\ y > \frac{3x}{4} - 3 \end{cases}$$

In which quadrant(s) does the system above have no solutions?

- A. Quadrant I
- B. Quadrants II and III
- C. Quadrant II
- D. Quadrant III

3- AUGUST 2021 Q 18



What is the solution region of the system  $x - y \leq 3$   $y > -x$  represented in the graph above?

- A. Region 1
- B. Region 2
- C. Region 3
- D. Region 4

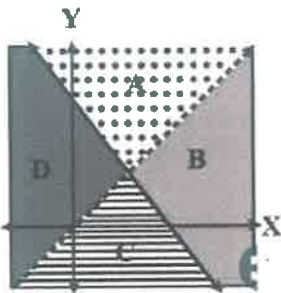
4 Sample question



A graph and the system of inequalities are shown above. Which region of the graph could represent the solution for the system of in equations?

$$y > x$$

$$3y \leq -4x + 6$$

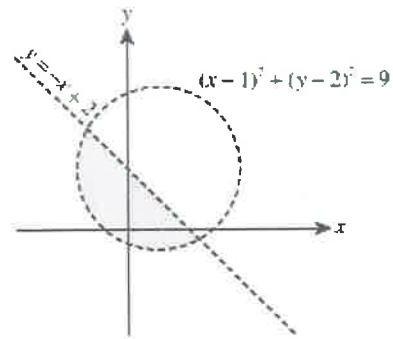


- A A
- B B
- C C
- D D

5 Sample question



The shaded region in the graph below represents the solution set to which of the following systems of inequalities?

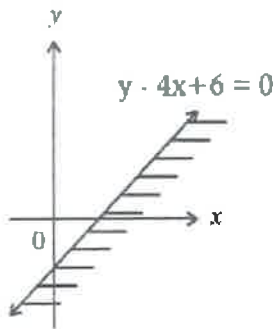


- A  $\begin{cases} y < -x - 2 \\ (x - 1)^2 - (y - 2)^2 < 9 \end{cases}$
- B  $\begin{cases} y > -x - 2 \\ (x - 1)^2 - (y - 2)^2 < 9 \end{cases}$
- C  $\begin{cases} y > -x - 2 \\ (x - 1)^2 - (y - 2)^2 > 9 \end{cases}$
- D  $\begin{cases} y < -x - 2 \\ (x - 1)^2 - (y - 2)^2 > 9 \end{cases}$

6- Sample question

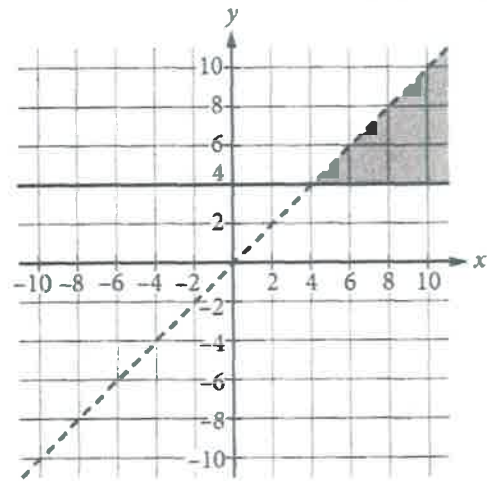


Identify the region described by the shaded part in the graph above.



- A  $y = 4x - 6$
- B  $y \leq 4x - 6$
- C  $y < 4x - 6$
- D  $y > 4x - 6$

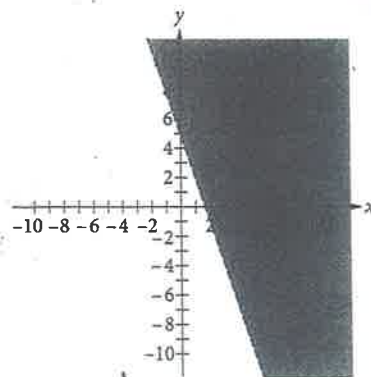
7- Sample test



The shaded region shown above represents the solution to which of the following systems of inequalities?

- A)  $y < x$   
 $y \leq 4$
- B)  $y < x$   
 $y \geq 4$
- C)  $y > x$   
 $y \leq 4$
- D)  $y > x$

8- Sample test



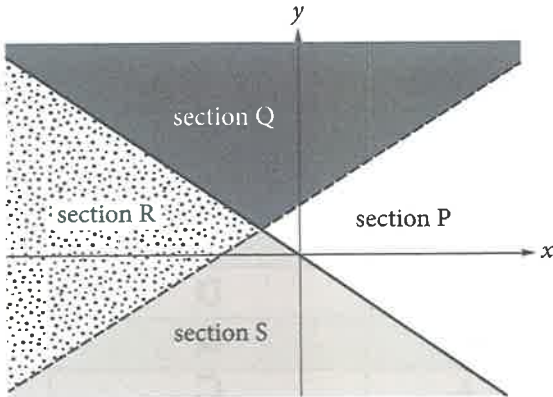
Which of the following inequalities is represented by the shaded region on the coordinate plane above?

- A)  $y > -3x + 5$
- B)  $y < -3x + 5$
- C)  $y \geq 3x - 5$
- D)  $y \leq 3x - 5$

9- Sample test



$$\begin{cases} y \leq -x \\ 2y > 3x + 2 \end{cases}$$



A system of inequalities and a graph are shown above. Which section or sections of the graph could represent all of the solutions to the system?

- A) Section R
- B) Sections Q and S
- C) Sections Q and P
- D) Sections Q, R, and S

10- Sample test

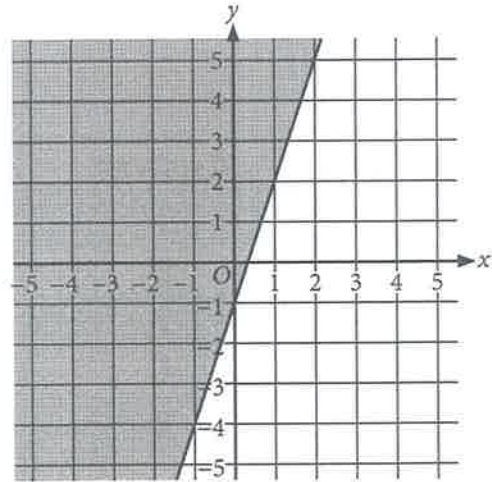


$$\begin{aligned} x + y &= 4 & y &= -x + 4 \\ x - y &= 2 & y &= x - 2 \end{aligned}$$

Which of the following is the graph in the  $xy$ -plane of the system of equations above?

- A)
- B)
- C)
- D)

11- Sample test



The shaded region shown represents the solutions to which inequality?

- A)  $y \leq 3x - 1$
- B)  $y \geq 3x - 1$
- C)  $y \leq -3x + 1$
- D)  $y \geq -3x + 1$

## ANSWERS OF LESSON ( COORDINATE INEQUALITY )

NON CALCULATOR



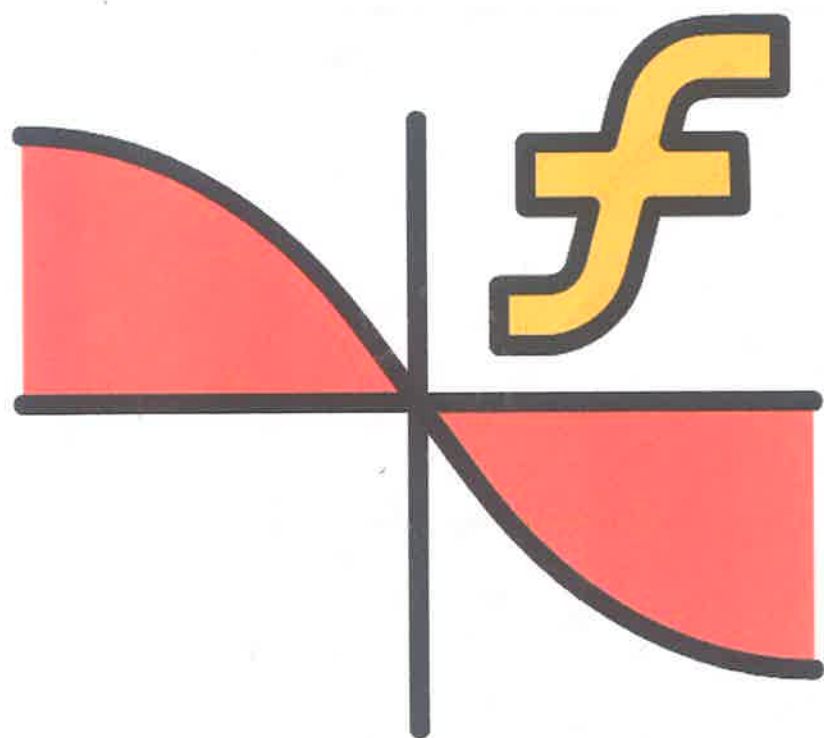
Question	Answer
1	1
2	B
3	A
4	C
5	B
6	
7	
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CALCULATOR



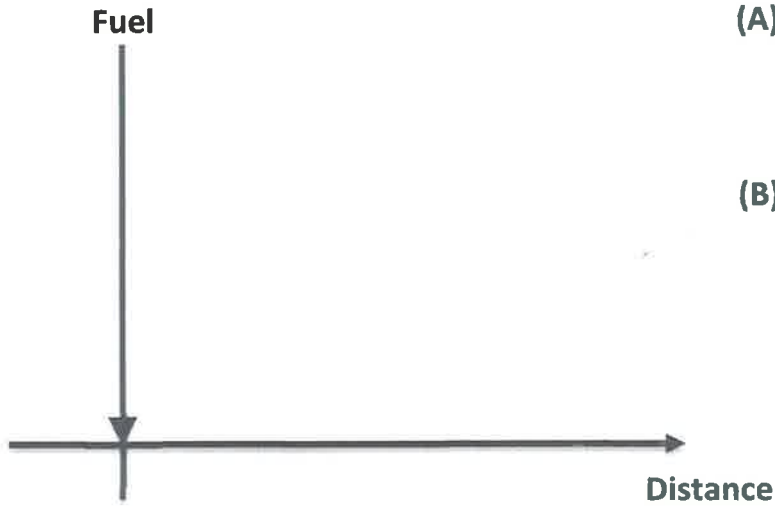
Question	Answer
1	B
2	C
3	B
4	D
5	A
6	C
7	B
8	A
9	A
10	A
11	B
12	
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# Function



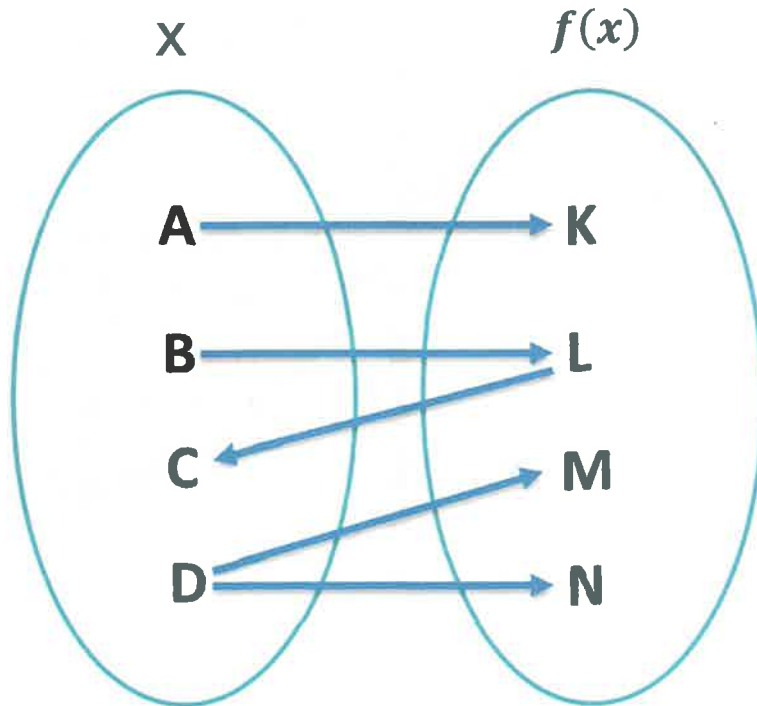
(A)

Domain & range



(A) The distance increases the fuel decrease

(B) the fuel decrease when the distance increase



$$f(x) = y = \frac{3x}{x+3}$$

Which is the value of  $x$  is not domain

?Find the domain of each of following

(A)  $f(x) = 1 + x^2$

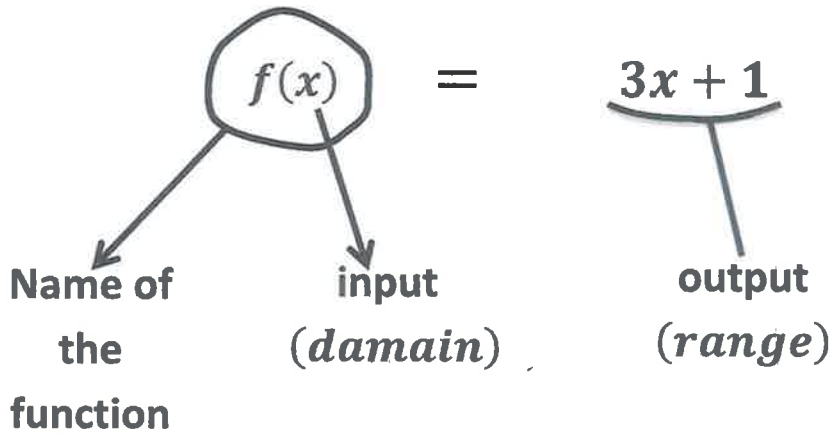
(B)  $f(x) = 1 - \sqrt{x}$

(C)  $f(x) = \frac{2}{t^2 - 16}$

(D)  $f(x) = \frac{4}{3 - x}$

(E)  $f(x) = \frac{1}{2 - x} + 3$

## Function Notation



$$f(2) = 3(2) + 1$$

$$f(k + n) = 3(k + n) + 1$$

### Question

★  $f(x) = -3x + 8$       find  $f(5)$

★  $h(x) = \frac{-2x+5}{4}$       find  $h\left(\frac{3}{2}\right)$

★  $k(x) = 3x^2 + 2x + 5$       find  $k(x + 1)$

★  $f(x) = 5x^2 - 7(4x + 3)$       find  $f(3)$


**Composition of Function**

$$f(x) = 7x - 5$$

$$g(x) = x^3 + 4x$$

$$(f \circ g)(x) = f(g(x))$$

$$(g \circ f)(x) = g(f(x))$$


**Question**

(A)  $f(x) = 3x - 4$

$$g(x) = x^2 - 3$$

Find

$$f(g(t)) = ?$$

(B)  $f(x) = x^2 - 6x - 1$

$$g(x) = -2x$$

Find

$$g(f(k)) = ?$$

(C)  $f(x) = 3x + 2$

$$g(x) = 4x - 5$$

Find

$$f(g(3)) = ?$$

(D)  $f(x) = 2x^2 - 3x - 1$

$$g(x) = -x + 5$$

Find

$$g(f(3)) = ?$$

(A)  $f(x + 1) = 30$

Find

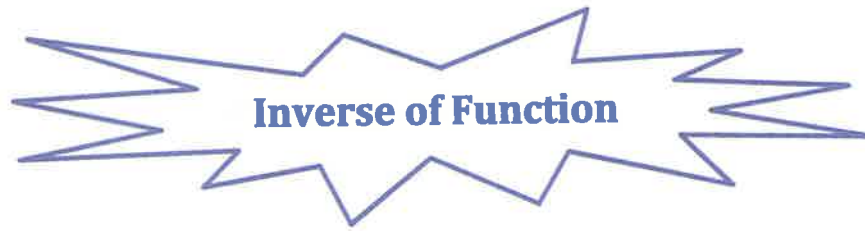
$$g(x + 2) = ?$$

$x$	$f(x)$	$g(x)$
1	10	20
2	30	40
3	50	60
4	70	80
5	90	100

(B)  $f(x) = g(x + 3) + f(x + 2)$

Find

$$h(1) = ?$$



$$f(x) = 3x + 5 \quad \longrightarrow \quad f^{-1}(x) = \frac{x-5}{3}$$

$$y = 3x + 5$$

$$x = 3y + 5$$

$$x - 5 = 3y$$

$$\frac{x-5}{3} = y$$

$$\frac{x-5}{3} = f^{-1}(x)$$

Find the inverse function for the following equation

(A)  $f(x) = 2x - 7$

(B)  $f(x) = \sqrt{\frac{x+1}{3}}$

(C)  $f(x) = \frac{x-5}{3}$



## Quadratic Function

★ Quadratic formula

$$ax^2 + bx + c = 0$$

★ To find solution without Calculator.

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

★ To find sum of solution

$$\text{sum} = \frac{-b}{a}$$

★ To find product of solution

$$\text{product} = \frac{c}{a}$$

★ To find vertex

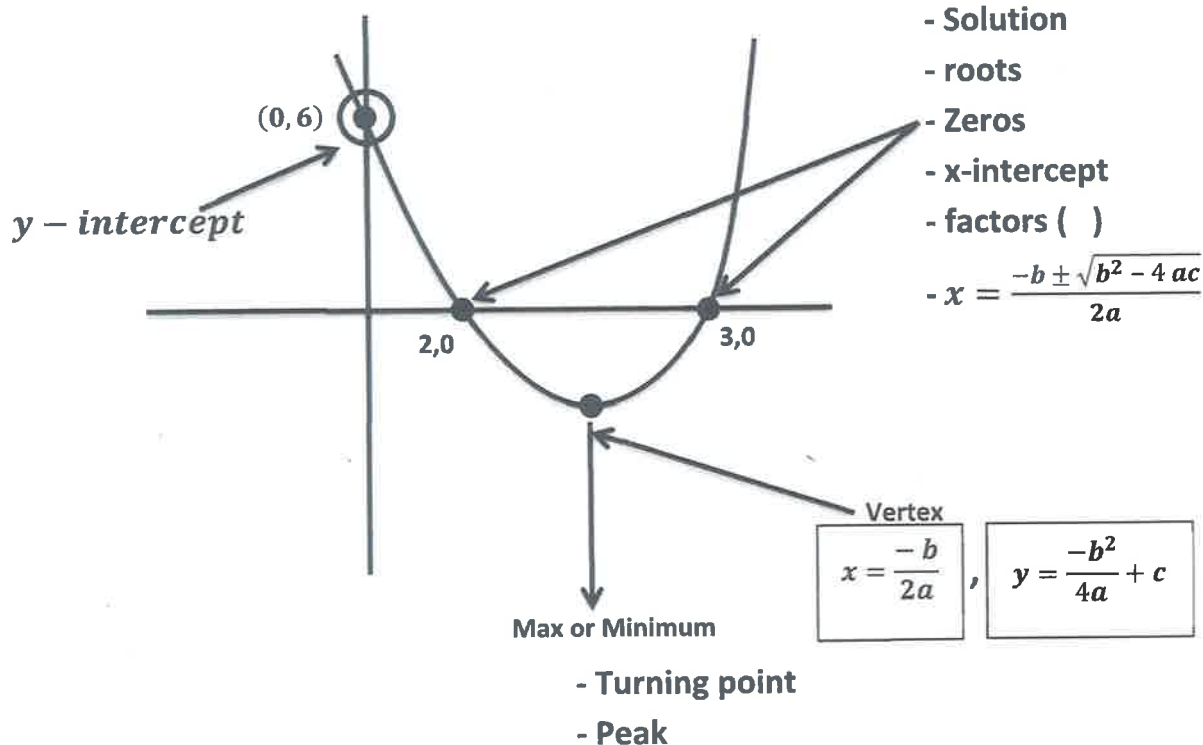
$$\bar{x} \text{ vertex} = \frac{-b}{2a}$$

$$\bar{y} \text{ vertex} = \frac{-b^2}{4a} + c$$

If we have function

as

$$f(x) = x^2 - 5x + 6$$



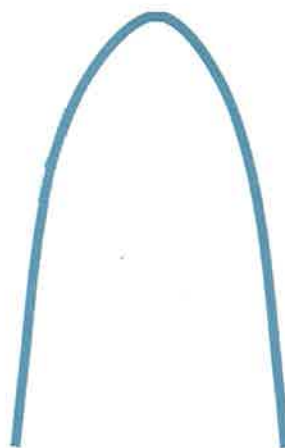
$$y = ax^2 + bx + c$$

$+ a$



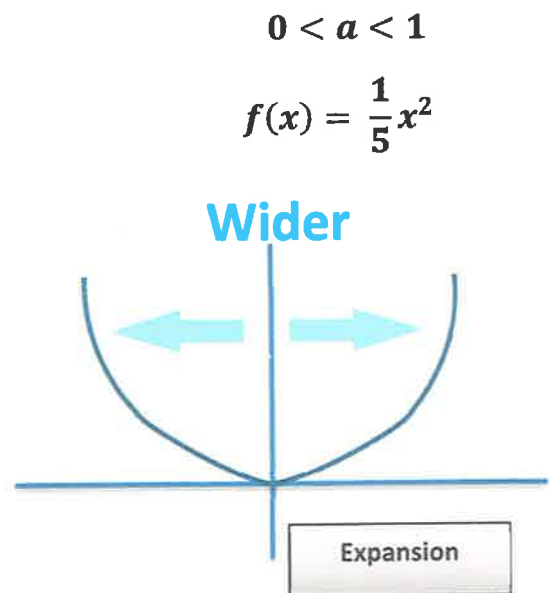
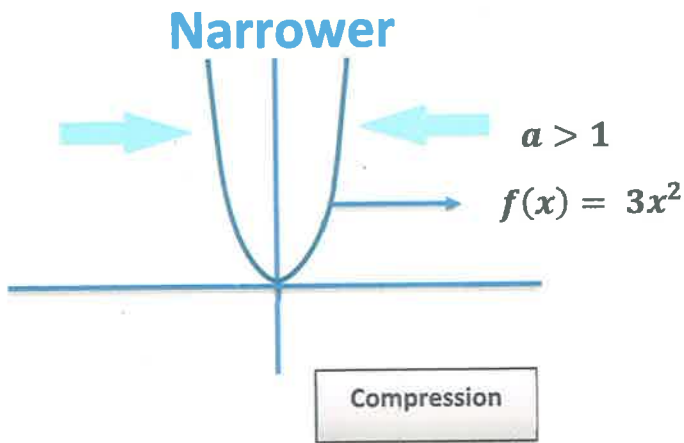
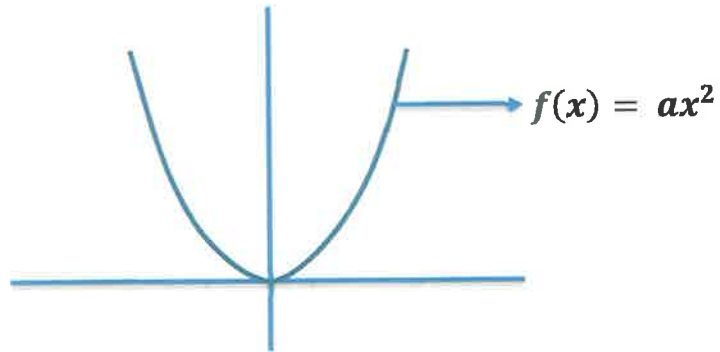
Opens up

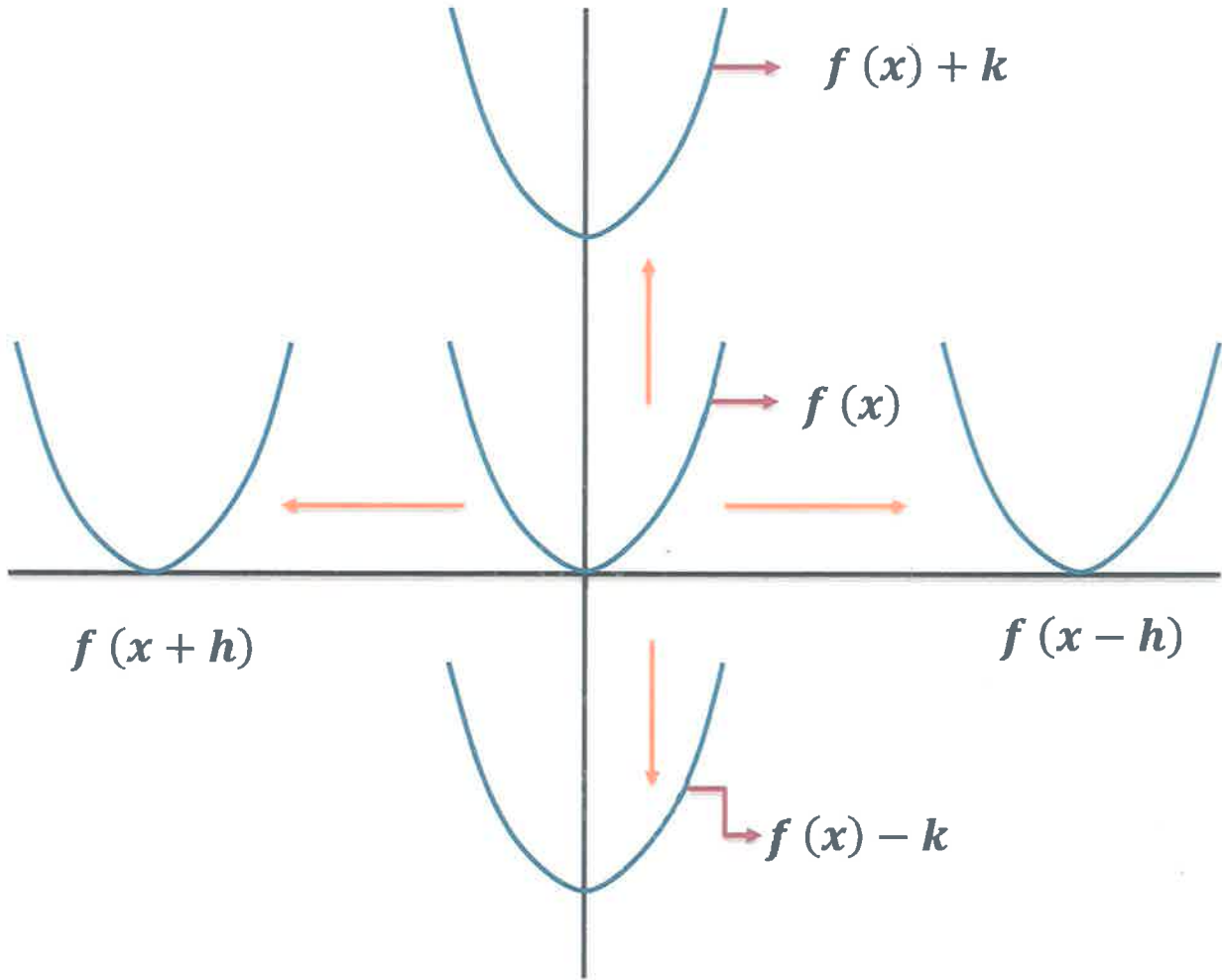
$- a$

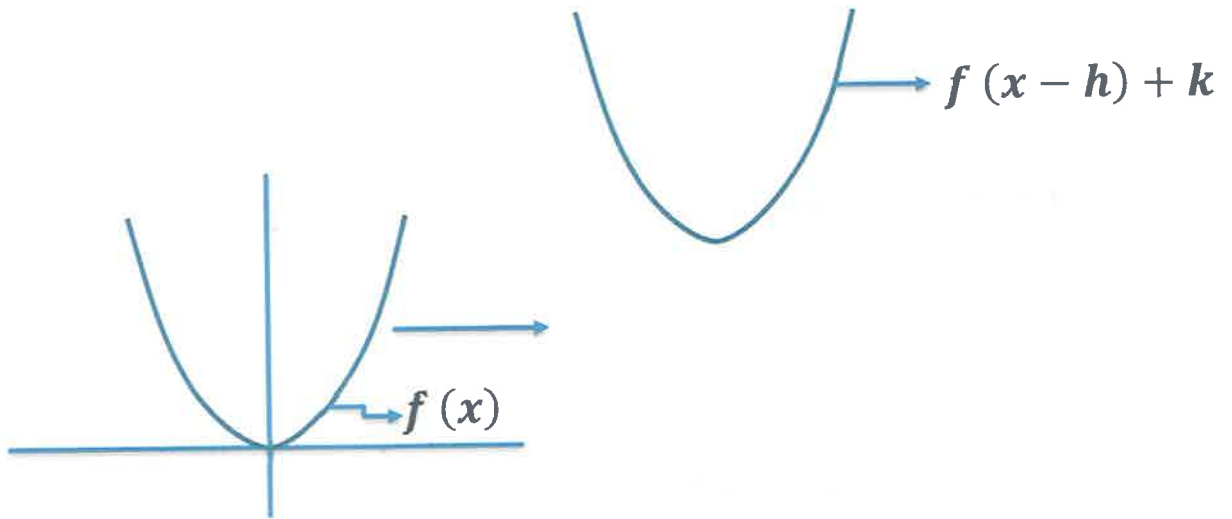


Opens down

# Function Transformation







Vertex from parabola

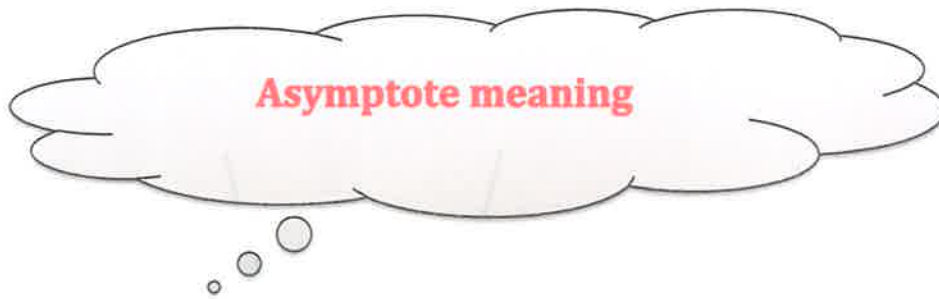
$$f(n) = \pm a(x-h)^2 + k$$

$$a > 1$$

$$0 < a < 1$$

$(h, k)$

Vertex

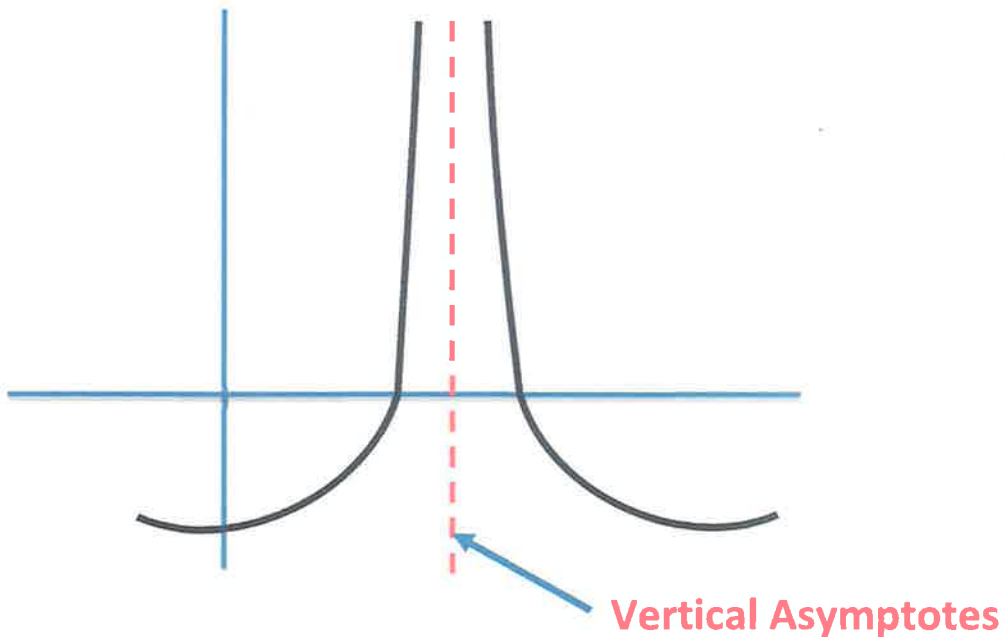


★ it is the line at which domain and range make the function undefined

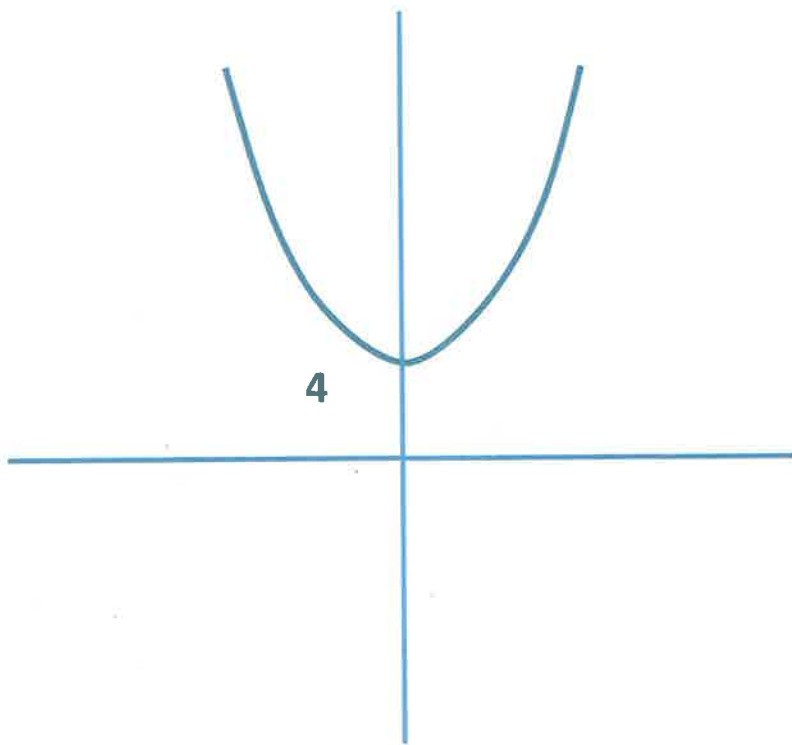
★ Vertical Asymptotes

When the Curve more to word (infinity)

$$f(x) = \frac{3x - 2}{x - 1}$$



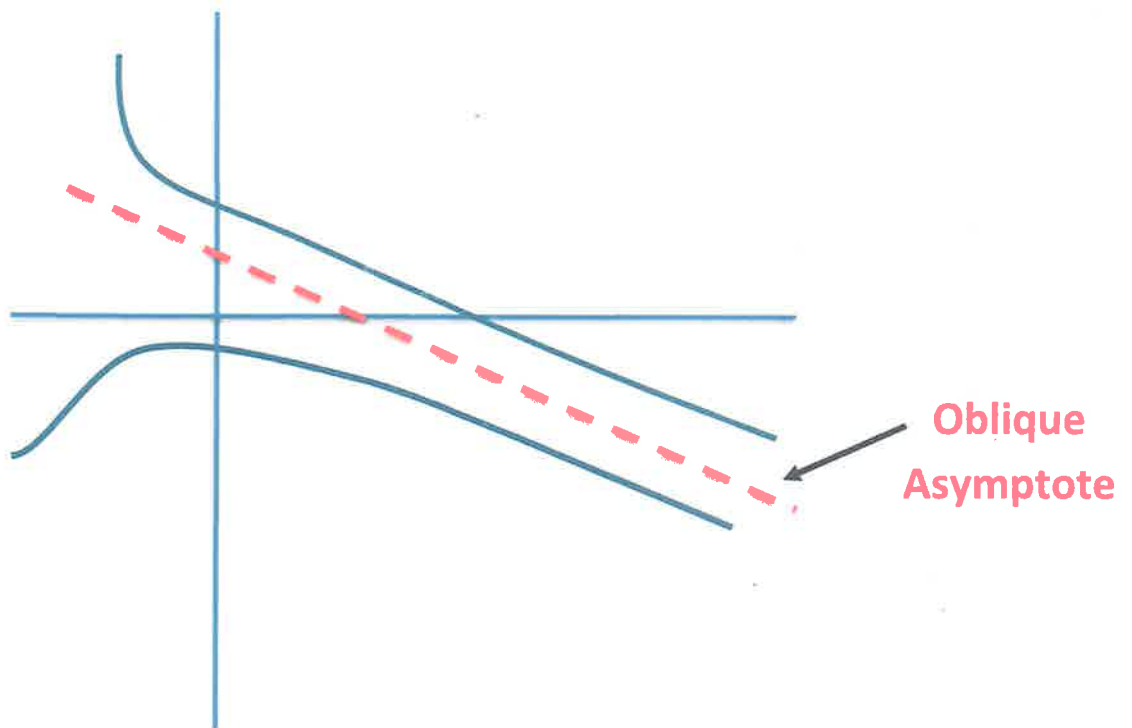
★ Horizontal Asymptotes



$$y = x^2 + 4$$



### Oblique Asymptote



What is the equation of the oblique asymptote of the function  $f(x) = \frac{3x^2 - 4x + 1}{2x + 1}$

- A.  $y = 1.5x - 2$
- B.  $y = 1.5x - 2.75$
- C.  $y = 1.5x$
- D.  $y = 1.5x + 2.75$
- E.  $y = 1.5x + 2$

# *Questions*



1- OCTOBER 2020 Q 11



If  $f(x) = x^2 - 5x - 6$  and  $g(x) = -3 - x$ , what is the value of  $f(g(-1))$ ?

- A. 13
- B. 8
- C. 0
- D. 30

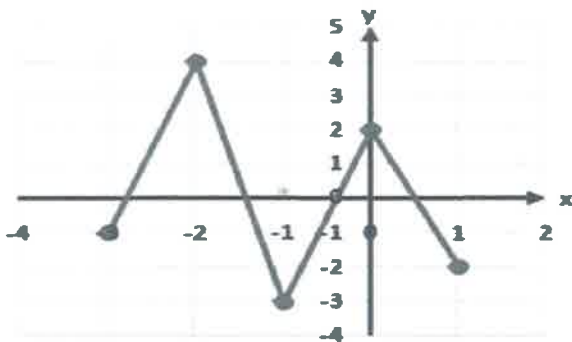
2- OCTOBER 2020 Q 13



The graph (C) of the function  $f(x) = 2(x + 2)(x - 6)$  is a parabola. If the line  $x = k$  is the axis of symmetry of the parabola, what is the value of  $k$ ?

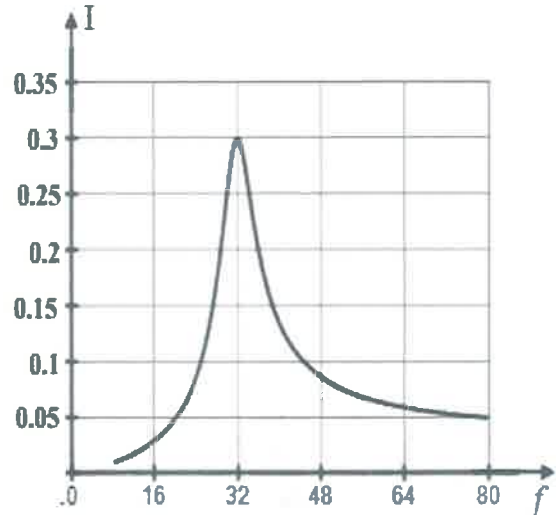
- A. 1
- B. 2
- C. 3
- D. 4

3- OCTOBER 2020 Q 18



Based on the above graph, if the absolute maximum and minimum of the represented function  $f(x)$  are  $(p, q)$  and  $(r, s)$  respectively, what is the value of  $q - p + s - r$ ?

4- DECEMBER 2020 Q 5



In a certain electric circuit, the generator has an adjustable feature called the frequency. For different frequencies between 60 and 80 Hertz, one obtains different intensities of current flowing in the circuit measured in Amperes. The graph given above represents the variation of the effective value of the current as a function of the frequency. Which of the following values of the current can be attained by only one value of the frequency?

- A. 0.04
- B. 0.1
- C. 0.23
- D. 0.35

5- DECEMBER 2020 Q 11

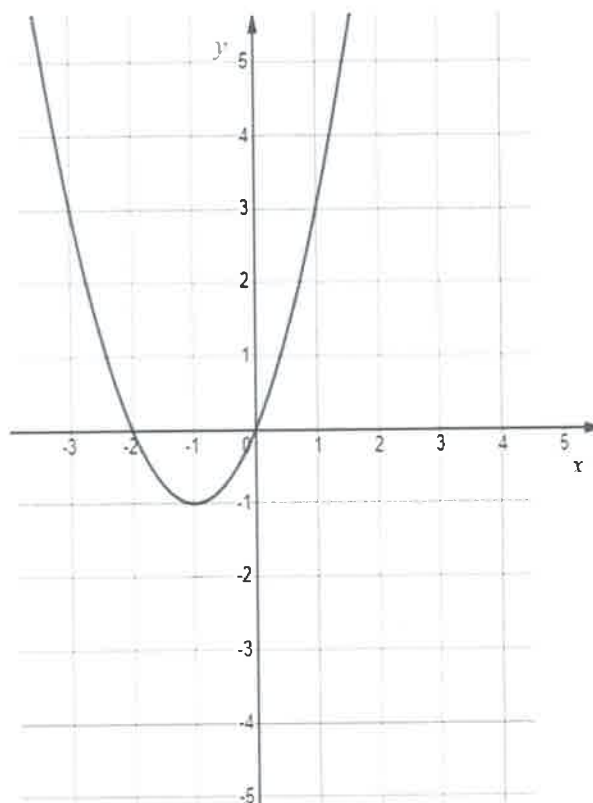


$x$	-3	-1	0	2	4	5	8
$f(x)$	2	1	4	7	-3	9	-5
$g(x)$	-7	8	-3	20	0	10	5

The table above shows some values of the two functions  $f$  and  $g$ . For what value of  $x$  is  $g(f(x)) = x$ ?

- A. -3
- B. 0
- C. 4
- D. 8

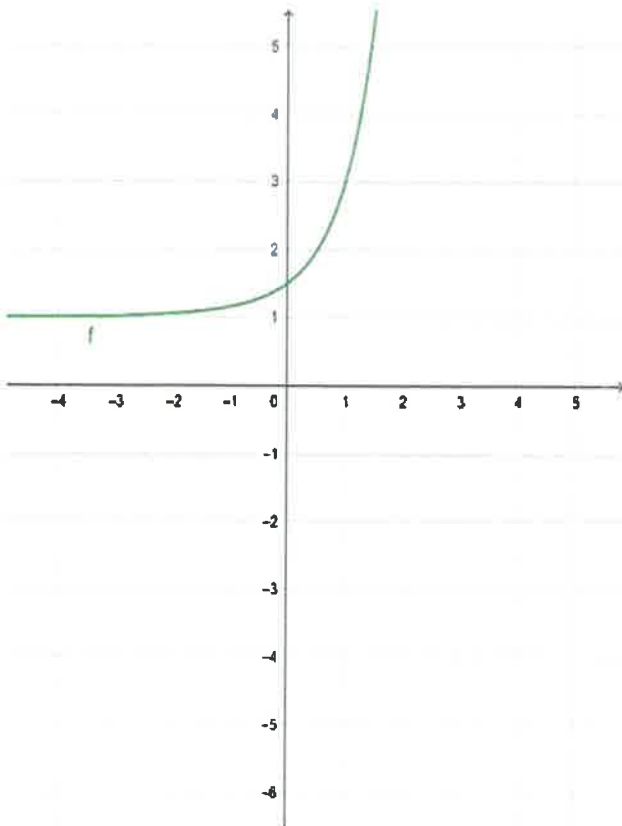
6- DECEMBER 2020 Q 14



The graph of the function  $f$  in the  $xy$ -plane above is a parabola. Which of the following expressions defines  $f$  while showing the  $x$ -intercepts as constants or coefficients?

- A.  $f(x) = x(x + 2)$
- B.  $f(x) = (x + 1)(x + 2)$
- C.  $f(x) = x^2(x + 2)$
- D.  $f(x) = (x + 2)^2 - 1$

7-MARCH 2021 Q 10

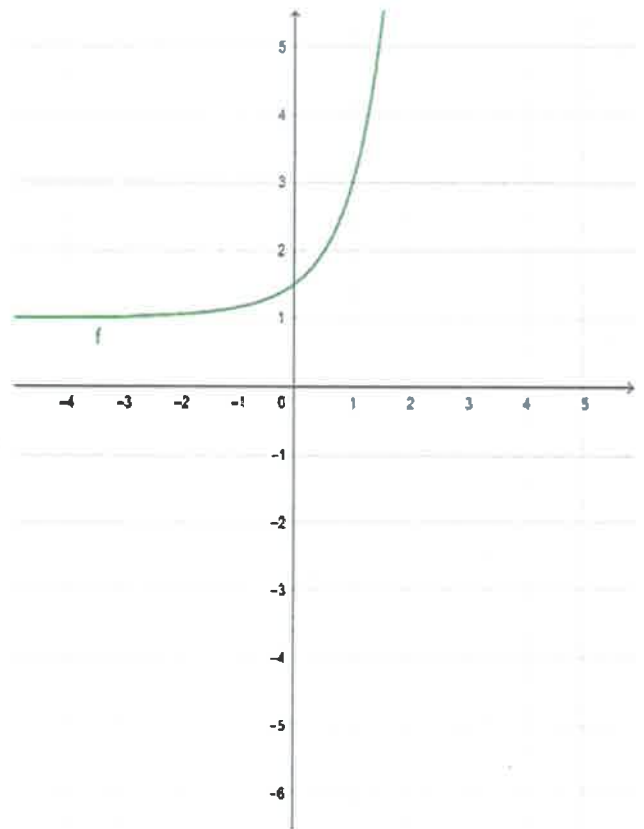


The graph above represents the curve of an increasing function  $f$ .

What is the solution of  $f(x) - 1.5 = 0$ ?

- A. 0
- B. 1.5
- C. 3
- D. 4.5

8-MARCH 2021 Q 11



The graph above represents the curve of an increasing function  $f$ .

If  $x$  approaches positive infinity, then  $f(x)$  will approach

- A. 0
- B. 1
- C. 5.5
- D.  $+\infty$

9- MARCH 2021 Q 13



In the  $xy$ - plane, the parabola with equation  $y = (x - 6)^2$  intersects the line with equation  $y = 4$  at two points A and B. What is the midpoint of [AB]?

- A. (6,0)
- B. (2,4)
- C. (8,4)
- D. (6,4)

12- MAY 2021 Q 20



What is the abscissa of the vertex of the function  $f(x) = 3x^2 - 18x + 4$ ? (grid-in)

10- MAY 2021 Q 13



What is the range of the function  $f(x) = x^2 + 4x - 3$ ?

- A.  $[-1, +\infty)$
- B.  $[1, +\infty)$
- C.  $[7, +\infty)$
- D.  $[-7, +\infty)$

13- JUNE 2021 Q 6



If  $h(x) = -x^2 + 3x - 2$  and  $k(x) = -2x - 5$ , what is the value of  $h(k(-2))$ ?

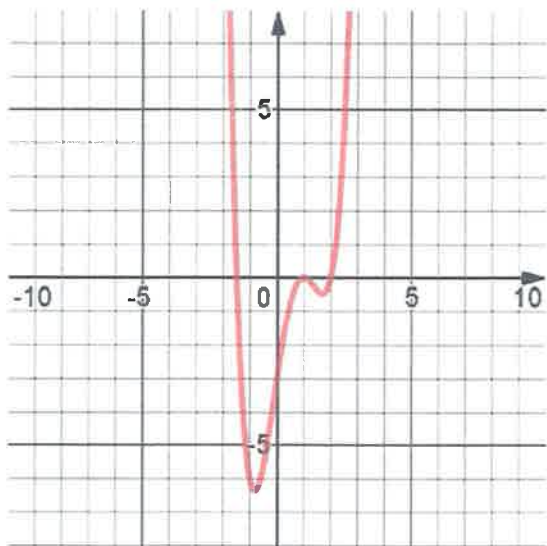
- A. -6
- B. -4
- C. 0
- D. 2

11- MAY 2021 Q 16



Given  $f(x) = 2x^2 - 3x + 1$  and  $g(x) = -3x + 5$ , what is the value of  $(f \circ g)(-2)$ ? (grid-in)

14- JUNE 2021 Q 7



The graph above depicts a function  $f(x)$ . How many solutions does the equation  $f(x) = 0$  admit?

- A. 1
- B. 2
- C. 3
- D. 4

15- JUNE 2021 Q 19



$x$	$q(x)$
-5	-7
-3	-15
-1	-15
1	-7
3	9
5	33

The table above shows several points from the graph of quadratic function  $q(x)$ . What is  $q(-9)$ ?

16- AUGUST 2021 Q 9



Which of the following is equivalent to  $f(x) = 2x^2 - 12x + 8$  ?

- A.  $(2x - 6)^2 - 28$
- B.  $2(x - 3)^2 - 10$
- C.  $2(x - 9)^2 + 5$
- D.  $4(x - 3)^2 - 5$

17- AUGUST 2021 Q 10



$$f(x) = ax^2 + (3 - b)x - 5$$

For the function  $f$  defined above,  $a$  and  $b$  are constants. If  $f(1) = 2$  and  $f(2) = -1$ , which of the following is the value of  $f(-1)$ ?

- A. -22
- B. -16
- C. 2
- D. 11

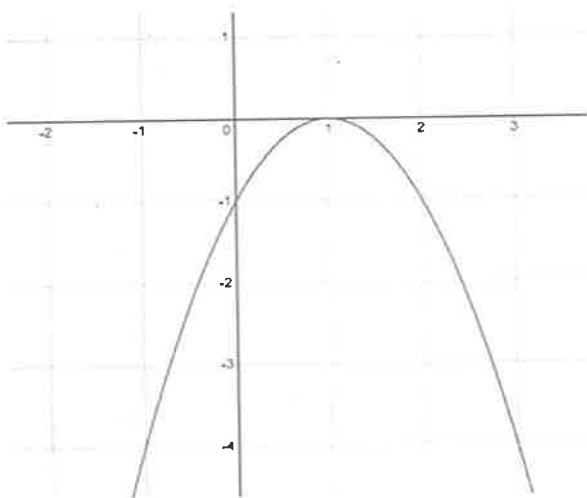
18- OCTOBER 2021 Q 5



Given  $f(x) = x^2 + 3x - 1$ , and  $g(x) = 2x - 1$ , what is the equivalent expression representing  $f(g(x))$ ?

- A.  $2x^2 + 2x - 3$
- B.  $4x^2 + 2x - 3$
- C.  $2x^2 + 4x - 1$
- D.  $4x^2 + 4x - 1$

19- OCTOBER 2021 Q 7

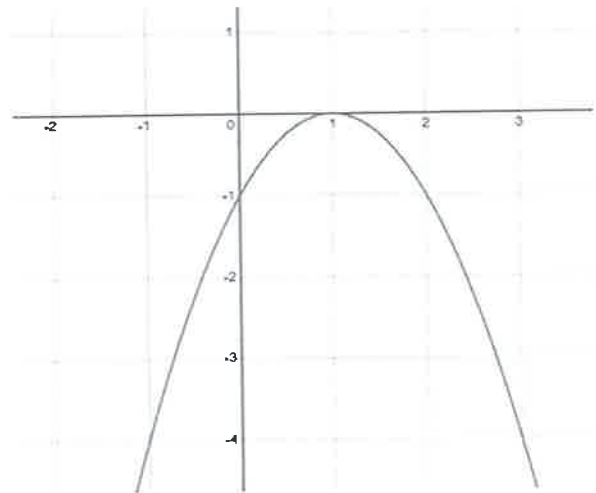


Which of the following statement(s) is/are true regarding the graph above?

- I. The coordinates of the vertex of the parabola are (1; 0).
- II. The axis of symmetry is at  $x = -1$ .
- III. The equation of the parabola is  $y = -x^2 + 2x - 1$ .

- A. I only
- B. II only
- C. I and II
- D. I and III

20- OCTOBER 2021 Q 8



What is the equation of the tangent to this parabola at the vertex?

- A.  $x = 0$
- B.  $y = 0$
- C.  $y = x$
- D.  $y = -x$

21- OCTOBER 2021 Q 12



Given  $f(x) = 2x^2 + ax - 1$ . What is the value of  $a$  if the axis of symmetry of the graph of  $f$  is equal to  $-2.5$ ?

- A.  $-10$
- B.  $5$
- C.  $10$
- D.  $20$

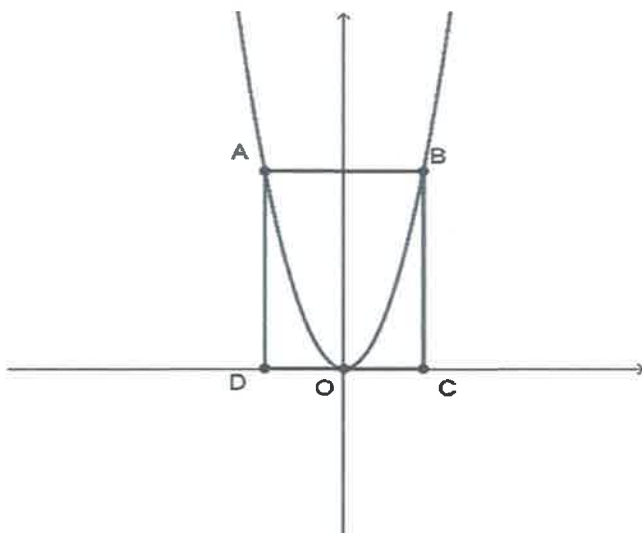
22- DECEMBER 2021 Q 14



The graph of an exponential function  $K$  in the  $xy$ -plane, where  $y = K(x)$  has a  $y$ -intercept of  $h$ , where  $h$  is a negative constant number. Which of the following could be function  $K$ ?

- A.  $K(x) = -h(x)^3$
- B.  $K(x) = 2(h)^x$
- C.  $K(x) = h(4)^x$
- D.  $K(x) = -\sqrt{3}hx$

23-DECEMBER 2021 Q 18



In the figure above, ABCD is a square and points A, B and O lie on the parabola of equation  $y = \frac{1}{k}x^2$ , where  $k$  is a constant number. If the area of ABCD is  $16 \text{ cm}^2$ , what is the value of  $k$ ? (The figure is not drawn to scale). (Grid in)

24- DECEMBER 2021 Q 20



How many asymptotes does the curve of the function  $f$  defined by  $f(x) = \frac{x^2 - 3}{9 - x^2}$  admit? (Grid in)

25 - MARCH 2022 / Q 10



If  $3 - 8x + 5x^2 = 0$ , which of the following is a solution for  $x$ ?

- A. 0
- B. 2
- C. -1
- D. 1

26 - MARCH 2022 / Q 13



What is the domain of the function  $f(x) = \sqrt{3-x}$ ?

- A.  $]-\infty; +\infty[$
- B.  $]-\infty; +3]$
- C.  $[+3; +\infty[$
- D.  $]-3; 3[$

27 - MARCH 2022 / Q 16



Given  $f(z) = \left(\frac{1}{3}\right)^z$  and  $h(z) = \frac{z+4}{z+1}$ .

What is the value of  $(h \circ f)(0)$ ?  
(grid-in)

28 - MARCH 2022 / Q 18



The function  $h(x) = (x^2 - a)(4 + x) - 112$  has zero at  $x=4$ . What is the value of  $a$ ? (grid-in)

29 - MARCH 2022 / Q 20



What is the abscissa of the vertex of the parabola defined by the quadratic function below?

$$g(x) = x^2 - 7x - 4 \text{ (grid-in)}$$

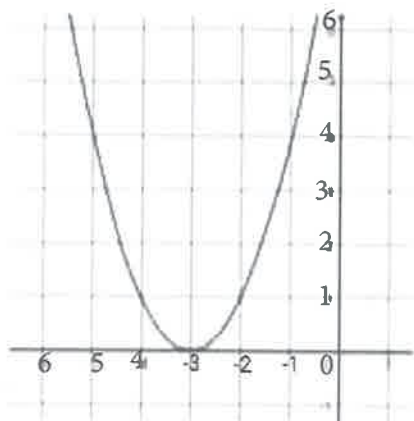
30 - SAMPLE TEST / Q 2



Which of the following is the ordinate of the vertex of the function  $f(x) = 2x^2 - 8x + 3$ ?

- A) 2
- B) 0.5
- C) -5
- D) -8

## 31 - SAMPLE TEST / Q 7



Which of the following functions represents the graph in the figure above?

- A)  $f(x) = x^2 + 3x + 9$
- B)  $f(x) = x^2 - 3x + 9$
- C)  $f(x) = x^2 + 6x + 9$
- D)  $f(x) = x^2 + 6x - 3$

## 32 - SAMPLE TEST / Q 12



Given  $f(x) = 3x^2 - 2x$ ,  
and  $g(x) = -3x$ , which  
expression is the result of  
 $(f \circ g)(-2y)$ ?

- A)  $108y^2 - 12y$
- B)  $-108y^2 + 12y$
- C)  $36y^2 - 12y$
- D)  $36y^2 - 6y$

## 33 - SAMPLE TEST / Q15



What is the product of  
the roots of the equation  
 $2x^2 + x - 10 = 0$ ?

- A) -20
- B) -5
- C) -2.5
- D) -2

## 34 - SAMPLE TEST / Q 20



Given the function  $f(x)$   
 $= x^2 - 2x + 1$ , what is the  
sum of its  $y$ -intercept(s)  
and its  $x$ -intercept(s)?

35 - JUNE 2022 ( cancelled ) / Q 11



What is the square of the ordinate of the vertex of the graph of the function  $f(x) = 3x^2 + 6x$ ?

- A. -6
- B. -2
- C. 1
- D. 9

36 - JUNE 2022 ( cancelled ) / Q 13



What is the value of  $[f(g \circ f)(1)]$  if  $f(x) = 2x^2 - 3$  and  $g(x) = 4x + 1$ ?

- A. -21
- B. -15
- C. 10
- D. 15

37 - JUNE 2022 ( cancelled ) / Q 19



What is the smallest value of the range of the function  $f(x) = 4x^2 - 2x + 1$ ?

- A.  $\frac{1}{4}$
- B.  $\frac{1}{2}$
- C.  $\frac{3}{4}$
- D. 1

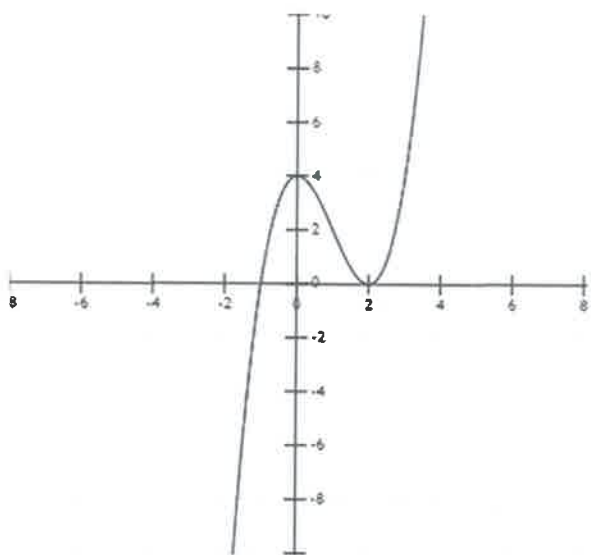
1- OCTOBER 2020 Q 5



If  $f(x) = 5 - 2x$  and  $g(x) = \frac{x^2}{4}$ , Which of the following is not in the range of  $f(g(x))$ ?

- A. -3
- B. 0
- C. 5
- D. 6

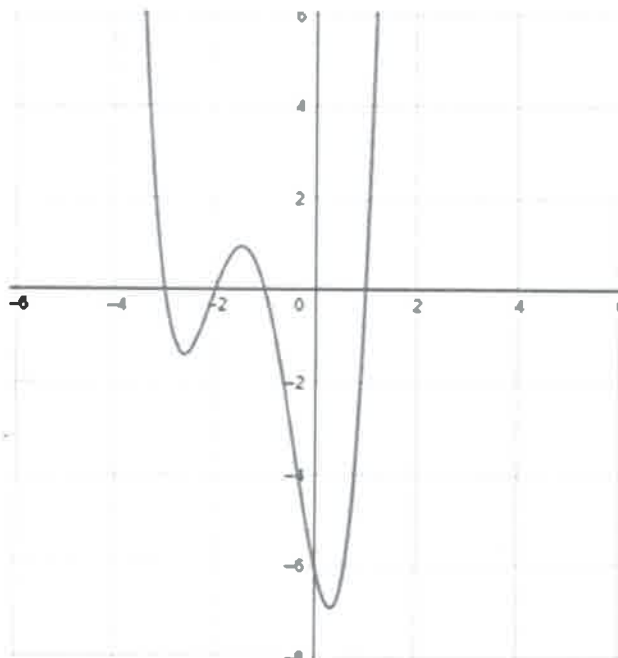
2- OCTOBER 2020 Q 22



The graph plotted above represents which of the following functions?

- A.  $f(x) = (x + 1)(x - 2)^2$
- B.  $f(x) = (x - 1)(x + 2)^2$
- C.  $f(x) = (x + 1)(x - 2)$
- D.  $f(x) = (x - 2)(x + 1)^2$

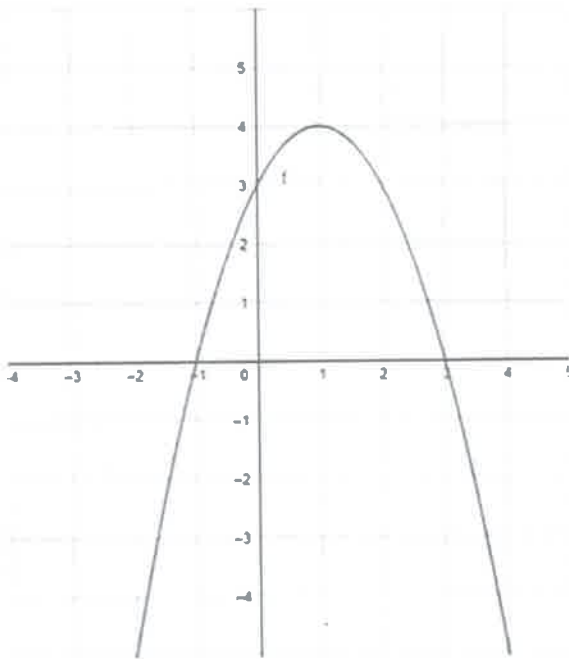
3- OCTOBER 2020 Q 24



The graph above depicts a function  $f(x)$ . How many solutions does the equation  $f(x) = 0.5$  admit?

- A. 1
- B. 2
- C. 3
- D. 4

4- OCTOBER 2020 Q 25



What is the equation of the function  $f$  graphed above?

- A.  $f(x) = (x+1)(x-3)$
- B.  $f(x) = (x-1)(x+3)$
- C.  $f(x) = -(x+1)(x-3)$
- D.  $f(x) = -(x-1)(x+3)$

5- OCTOBER 2020 Q 35



The function  $g$  is defined by  $g(x) = ax^2 - 2x - 5$  and  $g(-1) = 1$ . What is the value of  $g(2)$ ?

6- DECEMBER 2020 Q 13



John owns a drone that has a radio range of 55 meters, that is the owner can control it only if the drone is within 55 meters from him. As John launches the drone, the drone flies off a distance  $D$ , measured in meters, given by the expression  $D = 4t^2 + 20t$ , where  $t$  is the time in seconds after the drone is launched. Assuming John stays where he is, at least how many seconds after being launched, does the drone get out of range?

- A. 0 seconds
- B. 1 second
- C. 2 seconds
- D. 3 seconds

7- DECEMBER 2020 Q 14



The graph of the function  $h$  in the  $xy$ -plane contains the point  $(2, 5)$  and has a  $y$ -intercept of  $-7$ . The function  $g$  is defined by  $g(x) = 3 - 2h(x)$ . Which of the following points lie on the graph of  $g$ ?

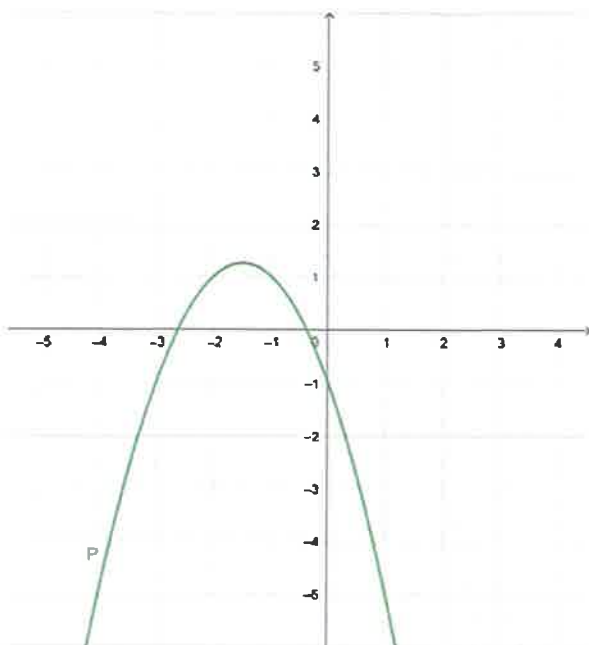
- A.  $(0, -7)$
- B.  $(2, 17)$
- C.  $(0, 17)$
- D.  $(-7, 3)$

8- DECEMBER 2020 Q 33



If  $f(x) = (2 - x)(x + 4)$  and  $g(x) = f(x - 10)$  are functions whose graphs are parabolas in an  $xy$ -plane, what is the  $y$ -coordinate of the vertex of the parabola represented by  $g$ ?

9- MARCH 2021 Q 26



The curve P above represents function  $f$  defined by  $f(x) = -x^2 + ax + b$ . What are the values of the real numbers  $a$  and  $b$ ?

- A.  $a = -1$  ;  $b = -3$
- B.  $a = -3$  ;  $b = -1$
- C.  $a = -1.5$  ;  $b = -1$
- D.  $a = -2.5$  ;  $b = -0.5$

10- MARCH 2021 Q 27



Consider the function  $f$  defined by  $f(x) = 2(x - 3)(x + 2)$ . What is the ordinate of the vertex of function  $f$ ?

- A. 2
- B. -4.5
- C. 2.5
- D. -12.5

11- MAY 2021 Q 11



If  $f(x) = \frac{2x^2 - 7x + 5}{x - 4}$  and  $g(x) = \frac{1}{3}x^2 - 7$ , what is the value of  $f[g(3)] - f(2)$ ?

- A.  $-\frac{69}{8}$
- B.  $-\frac{65}{8}$
- C.  $-\frac{61}{8}$
- D.  $-\frac{9}{2}$

12-MAY 2021 Q 16



What is the inverse function of

$$f(x) = \frac{x-2}{2x}?$$

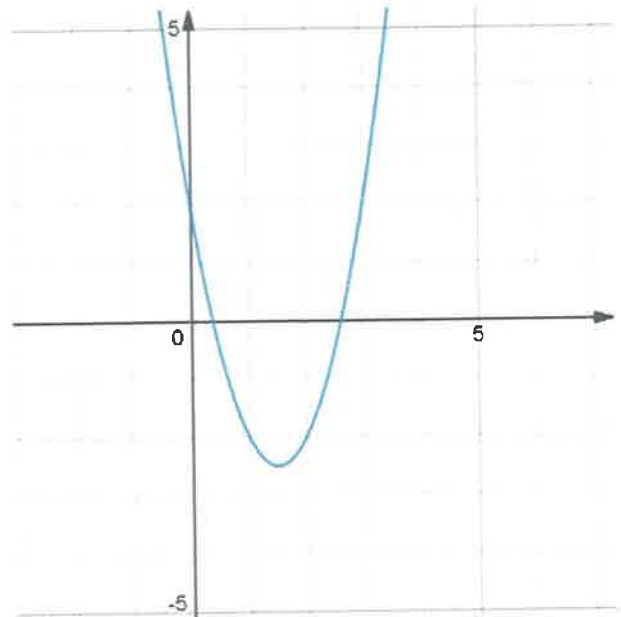
- A.  $f^{-1}(x) = \frac{2}{1-2x}$   
 B.  $f^{-1}(x) = 2 - \frac{1}{x}$   
 C.  $f^{-1}(x) = \frac{-2}{1-x}$   
 D.  $f^{-1}(x) = \frac{2}{x}$

13-MAY 2021 Q 31



If  $f(x) = -4x + 8(x - 5)$  and  $g(x) = -3x + 1$ , what is the value of  $f(2) \times g(1)$ ? (grid-in)

14-JUNE 2021 Q 3



If  $g(x) = ax^2 + bx + c$  represents the quadratic function whose graph is shown above, which of the following statements is not true?

- A.  $a > 0$   
 B.  $b > 0$   
 C.  $c > 0$   
 D.  $3a + b = 0$

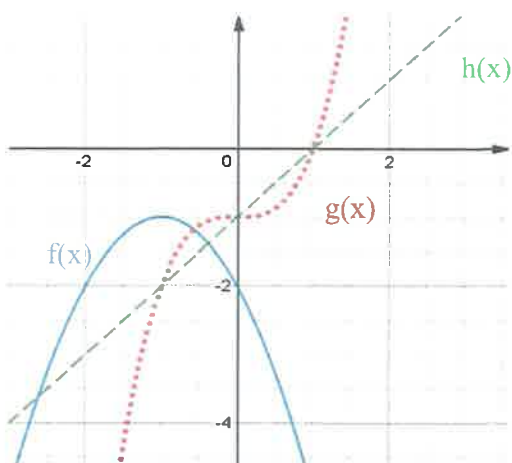
15- JUNE 2021 Q 6



If  $f(x) = -3 - 2x$  and  $g(x) = \frac{-x^2}{6}$ , Which of the following could not be in the range of  $f(g(x))$ ?

- A. -4
- B. -2
- C. 0
- D. 2

16- JUNE 2021 Q 20



Based on the graph above, what is the value of  $f(-1) + g(-1) + h(-1)$ ?

- A. -4
- B. -5
- C. -6
- D. -7

17- JUNE 2021 Q 25



The height of a launched cannonball can be described as a function of time according to the following quadratic equation:

$$h(t) = -2t^2 + 14t + 36$$

What is the maximum height attained by the cannonball?

- A. 60.5
- B. 36
- C. 9
- D. 2

18- JUNE 2021 Q 26



The height of a launched cannonball can be described as a function of time according to the following quadratic equation:

$$h(t) = -2t^2 + 14t + 36$$

After how many seconds will the cannonball hit the ground?

- A. 2
- B. 7
- C. 9
- D. 11

19-JUNE 2021 Q 32



The function  $g$  is defined by  $g(x) = 3x^2 + kx - 8$  and  $g(-2) = -4$ . What is the value of  $g(-3)$ ?

20-JUNE 2021 Q 36



$x$	-3	-2	-1	0	1	2
$p(x)$	7	4	1	-2	$-\frac{7}{5}$	-8
$q(x)$	-7	-5	-3	-1	1	3

The table above shows several values for the functions  $p(x)$  and  $q(x)$ . What is the value of  $p(q(0))$ ?

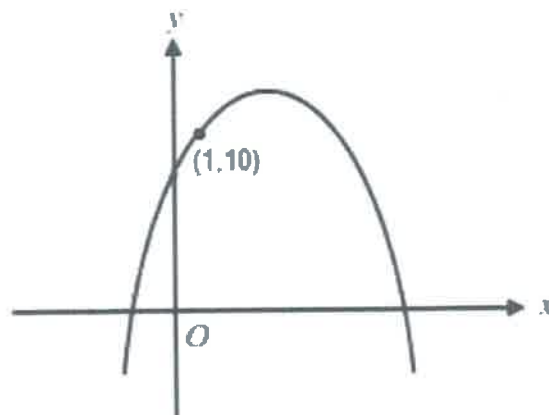
21-AUGUST 2021 Q 6



The supply function of a product is given by  $f(x) = \frac{1+x}{2}$  and the demand function of the same product is given by  $g(x) = \frac{2}{x} + 1$ , where  $x$  represents the price in dollars of the product in both functions. What is the market equilibrium of this product given that it is the point of intersection of the two curves of the two functions?

- A. 1.56
- B. 1.79
- C. 2.56
- D. 2.79

22-AUGUST 2021 Q 8



Note: Figure not drawn to scale.

The graph of  $y = tx^2 - 5tx - 6t$  is shown in the  $xy$ -plane above, where  $t$  is a constant. If the graph passes through the point  $(1, 10)$ , which of the following is the maximum value of  $y$ ?

- A. 2.5
- B. 10
- C. 11.75
- D. 12.25

23-JUNE 2022 (cancelled) / Q 32



If  $h(x) = 2x - 3g(x)$ , and  
 $g(x) = 3x + 7$ , what is the value of  
 $h(-4)$ ?

- a. -5
- b. -23
- c. 7
- d. 23

24-OCTOBER 2021 Q 5



What is the vertex form of the  
 function  $f(x) = 3x^2 - 9x + 1$  ?

- A.  $f(x) = 3\left(x - \frac{3}{2}\right)^2 - \frac{23}{4}$
- B.  $f(x) = 3\left(x - \frac{3}{2}\right)^2 + \frac{23}{4}$
- C.  $f(x) = 3\left(x + \frac{3}{2}\right)^2 - \frac{23}{4}$
- D.  $f(x) = 3\left(x + \frac{3}{2}\right)^2 + \frac{23}{4}$

25-OCTOBER 2021 Q 21



Which quadratic function has its  
 graph passing through the points  
 $(3, 0)$ ,  $(-2, 0)$ , and  $(1, 7)$  ?

- A.  $f(x) = \frac{7}{6}x^2 + \frac{7}{6}x + 7$
- B.  $f(x) = -\frac{7}{6}x^2 + \frac{7}{6}x + 7$
- C.  $f(x) = -\frac{7}{6}x^2 - \frac{7}{6}x + 7$
- D.  $f(x) = \frac{7}{6}x^2 - \frac{7}{6}x + 7$

26-MARCH 2021 Q 3



$$y \leq -10x + 2000$$

$$y \leq 5x$$

In the  $xy$ -plane, if a point with  
 coordinates  $(a, b)$  lies in the solution set  
 of the system of inequalities above, what  
 is the maximum possible value of  $b$ ?

- A.  $\frac{400}{3}$
- B.  $\frac{2000}{3}$
- C. 400
- D. 550

27-DECEMBER 2021 Q23



The math teacher asked four of her  
 students to draw the function  $f(x) =$   
 $\frac{2}{x-1}$  in the  $xy$ -plane and to write only  
 one piece of information from their  
 obtained curves. The table below  
 shows the results.

Maya	The curve admits a center of symmetry of coordinates $(1, 0)$ .
Tarek	The curve admits two vertices.
Mirna	The curve admits an asymptote of equation $y = 1$ .
Albert	The range of the function is $\mathbb{R}$ .

Which student could be right?

- A. Maya
- B. Tarek
- C. Mirna
- D. Albert

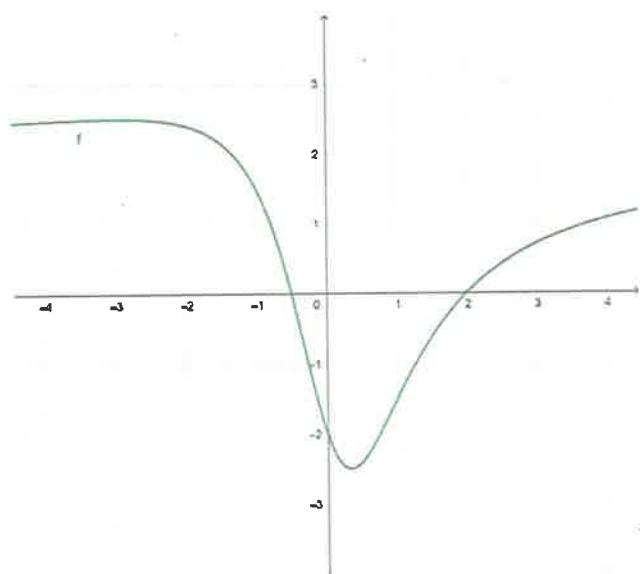
28- DECEMBER 2021 Q 25



If  $f(x) = x^2 + 3$  and  $h(x) = x \cdot f(x) + 3x$ , what is  $h(-1)$ ?

- A. 1
- B. -7
- C. -5
- D. -4

29- DECEMBER 2021 Q 26



The curve above represents the curve of function  $f$  defined over  $\mathbb{R}$ .

What is the solution of  $0 \leq f(x) \leq 2$ ?

- A.  $[-\frac{4}{3}, -0.5] \cup [2, +\infty[$
- B.  $[-2, -1] \cup [0, +\infty[$
- C.  $[-2.5, -0.5]$
- D.  $[-\frac{4}{3}, -0.5] \cup [-2, +\infty[$

30 - MARCH 2022 / Q 11



If  $f(x) = \frac{1}{x} - x$  and  $g(x) = f(2x)$ , what is the value of  $g(-3)$ ?

- A.  $\frac{35}{6}$
- B.  $\frac{15}{14}$
- C.  $\frac{5}{7}$
- D.  $\frac{-4}{7}$

31 - MARCH 2022 / Q 16



What is the inverse function of  $f(x) = \frac{2x+3}{3x+5}$ ?

- A.  $f^{-1}(x) = \frac{-5x-3}{-3x-2}$
- B.  $f^{-1}(x) = \frac{-3x-5}{-3x-2}$
- C.  $f^{-1}(x) = \frac{-5x+3}{3x-2}$
- D.  $f^{-1}(x) = \frac{+3x+5}{+3x+2}$

## 32 - SAMPLE TEST / Q 1



If  $g(x) = -3x^2 + 3x - 5$ ,  
and  $h(x) = \frac{1}{2}x^2 - 4$ , what is  
the value of  $|g(1) - 2h(-2)|$   
?

- A) -1
- B) 1
- C) 5
- D) 7

## 33 - SAMPLE TEST / Q 3



A line and a parabola are  
defined respectively by the  
equations  $y = -2x + 4$  and  
 $y = x^2 - 4x + 5$ . If they  
intersect, at what point(s)  
do they meet ?

- A) They intersect at (1,2)  
and at (2,1)
- B) They intersect at (2,1)
- C) They intersect at (1,2)
- D) They do not intersect

## 34 - SAMPLE TEST / Q 35



Given  $g(y) = \frac{729}{64y^3}$ , what  
will be the value of  $y$  if  $g(y) =$   
27 ?

## 35 - SAMPLE TEST / Q 36



$$F(x) = 4x^2 - 24x + 99$$

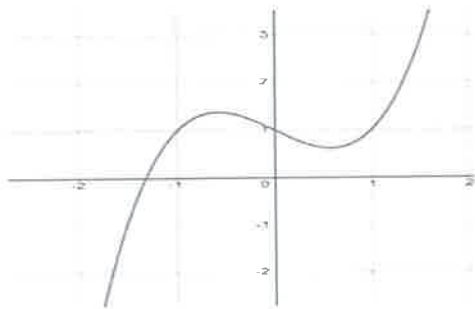
The function above represents  
the costs " $F$ " of creating a LED  
folding eye lamp " $x$ " by a small  
company per day. What is the  
minimum the company pays per  
week to produce these lamps ?

36 - JUNE 2022 (cancelled) / Q 13

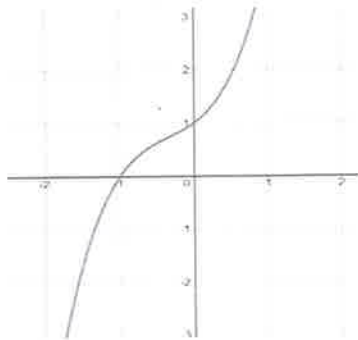


Which of the following represents the graph of the function  $f(x) = x^3 + x + 1$ ?

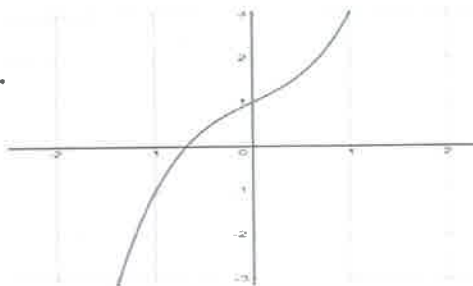
A.



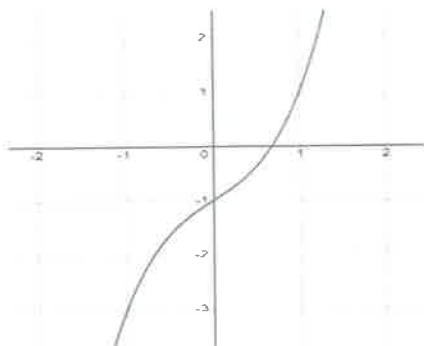
B.



C.



D.



37 - JUNE 2022 (cancelled) / Q 14



What is the range  $R$  of the function  $f(x) = \frac{2}{x+2}$ ?

- A.  $R = (-\infty, 0] \cup [0, +\infty)$
- B.  $R = (-\infty, 0) \cup (0, +\infty)$
- C.  $R = (-\infty, -2) \cup (-2, +\infty)$
- D.  $R = (-\infty, -2] \cup [2, +\infty)$

38 - JUNE 2022 (cancelled) / Q 19



If  $f(x) = 3x - 4(2x + 7)$  and  $g(x) = 4(-2x + 1)$ , what is the value of  $\frac{f(-1)}{g(3)}$ ?

- A.  $-\frac{43}{4}$
- B.  $-\frac{23}{20}$
- C.  $\frac{23}{20}$
- D.  $\frac{43}{4}$

39 - JUNE 2022 (cancelled) / Q 24



Which of the following equations represents the graph of a quadratic function that passes through points  $(2, 5)$ ,  $(3, 0)$ , and  $(-4, 0)$ ?

- A.  $y = -\frac{5}{6}x^2 + \frac{5}{6}x + 10$
- B.  $y = -\frac{5}{6}x^2 - \frac{5}{6}x + 10$
- C.  $y = \frac{5}{6}x^2 + \frac{5}{6}x + 10$
- D.  $y = \frac{5}{6}x^2 - \frac{5}{6}x + 1$

40 - JUNE 2022 (cancelled) / Q 25



Given that  $h(t) = \frac{2t+1}{5t^2}$  ( $t \neq 0$ ),  
what is the negative value of  $t$  if  
 $h(t) = 3$ ?

- A. -0.5
- B. -0.4
- C. -0.3
- D. -0.2

## ANSWERS OF LESSON ( FUNCTION )

### NON CALCULATOR



Q	Answer	Q	Answer
1	B	30	C
2	B	31	C
3	4	32	A
4	A	33	B
5	B	34	2
6	A	35	D
7	A	36	D
8	D	37	C
9	D		
10	D		
11	210		
12	3		
13	A		
14	D		
15	33		
16	B		
17	A		
18	B		
19	D		
20	B		
21	C		
22	C		
23	1		
24	3		
25	D		
26	B		
27	2.5 OR 5/2		
28	2		
29	3.5 OR 7/2		

### CALCULATOR



Q	Answer	Q	Answer
1	D	30	A
2	A	31	C
3	D	32	B
4	C	33	C
5	7	34	3/4
6	C	35	441
7	C	36	C
8	9	37	B
9	B	38	C
10	D	39	B
11	A	40	D
12	A		
13	64		
14	B		
15	A		
16	B		
17	A		
18	C		
19	7		
20	1		
21	C		
22	D		
23	C		
24	A		
25	B		
26	B		
27	A		
28	B		
29	A		

# Polynomial

## Function

$$3x^2 - 2xy + c$$

The diagram illustrates the components of the polynomial  $3x^2 - 2xy + c$  with annotations:

- The coefficient **3** is highlighted in green, with a green arrow pointing to it from the number **2** above.
- The exponent **2** on  $x$  is highlighted in blue, with a blue arrow pointing to it from the number **1** above.
- The coefficient **2** is highlighted in green, with a green arrow pointing to it from the number **2** above.
- Red brackets below the terms indicate coefficients: **3** for  $3x^2$ , **3** for  $-2xy$ , and **5** for  $+c$ .
- Blue arrows point upwards from the numbers **3** and **5** to the minus sign and plus sign, respectively.

## 1-OCTOBER 2020 Q 12



$$y = \frac{x^3 - 3x^2 + 2x - 1}{x - 3}$$

Which of the following expressions is equivalent to  $y$ ?

- A.  $y = x^2 + 2 + \frac{5}{x-3}$   
 B.  $y = x^2 - 2x + 2 + \frac{3}{x-3}$   
 C.  $y = x^2 - 3 - \frac{8}{x-3}$   
 D.  $y = x^2 + 2$

## 2-DECEMBER 2020 Q 2



$$9x^2 + 18x - 3 = 0$$

What is the average (arithmetic mean) of the two solutions of the equation given above?

- A. -1  
 B.  $-\frac{1}{6}$   
 C.  $\frac{1+\sqrt{2}}{2}$   
 D.  $\sqrt{2}$

## 3-MARCH 2021 Q 8



If  $y = \frac{x^2 - 3}{x + 2}$ ,  $x \neq -2$ , then  $y = x - m + \frac{1}{x+2}$  for  $m =$

- A. -2  
 B. -1  
 C. 1  
 D. 2

## 4-MAY 2021 Q 18



The function  $h(x) = x^2 - ax - 3$  has zeros at  $x = 3$  and  $x = -1$ . What is the value of  $a$ ? (grid-in)

## 5-JUNE 2021 Q 14



$$\frac{-6x^2 + 5x + 2}{2x + 1}$$

Which of the following is equivalent to the above expression?

- A.  $-3x + 4 - \frac{2}{2x+1}$   
 B.  $-3x + 4 + \frac{2}{2x+1}$   
 C.  $-3x - \frac{2}{2x+1}$   
 D.  $-3x + 4$

## 6-AUGUST 2021 Q 14



$$25x^2 - tx + 4 = (5x - 2)(ax + b)$$

In the equation above,  $a$ ,  $b$  and  $t$  are constant numbers.

What is the value of  $t$ ?

- A. 5
- B. -2
- C. 20
- D. -15

## 7-AUGUST 2021 Q 19



$$P(x) = (3a - 6)x^2 + (4 - 2b)x + c - 3$$

In the polynomial  $P$  above,  $a$ ,  $b$  and  $c$  are constant numbers.

If  $P$  is identically zero, what is the value of  $a + b + c$ ?

## 8-OCTOBER 2021 Q 18



The function  $y = 2x^2 + dx - 1$  has zero at  $x = -2$ . What is the value of  $d$ ? (Grid-in)

## 9-DECEMBER 2021 Q10



For what values of  $a$  and  $b$  will the equation  $x^2 + ax = b$  have the solutions 1 and  $-1$ ?

- A.  $a = 1$ ;  $b = 1$
- B.  $a = 0$ ;  $b = 1$
- C.  $a = 0$ ;  $b = -1$
- D.  $a = 1$ ;  $b = 0$

## 10-DECEMBER 2021 Q12



What is the coefficient of  $x^3$  when  $\frac{2}{5}x^3 + 2x^2 - 3$  is multiplied by  $5x + \frac{2}{5}$ ?

- A. 10
- B.  $\frac{4}{25}$
- C.  $\frac{54}{5}$
- D.  $\frac{254}{25}$

## 1-OCTOBER 2020 Q 36



What is the remainder of the division of  $k(x) = 3x^3 + 8x^2 - 2x - 7$  by  $x+2$ ?

## 2-OCTOBER 2020 Q 37



$$x^2 - 2mx = -9$$

What is the minimum positive integer value of  $m$  that allows the above equation to have two real solutions?

## 3-MARCH 2021 Q 3



$$\begin{aligned} y &\leq -10x + 2000 \\ y &\leq 5x \end{aligned}$$

In the  $xy$ -plane, if a point with coordinates  $(a, b)$  lies in the solution set of the system of inequalities above, what is the maximum possible value of  $b$ ?

- A.  $\frac{400}{3}$
- B.  $\frac{2000}{3}$
- C. 400
- D. 550

## 4-MARCH 2021 Q37



In the polynomial function  $P(x) = 3x^3 + (a - 1)x + 7$ , what is the value of the constant number  $a$  if  $-1$  is a root of  $P$ ?

## 5-MAY 2021 Q 26



For what values of  $x$  is  $f(x) = \frac{2x^2 - 3}{(x - 3)(2x + 5)}$  undefined?

- A.  $x = 2.5$  and  $x = 3$
- B.  $x = -2.5$  and  $x = -3$
- C.  $x = 2.5$  and  $x = -3$
- D.  $x = -2.5$  and  $x = 3$

## 6-JUNE 2021 Q 12



$$(4x + 1)^2 - 9x^2 = 0$$

What is the absolute value of the difference between the two roots of the above equation?

- A.  $\frac{8}{65}$
- B.  $\frac{6}{7}$
- C.  $\frac{1}{4}$
- D.  $\frac{3}{14}$

**7-JUNE 2021 Q 33**

What is the remainder of the division of  $P(x) = 4x^3 - x^2 - 8x + 6$  by  $x - 1$ ?

**8-OCTOBER 2021 Q 27**

What is twice the remainder of the division of  $(2x^3 - 1 + 3x^2)$  by  $(2x - 3)$ ?

- A. 4.5
- B. 12.5
- C. 25
- D. 26

## ANSWERS OF LESSON ( POLYNOMIAL FUNCTION )

NON CALCULATOR



Question	Answer
1	A
2	A
3	D
4	2
5	A
6	C
7	7
8	7/2 OR 3.5
9	B
10	D
11	
12	
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CALCULATOR



Question	Answer
1	5
2	4
3	B
4	5
5	D
6	B
7	1
8	C
9	
10	
11	
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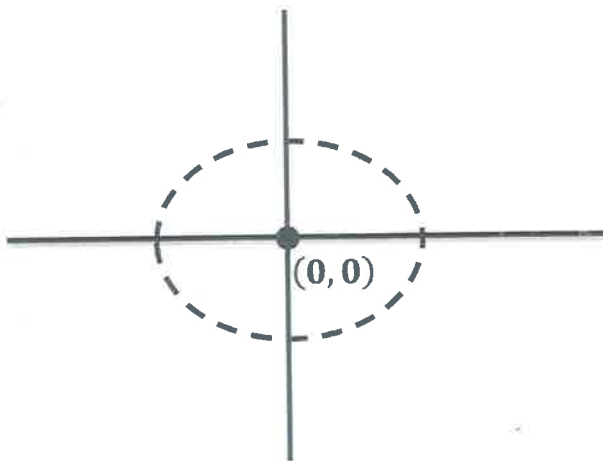
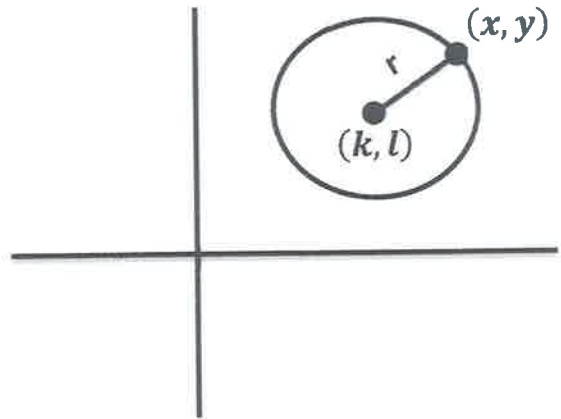
# Equation Of Circle

$$E = mc^2$$



Equation of circle with center  $(k, l)$  ?

$$(x - k)^2 + (y - l)^2 = r^2$$



Equation of circle at  $(0, 0)$  ?

$$x^2 + y^2 = r^2$$



**General Formula of Equation of circle**

$$1x^2 + 1y^2 + ax + by = c$$

**Center**

$$\left( \frac{-a}{2}, \frac{-b}{2} \right)$$

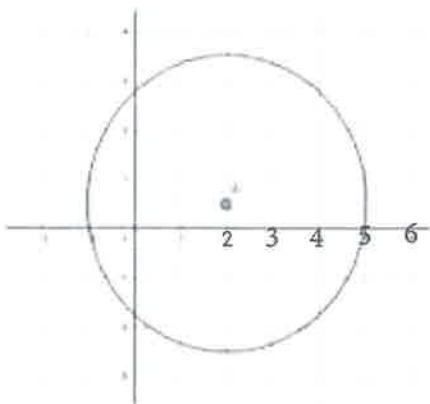
**Radius**

$$r = \sqrt{\left(\frac{a}{2}\right)^2 + \left(\frac{b}{2}\right)^2 + c}$$

# *Questions*



## 1 - SAMPLE TEST / Q 13



The graph above shows a circle of center A. Which of the following is the equation of the circle?

- A)  $(x + 2)^2 + (y + \frac{1}{2})^2 = 9$
- B)  $(x + 2)^2 + (y + \frac{1}{2})^2 = 3$
- C)  $(x - 2)^2 + (y - \frac{1}{2})^2 = 9$
- D)  $(x - 2)^2 + (y - \frac{1}{2})^2 = 3$

## 2- Sample Question

In the  $xy$ -plane, a circle has center  $(0, 0)$  and radius 2. Which of the following is an equation of this circle?

- A)  $2x^2 + y^2 = 0$
- B)  $x^2 + y^2 = 4$
- C)  $(x + 2)^2 + (y + 2)^2 = 0$
- D)  $(x + 2)^2 + (y + 2)^2 = 4$

## 3- Sample Question

$$x^2 + y^2 - 2y = 3$$

Which of the following coordinate points is the center of the circle represented by the equation above?

- A)  $(0, -1)$
- B)  $(0, 2)$
- C)  $(1, 0)$
- D)  $(0, 1)$



#### 4- Sample Question

The graph in the  $xy$ -plane of the equation  $(x+1)^2 + (y-4)^2 = 25$  is a circle. What is the diameter of the circle?

#### 5- Sample Question

$$(x-5)^2 + (y+2)^2 = 3$$

Which of the following describes the graph in the  $xy$ -plane of the equation above?

- A) A circle
- B) A line
- C) A parabola
- D) A square

#### 6- Sample Question

In the  $xy$ -plane, the circle with radius 5 and center

$(8, 3)$  contains the point  $(w, 0)$ . What is one possible value of  $w$ ?

#### 7- Sample Question

In the  $xy$ -plane, the points  $(2, 4)$  and  $(-2, -4)$  are the endpoints of a diameter of a circle. Which of the following is an equation of the circle?

- A.  $(x-2)^2 + (y+4)^2 = 80$
- B.  $(x-2)^2 + (y+4)^2 = 20$
- C.  $x^2 + y^2 = 80$
- D.  $x^2 + y^2 = 20$

1- OCTOBER 2020 Q3



What is the area of the sector defined by a central angle of  $54^\circ$  in the circle of equation  $x^2 + y^2 - 8x + 12y - 12 = 0$ ?

- A.  $15\pi$
- B.  $9.6\pi$
- C.  $5.4\pi$
- D.  $2.4\pi$

2- DECEMBER 2020 Q 29



In the  $xy$ -plane, A is the point of coordinates (3,6) and B is the point of coordinates (3,10). If C is the circle of diameter  $\overline{AB}$ , which of the following is the equation of C?

- A.  $(x - 3)^2 + (y - 8)^2 = 16$
- B.  $(x - 3)^2 + (y + 8)^2 = 4$
- C.  $(x + 3)^2 + (y + 8)^2 = 16$
- D.  $(x - 3)^2 + (y - 8)^2 = 4$

3- MARCH 2021 Q 38



In the  $xy$ -plane, let  $x^2 + y^2 - 2kx + 4y - 3k^2 = 0$  be the equation of a circle of center  $A\left(\frac{1}{2}, -2\right)$  and radius  $r = \sqrt{5}$ . What is the value of the real number  $k$ ?

4- AUGUST 2021 Q 30



$$x^2 + y^2 - 6x - 4y + 9 = 0$$

The equation above is an equation of a circle. Which of the lines represented by the equations below is tangent to this circle?

- A.  $y = \frac{1}{3}x - \frac{1}{3}$
- B.  $y = x$
- C.  $y = 3$
- D.  $x = 5$

## 5- Sample question



In the  $xy$ -plane, the graph of  $2x^2 - 6x + 2y^2 + 2y = 45$  is a circle. What is the radius of the circle?

- A) 5
- B) 6.5
- C) 40
- D) 50

## 6- Sample question



$$(x - 6)^2 + (y + 5)^2 = 16$$

In the  $xy$ -plane, the graph of the equation above is a circle. Point  $P$  is on the circle and has coordinates  $(10, -5)$ . If  $\overline{PQ}$  is a diameter of the circle, what are the coordinates of point  $Q$ ?

- A)  $(2, -5)$
- B)  $(6, -1)$
- C)  $(6, -5)$
- D)  $(6, -9)$

## 7- Sample question



A circle in the  $xy$ -plane has equation  $(x + 3)^2 + (y - 1)^2 = 25$ . Which of the following points does NOT lie in the interior of the circle?

- A)  $(-7, 3)$
- B)  $(-3, 1)$
- C)  $(0, 0)$
- D)  $(3, 2)$

## 8- Sample question



A circle in the  $xy$ -plane has a diameter with endpoints  $(-1, -3)$  and  $(7, 3)$ . If the point  $(0, b)$  lies on the circle and  $b > 0$ , what is the value of  $b$ ?

## 9- Sample question



A circle in the  $xy$ -plane has a center of  $(-6, -8)$ , and the origin lies on the circle. Which of the following is an equation for the circle?

- A)  $(x + 6)^2 + (y + 8)^2 = 100$
- B)  $(x + 6)^2 + (y + 8)^2 = 10$
- C)  $(x - 6)^2 + (y - 8)^2 = 100$
- D)  $(x - 6)^2 + (y - 8)^2 = 10$

## 10- Sample question



If the equations of the two diameters of a circle are  $x - y = 5$  and  $2x + y = 4$  and the radius of the circle is 5 find the equation of the circle.

- A)  $x^2 + y^2 + 6x - 4y + 8 = 0$
- B)  $x^2 + y^2 - 6x + 4y - 12 = 0$
- C)  $x^2 + y^2 + 10x + 8 = 0$
- D)  $x^2 + y^2 - 10y + 8 = 0$

## 11- Sample question



Equation of tangent to the circle

$$x^2 + y^2 - 6x - 4y + 5 = 0$$

which make an angle of  $45^\circ$

with  $x$ -axis is

- A)  $y = x - 7$
- B)  $y = x - 4$
- C)  $y = x + 3$
- D)  $y = -x + 3$

## ANSWERS OF LESSON ( EQUATION OF CIRCLE )

**NON CALCULATOR**



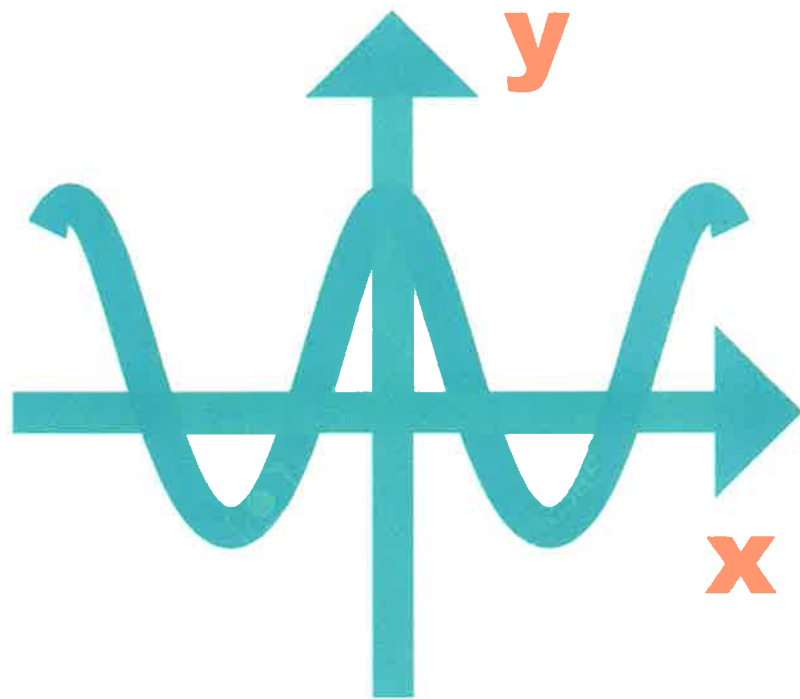
Question	Answer
1	C
2	B
3	D
4	10
5	A
6	4
7	D
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**CALCULATOR**

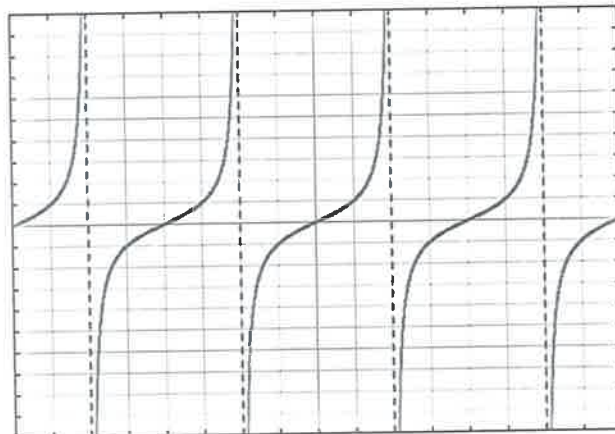
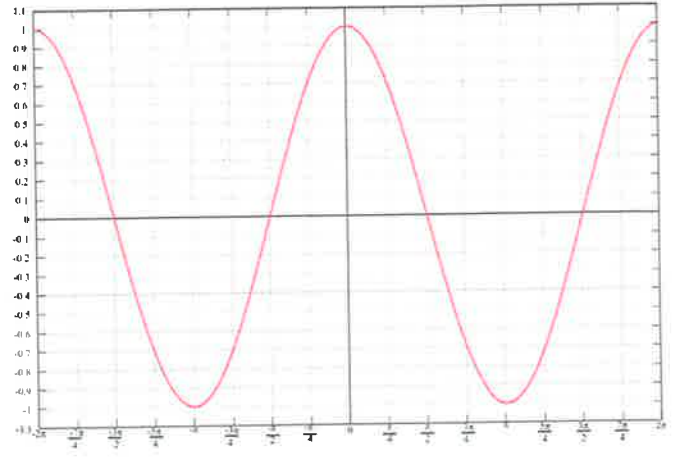
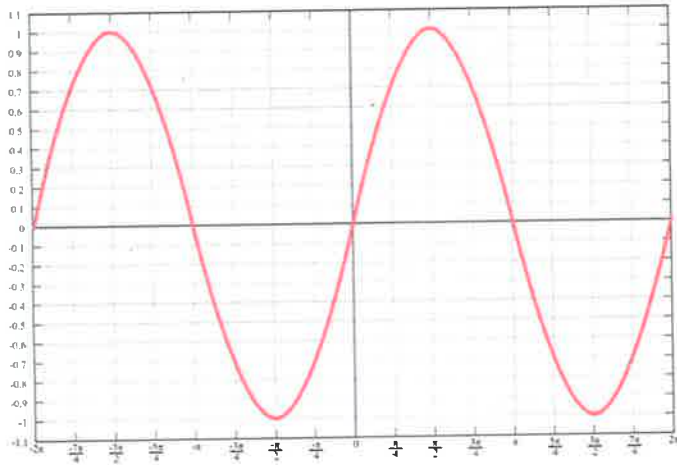
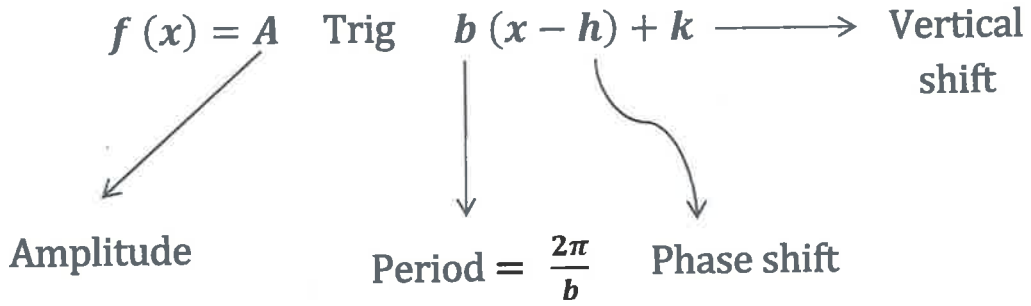


Question	Answer
1	B
2	D
3	0.5
4	D
5	A
6	A
7	C
8	B
9	A
10	A
11	D
12	D
13	A
14	B
15	D
16	
17	
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19	
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# Trigonometric Function



# Trigonometric Function



	Amplitude	Period	Phase shift	Vertical shift	Range
$y = a \sin b(x - h) + k$	$ a $	$\frac{2\pi}{ b }$	$h$	$k$	$k - a < r < k + a$
$y = a \cos b(x - h) + k$	$ a $	$\frac{2\pi}{ b }$	$h$	$k$	$k - a < r < k + a$
$y = a \tan b(x - h) + k$	Unedified	$\frac{\pi}{ b }$	$h$	$k$	$-\infty < r < \infty$

# *Questions*



1- MARCH 2021 Q 29



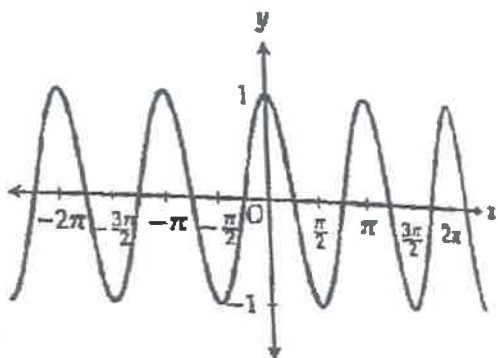
Which of the following statements is true?

- A. The amplitude of  $f(t) = -2 \sin(2t) + 2$  is 1.
- B. The period of  $g(t) = \frac{-1}{2} \cos(2t)$  is  $\pi$ .
- C. The period of  $h(t) = 3 \tan(2t)$  is  $\frac{\pi}{4}$ .
- D. The amplitude of  $k(t) = -3 \tan t$  is  $-3$ .

2- sample test



The graph of  $y = \cos 2x$  is shown in the standard  $(x, y)$  coordinate plane below. What is the period of  $\cos 2x$ ?



- A.  $\frac{\pi}{2}$
- B.  $\pi$
- C.  $\frac{3\pi}{2}$
- D.  $2\pi$

3- sample test



What is the amplitude of the function defined by  $y = \frac{1}{3} \sin(2x + 1)$ ?

- A.  $\frac{1}{3}$
- B.  $\frac{1}{2}$
- C.  $\frac{2}{3}$
- D. 2

4- sample test



What is the range of the function defined by  $y = 3 \cos(\pi x)$  in the standard  $(x, y)$  coordinate plane?

- A.  $-6\pi \leq y \leq 6\pi$
- B.  $-3\pi \leq y \leq 3\pi$
- C.  $-\pi \leq y \leq \pi$
- D.  $-3 \leq y \leq 3$

5- sample test



What is the equation for a cosine graph with an amplitude of five and a vertical shift of three?

- A.  $5 \cos(x) + 3$
- B.  $3 \cos(x) + 5$
- C.  $5 \cos(3x)$
- D.  $3 \cos(x + 5)$

6- sample test



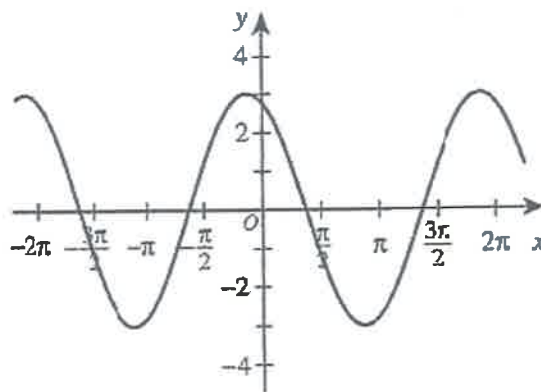
Compared to the original equation,  $y = \cos x$ , the amplitude and period of the new equation,  $y = \cos(x - 2) + 2$ , are:

- (A) both doubled
- (B) both unchanged
- (C) amplitude doubled, period halved
- (D) amplitude halved, period doubled

7- sample test



The graph of  $y = 3 \sin(x + 2)$  is shown in the standard  $(x,y)$  coordinate plane below. What is the maximum value of this function?

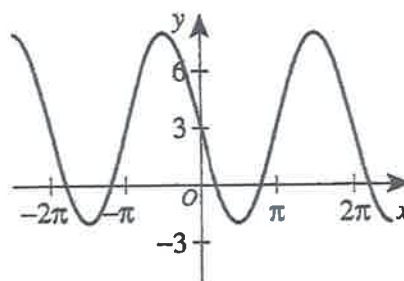


- A. 2
- B. 3
- C. 6
- D.  $\pi$

8- sample test



The graph of  $y = 3 - 5 \sin(x - \pi)$  is shown in the standard  $(x,y)$  coordinate plane below. What is the range of  $y$ ?



- F.  $-5 \leq y \leq 5$
- G.  $-2 \leq y \leq 2$
- H.  $-2 \leq y \leq 8$
- J.  $3 \leq y \leq 8$

9- sample test



What is the amplitude of the function

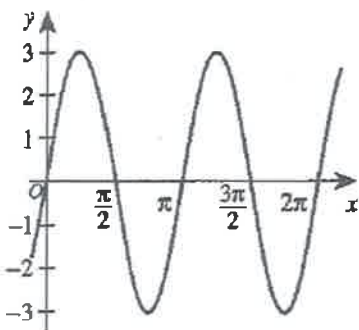
$$f(x) = \frac{1}{2} \cos(3x + \pi) ?$$

- A.  $\frac{1}{3}$
- B.  $\frac{1}{2}$
- C.  $\frac{3}{2}$
- D. 2

10-sample test



The graph of the function  $y = 3 \sin(2x)$  is shown below in the standard  $(x,y)$  coordinate plane. What are the amplitude and the period of the function?

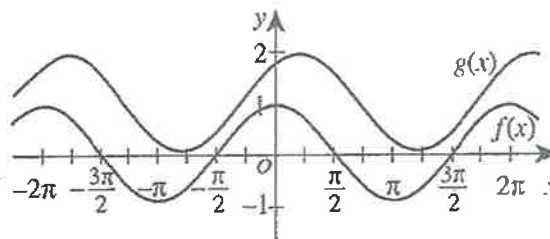


- |    | amplitude | period |
|----|-----------|--------|
| A. | 3         | $\pi$  |
| B. | 3         | $2\pi$ |
| C. | 6         | $\pi$  |
| D. | 6         | $2\pi$ |

11-sample test



The graphs of  $f(x) = \cos x$  and  $g(x) = \cos\left(x - \frac{\pi}{4}\right) + 1$  are shown in the standard  $(x,y)$  coordinate plane below. After one of the following pairs of transformations is applied to the graph of  $f(x)$ , the image of the graph of  $f(x)$  is the graph of  $g(x)$ . Which pair is it?



- A. Shift  $f(x)$  1 unit left and  $\frac{\pi}{4}$  units down.
- B. Shift  $f(x)$  1 unit left and  $\frac{\pi}{4}$  units up.
- C. Shift  $f(x)$  1 unit right and  $\frac{\pi}{4}$  units down.
- D. Shift  $f(x)$   $\frac{\pi}{4}$  units right and 1 unit up.

12-sample test



In the standard  $(x,y)$  coordinate plane, what is the range of the function defined by the equation  $y = 3 \sin(2x)$ ?

- F.  $-\pi \leq y \leq \pi$
- G.  $-2\pi \leq y \leq 2\pi$
- H.  $-2 \leq y \leq 2$
- J.  $-3 \leq y \leq 3$

**13- sample test**

Which of the following trigonometric functions has an amplitude of 2?

(Note: The *amplitude* of a trigonometric function is  $\frac{1}{2}$  the nonnegative difference between the maximum and minimum values of the function.)

F.  $f(x) = 2 \sin x$

G.  $f(x) = 2 \tan x$

H.  $f(x) = \sin\left(\frac{1}{2}x\right)$

J.  $f(x) = \cos 2x$

**14- sample test**

The domain of the function  $y(x) = 3 \cos(5x - 4) + 1$  is all real numbers. Which of the following is the range of the function  $y(x)$ ?

- A.  $-3 \leq y(x) \leq 3$
- B.  $-4 \leq y(x) \leq 3$
- C.  $-4 \leq y(x) \leq 2$
- D.  $-2 \leq y(x) \leq 4$

## ANSWERS OF LESSON ( TRIGONOMETRIC FUNCTION )

NON CALCULATOR



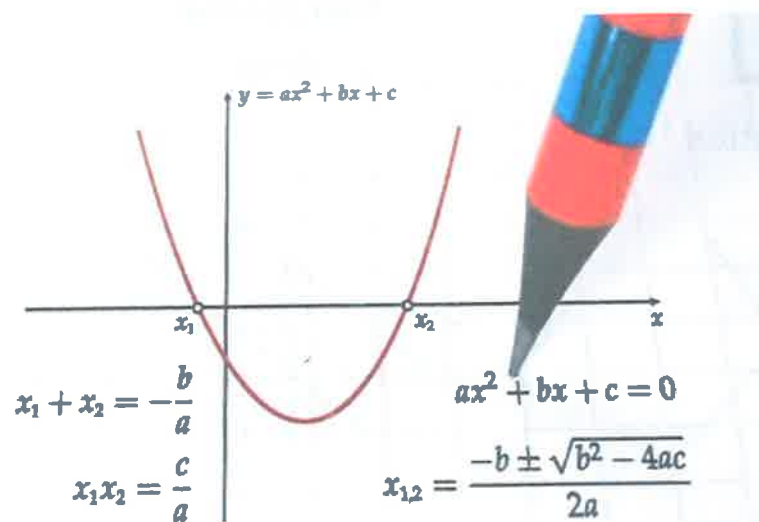
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CALCULATOR



Question	Answer
1	B
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4	D
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6	B
7	B
8	H
9	B
10	A
11	D
12	J
13	F
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# Solution



**Solution for Lines**

$$\begin{aligned} a_1x + b_1y &= c_1 \\ a_2x + b_2y &= c_2 \end{aligned}$$

**Solution for lines**

$m = \text{slope}$   
 $b = y - \text{int}$

$$ax + by = c$$

To Find

$$\text{slope} = \frac{-a}{b}$$

$$y - \text{int} = \frac{c}{b}$$

$$x - \text{int} = \frac{c}{a}$$

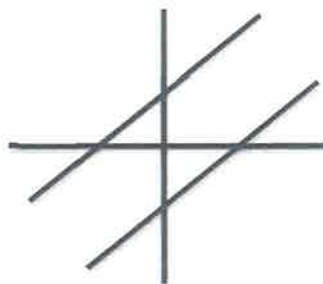
**One solution**



$$m_1 \neq m_2$$

$$\frac{a_1}{a_2} \neq \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$$

**No solution  
two parallel  
lines**



$$m_1 = m_2$$

$$b_1 \neq b_2$$

$$\frac{a_1}{a_2} = \frac{b_1}{b_2}$$

**Infinity many  
solutions  
Same Lines**

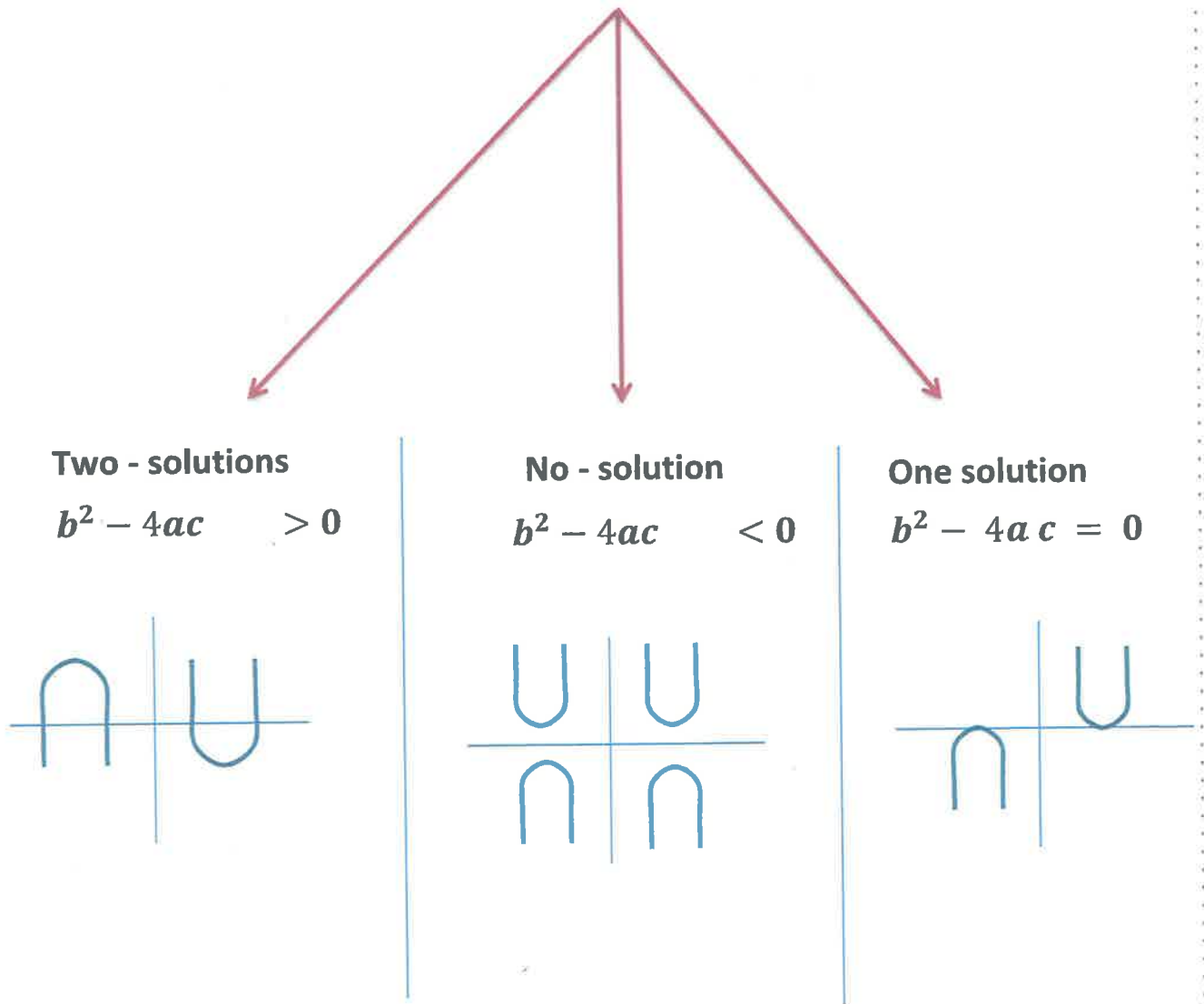


$$m_1 = m_2$$

$$b_1 = b_2$$

$$\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$$

## Solution for parabola

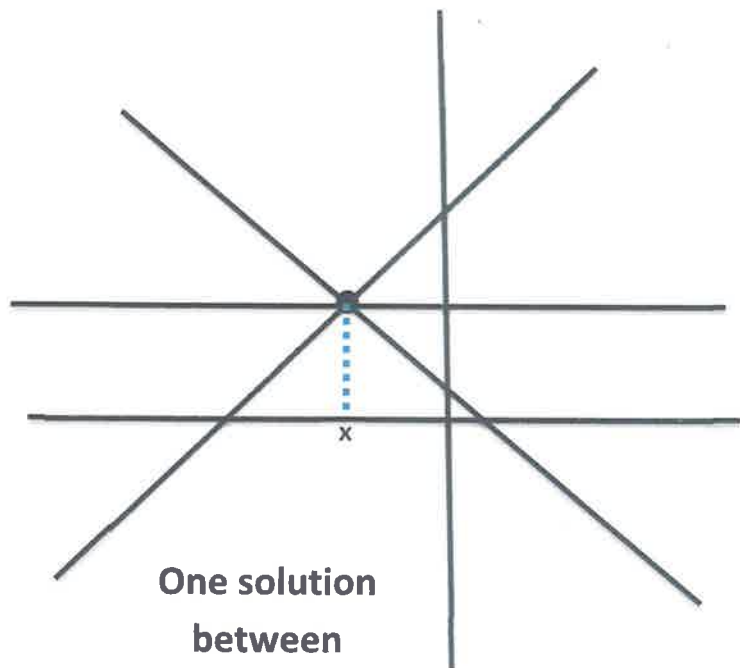
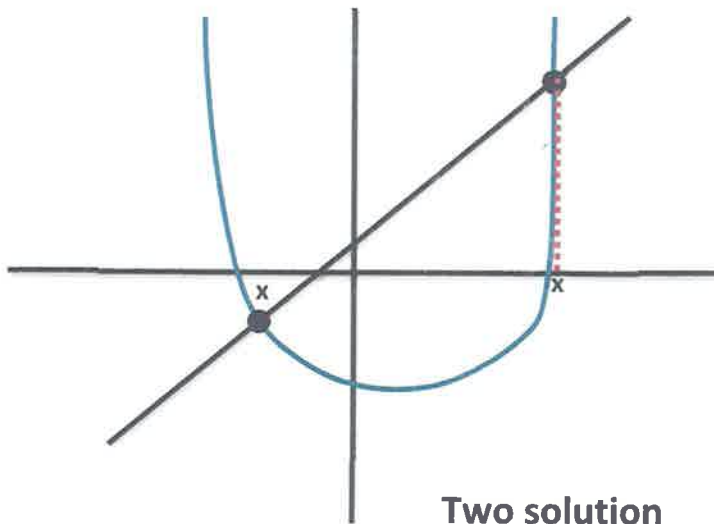


$$\text{Sum of solution} = \frac{-b}{a}$$

$$\text{Product of solution} = \frac{c}{a}$$

# System of Solution

It is the intersection point between two graphs or more



**X** Coordinate of the point of intersection is the solution

# *Questions*



1- DECEMBER 2020 Q 10



$$ax - \frac{1}{2}y = c$$

$$2x + 4y = 5$$

The system of equations above has infinitely many solutions. If  $a$  and  $c$  are constants, what is the value of  $c$ ?

- A.  $-\frac{5}{8}$
- B.  $\frac{1}{4}$
- C.  $\frac{5}{4}$
- D.  $\frac{11}{4}$

2- MARCH 2021 Q 19



For what value of  $b$  does the equation  $ba^2 + 2a - 3 = 0$  have a single real solution for  $a$ ?

(Grid in)

3- AUGUST 2021 Q12



If  $m$  is a real parameter different than zero, what is the number of the real roots of the equation  $2x(x^2 + 4)(mx^2 + x - m) = 0$ ?

- A. 1
- B. 2
- C. 3
- D.  $>3$

4- AUGUST 2021 Q 13



$$\sqrt{x^2 + 3} = x - 5$$

Which of the following could be a solution for the equation above?

- A. 0
- B. 2.2
- C. 5
- D. None of the above

5 - AUGUST 2021 Q 20



$$\sqrt{x^2 - 5x + 8} = 2$$

What is the product of the two solutions of the equation above?

6 - OCTOBER 2021 Q 17



What is the product of the solutions of the equation  $x^2 - 3x = -2$  ?  
(Grid-in)

7 - MARCH 2022 / Q 10



If  $3 - 8x + 5x^2 = 0$ , which of the following is a solution for  $x$ ?

- A. 0
- B. 2
- C. -1
- D. 1

8 - SAMPLE TEST / Q 15



What is the product of the roots of the equation  $2x^2 + x - 10 = 0$  ?

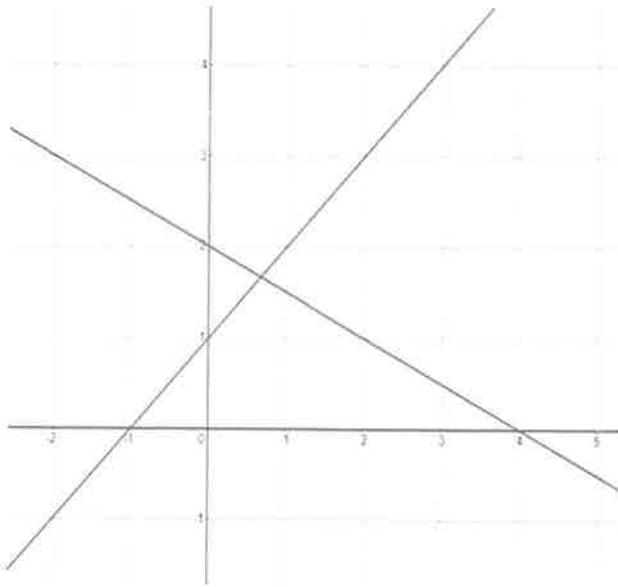
A) -20

B) -5

C) -2.5

D) -2

9 - JUNE 2022 ( cancelled ) / Q 12



Which of the systems of equations below is being represented in the graph above?

- A.  $\begin{cases} x + 2y = 4 \\ x - y = 1 \end{cases}$
- B.  $\begin{cases} x + 2y = 4 \\ -x + y = 1 \end{cases}$
- C.  $\begin{cases} x - 2y = 4 \\ x - y = 1 \end{cases}$
- D.  $\begin{cases} x - 2y = 4 \\ -x + y = 1 \end{cases}$

10 - JUNE 2022 ( cancelled ) / Q 15



What is triple the square root of the discriminant of the equation  $4x^2 - 5(x + 3) = -6$ ?

- A. 13
- B. 26
- C. 39
- D.  $13\sqrt{3}$

1- OCTOBER 2020 Q 21



$$\begin{cases} \frac{2}{5}x - \frac{1}{3}y = 7 \\ -\frac{m}{10}x + \frac{5}{6}y = 3 \end{cases}$$

If the system of linear equations above admits no solutions, and  $m$  is an integer, what is the value of  $m$ ?

- A. -2
- B. 10
- C. 6
- D. -10

2- MARCH 2021 Q 5



When a system of two linear equations has no solution, how do the graphs of the equations appear?

- A. The lines intersect at a single point.
- B. The lines have the same  $x$ -intercept.
- C. The lines are parallel.
- D. The lines are confounded.

3- MAY 2021 Q 1



Which of the following is a point of intersection between the line with equation  $y = 3x + 9$  and the parabola with the equation  $y = 2x^2 + 3x + 1$ ?

- A. (2, 3)
- B. (2, 15)
- C. (-2, 15)
- D. (-2, 2)

4- MAY 2021 Q 8



What is the sum of the solutions of  $(a - 1)(a^2 + 8a + 15) = 0$ ?

- A. 8
- B. 7
- C. -7
- D. -8

5- MAY 2021 Q 12



What is the product of the solutions of  $2x^4 = 4x^2 + 6$ ?

- A.  $3i$
- B.  $0$
- C.  $-3i$
- D.  $-3$

6- JUNE 2021 Q 1



$$\frac{6(x-1)+4}{3} - \frac{3-(5-4x)}{2} = 0$$

What is the value of  $x$  that satisfies the equation?

- A.  $-\frac{2}{5}$
- B.  $-\frac{3}{7}$
- C. There is no value of  $x$  for which the equation is true.
- D. There are infinitely many values of  $x$  for which the equation is true.

7- JUNE 2021 Q 9



$$\begin{cases} 2x + 15y = 18 \\ kx - 5y = -7 \end{cases}$$

What is the value of  $k$  if the above system of simultaneous equations admits no solutions?

- A.  $-\frac{1}{3}$
- B.  $-6$
- C.  $-\frac{2}{3}$
- D.  $\frac{2}{3}$

8- OCTOBER 2021 Q 19



Which of the following systems has infinite number of solutions?

- A.  $\begin{cases} 2x - 3y = 1 \\ x + 3y = 4 \end{cases}$
- B.  $\begin{cases} -2x + y = -1 \\ 5y = -2x \end{cases}$
- C.  $\begin{cases} 3x + y = 2 \\ x = -5y \end{cases}$
- D.  $\begin{cases} -2x - 2y = 4 \\ y = -x - 2 \end{cases}$

## 9 - MARCH 2022 / Q 1



Which of the following is a point of intersection between the line with the equation  $y = 3x + 2$  and the parabola with the equation  $y = 4x^2 - 9x + 11$ ?

- A. (3.5 ; 3)
- B. (4 ; 14)
- C. (-2 ; -4)
- D. (1.5 ; 6.5)

## 10 - MARCH 2022 / Q 8



What is the product of the solutions of  $x^3 - 4x^2 - 7x + 10 = 0$ ?

- A. -10
- B. -12
- C. 14
- D. 5

## 11 - MARCH 2022 / Q 18



If the graph of  $y = ax^2 + 5x + c$  has x-intercepts at 1 and 3, what is the value of  $a + c$ ?

- A. 5
- B. -3
- C. 8
- D. -5

## 12 - SAMPLE TEST / Q 9



If  $f(3) = 16$ , and  $f(-3) = 40$ , which of the following represents the function  $f$ ?

- A)  $f(x) = 2x^2 - 2x + 4$
- B)  $f(x) = 2x^2 + 1$
- C)  $f(x) = -x^2 + 7x + 4$
- D)  $f(x) = 3x^2 - 4x + 1$

## 13 - SAMPLE TEST / Q 20



What is the square of the sum of the reciprocals of the solutions of  $6x^2 + 7x - 20 = 0$ ?

- A) 0.12
- B) 0.28
- C) 1.36
- D) 14.69

## ANSWERS OF LESSON ( SOLUTION )

### NON CALCULATOR



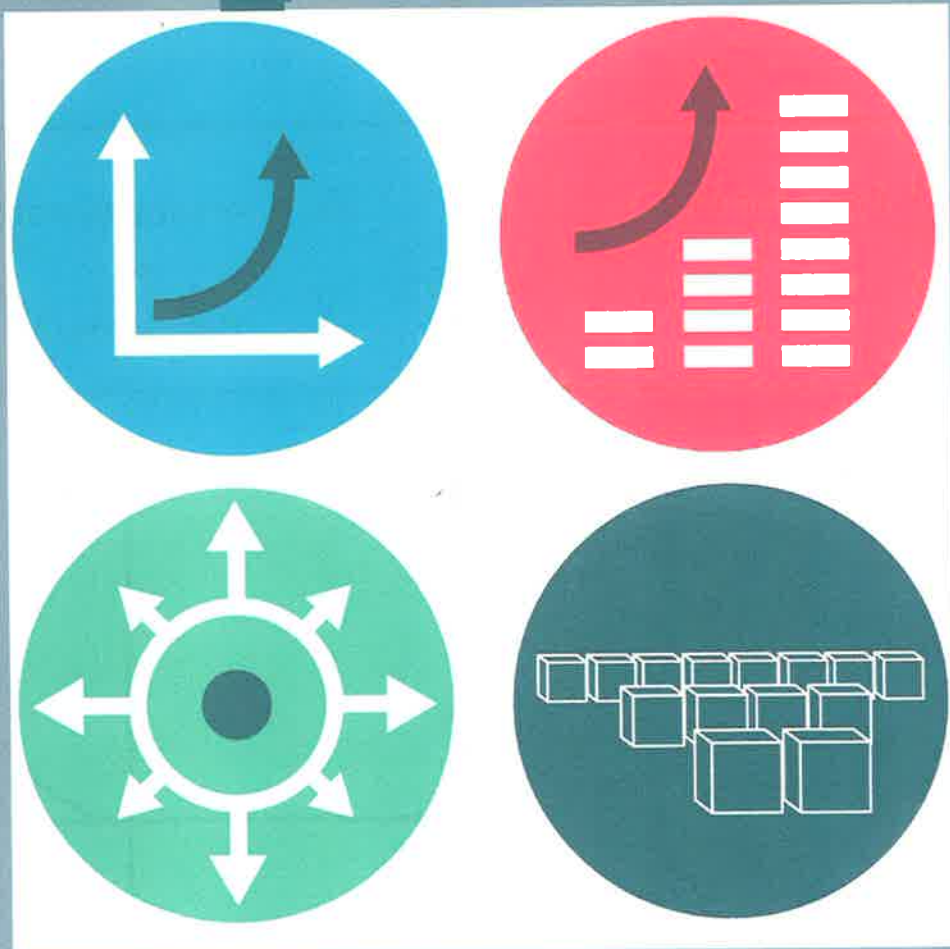
Question	Answer
1	A
2	ZERO
3	C
4	D
5	4
6	2
7	D
8	B
9	B
10	C
11	
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### CALCULATOR



Question	Answer
1	B
2	C
3	B
4	C
5	D
6	C
7	C
8	D
9	D
10	A
11	D
12	D
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# Linear *AND* Exponential



**Linear function**

$y = m x + b$

↓                      ↘

Constant      Initial  
increase      amount  
of decrease

**Exponential function**

$y = a (r)^t$

↓                      ↓

Initial                      Rate of  
change

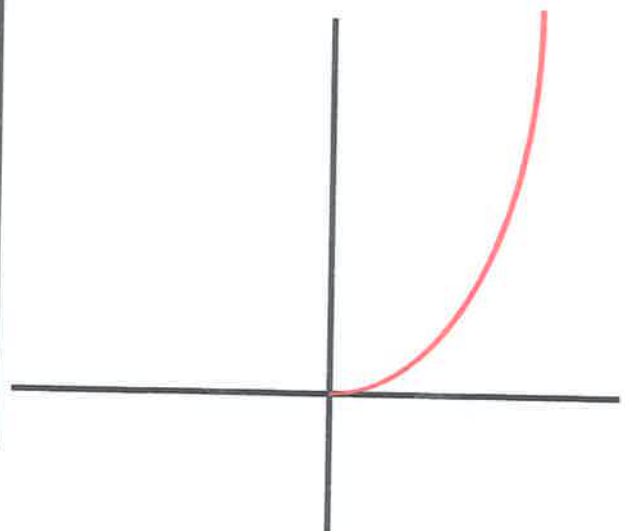
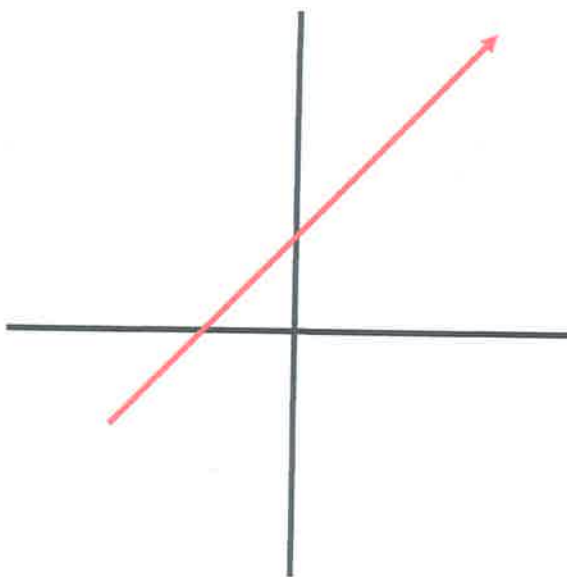
$a > 1$        $0 < a < 1$

Increase      Decrease  
grow              decay

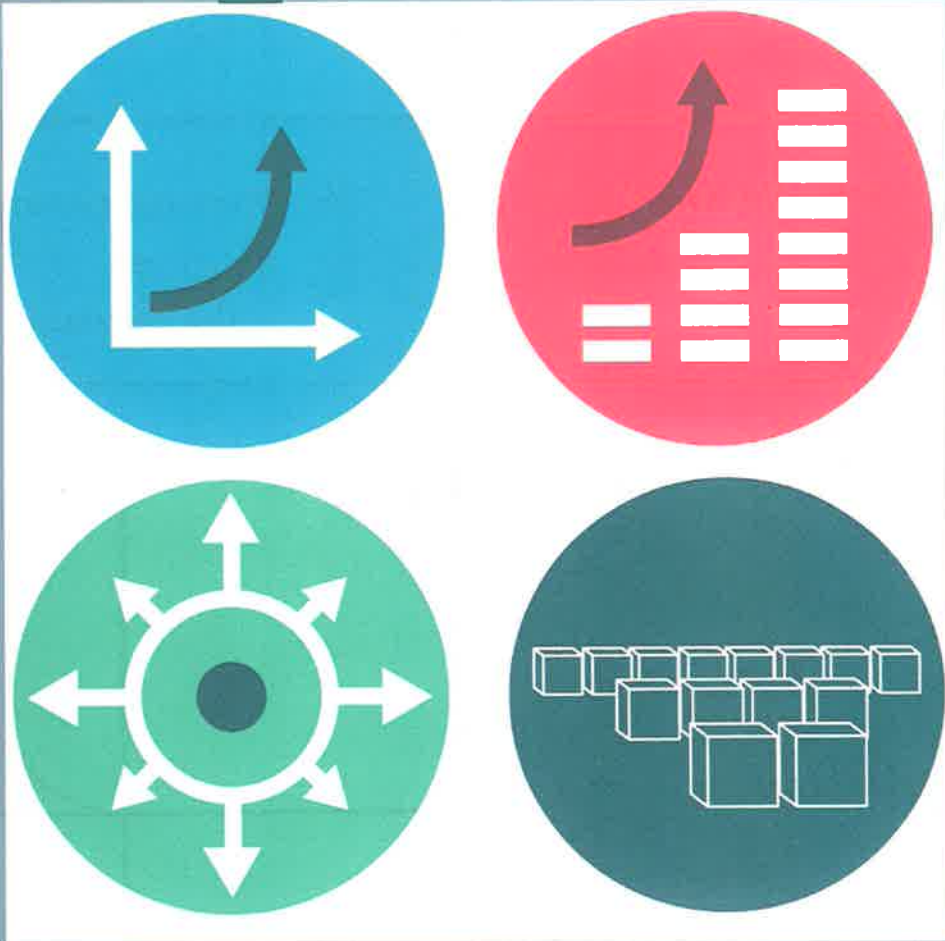
Non-Constant  
decay or grow

% From the initial

% From the current  
or  
the pervious



# Linear *AND* Exponential



# *Questions*



1- OCTOBER 2020 Q 15



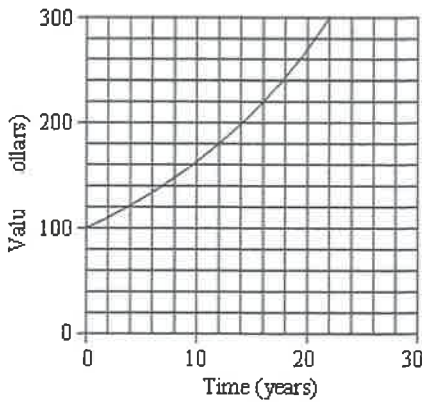
In 2017, the number of people who had access to the internet in a country was 3.2 million. If this number grows at a rate of 18% each year, which expression best describes the number of people  $y$ , in million, having access to the internet  $x$  years after 2017?

- A.  $y = 0.18x + 32$
- B.  $y = 1.18x + 32$
- C.  $y = 3.2(0.18)^x$
- D.  $y = 3.2(1.18)^x$

2- Sample test



The graph shown models the value, in dollars, of an investment account over time, in years, after an original amount is deposited.



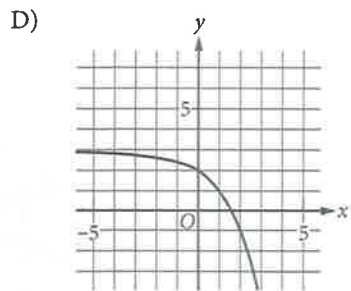
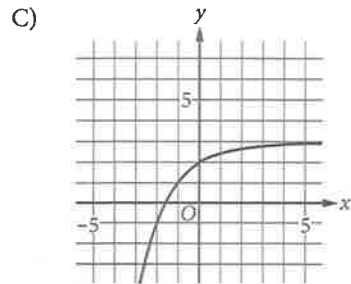
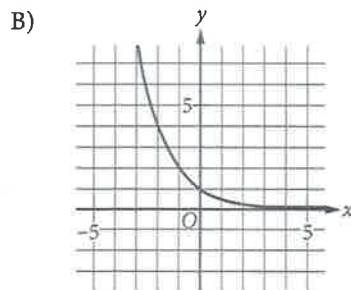
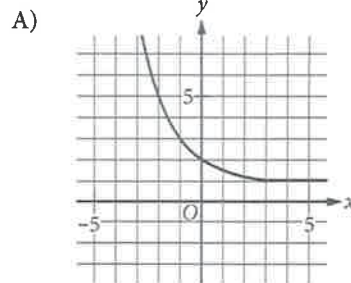
According to the graph, how many year does it take for the value of the investment account to double?

- A) 2
- B) 3
- C) 7
- D) 14

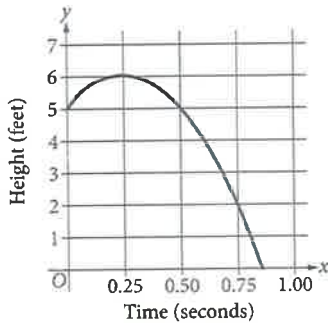
3- Sample test -



What is the graph of the equation  $y = 2^{-x} + 1$ ?



## -4 Sample test -



The graph shown models the height  $y$ , in feet, of a volleyball  $x$  seconds after it was hit by a player. Which equation represents the relationship between the height of the volleyball and the time since the volleyball was hit?

- A)  $y = -16x^2 + 5$
- B)  $y = -16(x - 5)^2$
- C)  $y = -16(x - 0.86)^2$
- D)  $y = -16(x - 0.25)^2 + 6$

## 1- DECEMBER 2020 Q 12



In a certain village, the number of people doubles every three months. If there were 120 people in the village in March, which of the following equations should be solved to find when the population reaches 1500 assuming no deaths occur? ( $m$  represents the number of months)

- A.  $120(2)^{\frac{m}{3}} = 1500$
- B.  $120(2)^{3m} = 1500$
- C.  $2(120)^{\frac{m}{3}} = 1500$
- D.  $1500(2)^{\frac{m}{3}} = 120$

## 2- Sample test



The population of a city was approximately 300,000 one year and 330,000 the next year. Using these data, Maia modeled the population of the city for a 10-year period with an exponential function of the form  $y = ab^t$ , where  $a$  and  $b$  are constants and  $t$  is the number of years after the start of the 10-year period. Which of the following statements best characterizes the change in population that her model predicts?

- A) The model predicts an increase of 30,000 people every year during the 10-year period.
- B) The model predicts an increase of 330,000 people at the end of the 10-year period.
- C) The model predicts a 10% increase over the prior year's population every year during the 10-year period.
- D) The model predicts a 100% increase over the initial population at the end of the 10-year period.

3- Sample test



The wholesale price of a kilogram of lentils decreased by 1% from the previous month for six consecutive months. If  $x$  is the number of months since the price began to drop and  $y$  is the cost of a kilogram of lentils, which of the following equations could model the cost of lentils over this time period?

- A)  $y = 0.99x + 1.65$
- B)  $y = 1.01x + 1.65$
- C)  $y = 1.65(0.99)^x$
- D)  $y = 1.65(1.01)^x$

4- Sample test



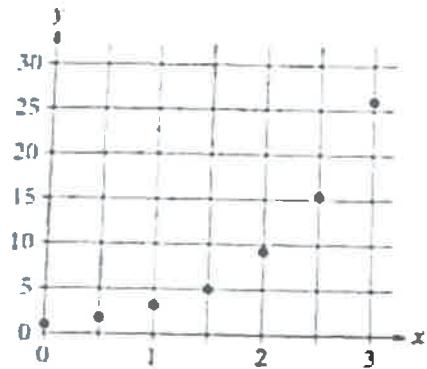
Karolina observed bacteria in a liquid culture and recorded the number of bacteria,  $N$ , every two hours. Her data are shown in the table below.

time (hours)	$N$
0	7,740
2	10,290
4	13,690
6	18,200
8	24,200
10	32,180

According to Karolina's data, which of the following best describes the relationship between the number of bacteria and time during this 10-hour period?

- A) The number of bacteria is decreasing exponentially with time.
- B) The number of bacteria is increasing exponentially with time.
- C) The number of bacteria is decreasing linearly with time.
- D) The number of bacteria is increasing linearly with time.

5- Sample test



Which of the following exponential equations best models the data shown?

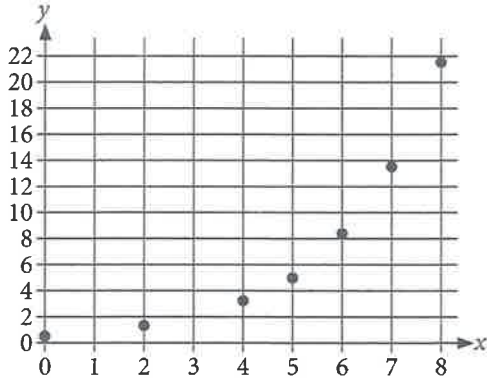
- A)  $y = 2^{-x}$
- B)  $y = 2^x$
- C)  $y = 3^{-x}$
- D)  $y = 3^x$

6- Sample test



A microbiologist is growing mammalian cells in a liquid culture. At the beginning of each day, there are twice as many cells in the culture as there were at the beginning of the preceding day. If there are 100 cells at the beginning of day 1, how many cells will be in the culture at the beginning of day 6?

7- Sample test



Of the following, which best models the data in the scatterplot shown?

- A)  $y = 1.6(0.5)^x$
- B)  $y = 1.6(1.5)^x$
- C)  $y = 0.5(0.6)^x$
- D)  $y = 0.5(1.6)^x$

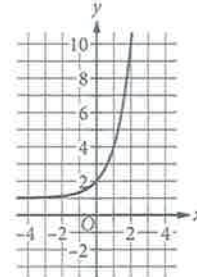
8- Sample test



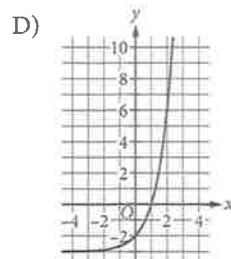
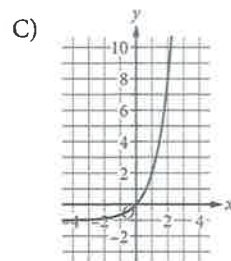
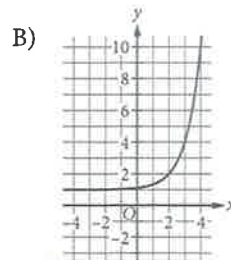
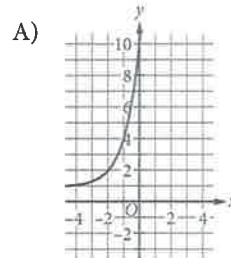
During an experiment, the number of phytoplankton in a population doubled each day. There were 300 phytoplankton at the start of the experiment. Which function represents the population size,  $P(x)$ ,  $x$  days after the start of the experiment ?

- A)  $P(x) = 2^{300x}$
- B)  $P(x) = 300^{2x}$
- C)  $P(x) = 2(300)^x$
- D)  $P(x) = 300(2)^x$

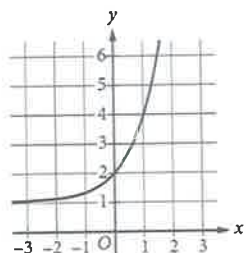
9- Sample test



The graph of  $y = f(x)$  is shown. What is the graph of  $y = f(x) - 2$  ?



## 10- Sample test



The graph of  $y=f(x)+1$  is shown. Which equation defines the function  $f$ ?

- A)  $f(x) = 2^x$
- B)  $f(x) = 3^x$
- C)  $f(x) = 2^x + 1$
- D)  $f(x) = 3^x + 2$

## 11- Sample test



The original value of a car is \$22,000, and it is estimated that each year the value of the car will depreciate by approximately 8.5% from the previous year. Which type of function best models the relationship between time and the value of the car?

- A) Linear function whose graph has a positive slope
- B) Linear function whose graph has a negative slope
- C) Quadratic function
- D) Exponential function

## 12- Sample test



Ms. Keaton wants to invest her money in an account that will double the amount of money in the account every eight years. Which type of function best models the relationship between the amount of money in the account and the number of eight-year time periods?

- A) Exponential growth
- B) Exponential decay
- C) Increasing linear
- D) Decreasing linear

## 13- Sample test



Which of the following describes an exponential relationship between the pair of variables listed?

- A) For every 3-millimeter increase  $m$  in the thickness of a piece of glass, the intensity of light  $I$  traveling through the glass decreases by 20%.
- B) Each second  $s$ , a car's speed  $C$  decreases at a constant rate of 10 meters per second.
- C) With every 33-foot increase in depth  $d$  below the surface of water, the pressure  $p$  on an object increases by 14.7 pounds per square inch.
- D) The depth  $d$  of water remaining in a reservoir decreases by 15 inches each minute  $m$  as the water is being pumped out at a constant rate.

## 14- Sample test



The population of squirrels in a park has been doubling every 15 years. Which of the following statements describes the type of function that best models the relationship between the population of squirrels in the park and the number of 15-year time periods?

- A) Exponential growth, because the population of squirrels is increasing by the same amount each 15-year time period
- B) Exponential growth, because the population of squirrels is increasing by the same percentage each 15-year time period
- C) Linear growth, because the population of squirrels is increasing by the same amount each 15-year time period
- D) Linear growth, because the population of squirrels is increasing by the same percentage each 15-year time period

## 15- Sample test



Of the following four types of savings account plans, which option would yield exponential growth of the money in the account?

- A) Each successive year, 2% of the initial savings is added to the value of the account.
- B) Each successive year, 1.5% of the initial savings and \$100 is added to the value of the account.
- C) Each successive year, 1% of the current value is added to the value of the account.
- D) Each successive year, \$100 is added to the value of the account.

## 16- Sample test



The population of mosquitoes in a swamp is estimated over the course of twenty weeks, as shown in the table.

Time (weeks)	Population
0	100
5	1,000
10	10,000
15	100,000
20	1,000,000

Which of the following best describes the relationship between time and the estimated population of mosquitoes during the twenty weeks?

- A) Increasing linear
- B) Decreasing linear
- C) Exponential growth
- D) Exponential decay

## ANSWERS OF LESSON ( LINEAR EXPONENTIAL )

NON CALCULATOR



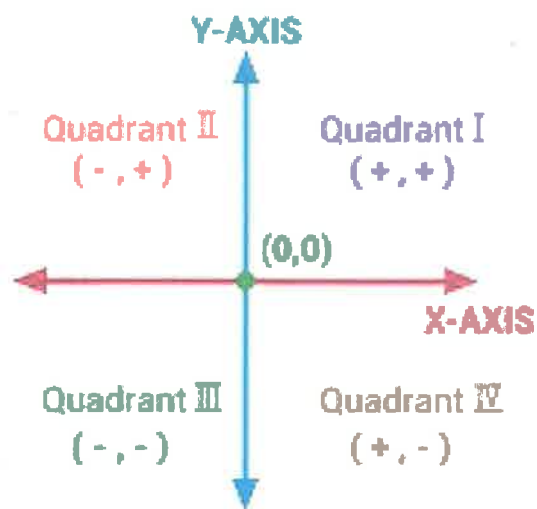
Question	Answer
1	D
2	D
3	A
4	D
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CALCULATOR



Question	Answer
1	A
2	C
3	C
4	B
5	D
6	3200
7	D
8	D
9	C
10	B
11	D
12	A
13	A
14	B
15	C
16	C
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# Coordinate Word Problem



**Coordinate Word Problem****Slope:**

- 1 – Rate of change.
- 2 – Rate of increase or decrease.
- 3 – Increase or decrease per unit.
- 4 – The constant increase or decrease.
- 5 – Change in  $y$  per unit  $x$

**Y – intercept**

- 1 – Initial point.
- 2 – The value of  $y$  of  $x = 0$ .
- 3 – Starting point.
- 4 – Zero point.
- 5 – Fixed fees .....
- 6 – Starting fees.
- 7 – Starting each period.

**X – intercept**

- 1 – The value of  $x$  at  $y = 0$ .
- 2 – The value of  $x$  at then  $y$  not found.

# *Questions*



**Coordinate Word Problem****Slope:**

- 1 – Rate of change.
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- 3 – Increase or decrease per unit.
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- 7 – Starting each period.

**X – intercept**

- 1 – The value of  $x$  at  $y = 0$ .
- 2 – The value of  $x$  at then  $y$  not found.

## 1- DECEMBER 2021 Q4



Questions 4 and 5 refer to the same information

$$g = 12 - \frac{m}{20}$$

Ibrahim fills up the gas tank of his car before going on a trip. The equation above models the amount of gas  $g$ , in gallons, remaining in Ibrahim's car after he has driven  $m$  kilometers.

How many gallons of gas can Ibrahim's tank hold?

- A. 20
- B. 8
- C. 12
- D. 11.95

## 2- DECEMBER 2021 Q 5



Questions 4 and 5 refer to the same information

$$g = 12 - \frac{m}{20}$$

Ibrahim fills up the gas tank of his car before going on a trip. The equation above models the amount of gas  $g$ , in gallons, remaining in Ibrahim's car after he has driven  $m$  kilometers.

What does 20 represent in the equation above?

- A. Ibrahim's tank can hold 20 gallons of gas.
- B. Ibrahim's car can travel 20 kilometers on 12 gallons of gas.
- C. Ibrahim uses 20 gallons of gas per kilometer.
- D. Ibrahim's car can travel 20 kilometers to the gallon.

## 3 - MARCH 2022 / Q 15



Starting at sunrise, the temperature rose 1.5 degrees Celsius every hour. After 10 hours, the temperature was 40 degrees Celsius. Which of the following models the temperature  $y$ , in Celsius, after  $x$  hours from sunrise?

- A.  $y - 40 = 1.5(x - 10)$
- B.  $y - 10 = 10(x + 1.5)$
- C.  $y - 10 = 1.5(x - 40)$
- D.  $y - 1.5 = 10(x + 40)$

## 4- Sample test



$$2,000 - 61k = 48$$

In 1962, the population of a bird species was 2,000. The population  $k$  years after 1962 was 48, and  $k$  satisfies the equation above. Which of the following is the best interpretation of the number 61 in this context?

- A. The population  $k$  years after 1962
- B. The value of  $k$  when the population was 48
- C. The difference between the population in 1962 and the population  $k$  years after 1962
- D. The average decrease in the population per year from 1962 to  $k$  years after 1962

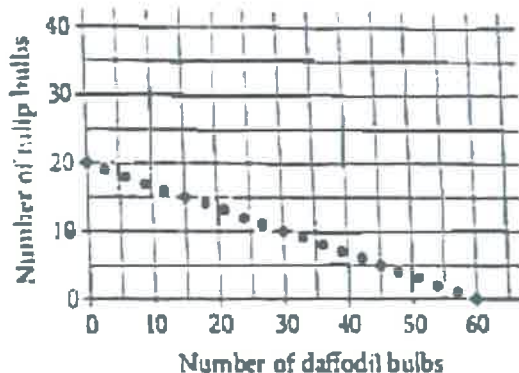
## 5- Sample test



Chris has a 12-fluid-ounce bottle of shampoo from which he uses  $\frac{1}{2}$  fluid ounce of shampoo every day. Which of the following is an expression for the number of fluid ounces of shampoo that Chris will have left after  $n$  days?

- A)  $12 + \frac{1}{2}n$
- B)  $12 - \frac{1}{2}n$
- C)  $12n - \frac{1}{2}$
- D)  $12n + \frac{1}{2}$

## 6- Sample test



Alice is shopping at a garden center where tulip bulbs cost \$1.50 each and daffodil bulbs cost \$0.50 each. Each point on the graph above represents one combination of tulip and daffodil bulbs that Alice can buy using her entire gardening budget. Based on the graph, if Alice spends her entire budget on daffodil bulbs, how many daffodil bulbs does she buy?

- A) 20
- B) 30
- C) 60
- D) 80

## 7- Sample test



On April 1, a bamboo stalk had a height of 18 inches. This type of bamboo grows at an average rate of 12 inches per day. At this rate, which of the following represents the estimated height  $h$ , in inches, of the bamboo stalk  $d$  days after April 1?

- A)  $h = 12d$
- B)  $h = 12d + 18$
- C)  $h = 18d$
- D)  $h = 18d + 12$

## 8- Sample test



The gas tank of Janessa's car contains 12 gallons of gas at the start of a road trip. Her car uses 1 gallon of gas for every 40 miles it is driven. Which of the following equations gives the number of gallons,  $g$  of gas remaining in the car's gas tank after it has been driven  $m$  miles on the road trip?

- A)  $g = 12 - \frac{m}{40}$
- B)  $g = 12 = 40m$
- C)  $g = 40 - \frac{m}{12}$
- D)  $g = 40 - 12m$

## 9- Sample test



If Jessica runs at a constant speed of 12 miles every 2 hours, which of the following functions represents the number of miles,  $m$ , Jessica runs in  $t$  hours?

- A)  $m(t) = 24t$
- B)  $m(t) = 12t$
- C)  $m(t) = 6t$
- D)  $m(t) = 2t$

## 10- Sample test



$$g(x) = -0.038x + 2.136$$

The given linear function  $g$  models the annual percentage increase in the population of India  $x$  years after 1990. What is the best interpretation of  $g(20) = 1.376$  in this context?

- A) 1.376 years after 1990, the percentage increase in the population of India was 20% over the previous year.
- B) 1.376 years after 1990, India's population was approximately 20 times its population in 1990
- C) 20 years after 1990, the percentage increase in the population of India was 1.376% over the previous year.
- D) 20 years after 1990, India's population was approximately 1.376 times its population in 1990.

## 1-AUGUST 2021 Q 1



In 2017, country Y had 500 miles of paved roads. Starting in 2018, the country has been building 6 miles of new paved roads each year. At this rate, if  $m$  is the number of years after 2017, which of the following functions  $f$  gives the number of miles of paved roads that will be in country Y assuming that no paved roads go out of service?

- A.  $f(m) = 6 + 2017m$
- B.  $f(m) = 2017 + 6m$
- C.  $f(m) = 500 + 6m$
- D.  $f(m) = 2018 + 6m$

## 2- Sample test



Kathy is a repair technician for a phone company. Each week, she receives a batch of phones that need repairs. The number of phones that she has left to fix at the end of each day can be estimated with the equation  $P = 108 - 23d$ , where  $P$  is the number of phones left and  $d$  is the number of days she has worked that week. What is the meaning of the value 108 in this equation?

- A) Kathy will complete the repairs within 108 days.
- B) Kathy starts each week with 108 phones to fix.
- C) Kathy repairs phones at a rate of 108 per hour.
- D) Kathy repairs phones at a rate of 108 per day.

## 3- Sample test



A landscaping company estimates the price of a job, in dollars, using the expression  $60 + 12nh$ , where  $n$  is the number of landscapers who will be working and  $h$  is the total number of hours the job will take using  $n$  landscapers. Which of the following is the best interpretation of the number 12 in the expression?

- A) The company charges \$12 per hour for each landscaper.
- B) A minimum of 12 landscapers will work on each job.
- C) The price of every job increases by \$12 every hour.
- D) Each landscaper works 12 hours a day.

## 4- Sample test



In air, the speed of sound  $S$ , in meters per second, is a linear function of the air temperature  $T$ , in degrees Celsius, and is given by  $S(T) = 0.6T + 331.4$ . Which of the following statements is the best interpretation of the number 331.4 in this context?

- A) The speed of sound, in meters per second, at  $0^\circ\text{C}$
- B) The speed of sound, in meters per second, at  $0.6^\circ\text{C}$
- C) The increase in the speed of sound, in meters per second, that corresponds to an increase of  $1^\circ\text{C}$
- D) The increase in the speed of sound, in meters per second, that corresponds to an increase of  $0.6^\circ\text{C}$

## 5- Sample test



Salim wants to purchase tickets from a vendor to watch a tennis match. The vendor charges a one-time service fee for processing the purchase of the tickets. The equation  $T = 15n + 12$  represents the total amount  $T$ , in dollars, Salim will pay for  $n$  tickets. What does 12 represent in the equation?

- A) The price of one ticket, in dollars
- B) The amount of the service fee, in dollars
- C) The total amount, in dollars, Salim will pay for one ticket
- D) The total amount, in dollars, Salim will pay for any number of tickets

## 6- Sample test



Salim wants to purchase tickets from a vendor to watch a tennis match. The vendor charges a one-time service fee for processing the purchase of the tickets. The equation  $T = 15n + 12$  represents the total amount  $T$ , in dollars, Salim will pay for  $n$  tickets. What does 12 represent in the equation?

- A) The price of one ticket, in dollars
- B) The amount of the service fee, in dollars
- C) The total amount, in dollars, Salim will pay for one ticket
- D) The total amount, in dollars, Salim will pay for any number of tickets

## 8- Sample test



$$n = 456 - 3T$$

The equation above is used to model the relationship between the number of cups,  $n$ , of hot chocolate sold per day in a coffee shop and the average daily temperature,  $T$ , in degrees Fahrenheit. According to the model, what is the meaning of the 3 in the equation?

- A) For every increase of  $3^{\circ}\text{F}$ , one more cup of hot chocolate will be sold.
- B) For every decrease of  $3^{\circ}\text{F}$ , one more cup of hot chocolate will be sold.
- C) For every increase of  $1^{\circ}\text{F}$ , three more cups of hot chocolate will be sold.
- D) For every decrease of  $1^{\circ}\text{F}$ , three more cups of hot chocolate will be sold.

## 7- Sample test



$$y = 19.99 + 1.50x$$

The equation above models the total cost  $y$ , in dollars, that a company charges a customer to rent a truck for one day and drive the truck  $x$  miles. The total cost consists of a flat fee plus a charge per mile driven. When the equation is graphed in the  $xy$ -plane, what does the  $y$ -intercept of the graph represent in terms of the model?

- A) A flat fee of \$19.99
- B) A charge per mile of \$1.50
- C) A charge per mile of \$19.99
- D) Total daily charges of \$21.49

## 9- Sample test



$$110x + y = 1,210$$

A coffee shop is running a promotion where a number of free coffee samples are given away each day. The equation above can be used to model the number of free coffee samples,  $y$ , that remain to be given away  $x$  days after the promotion began. What does it mean that  $(11, 0)$  is a solution to this equation?

- A) During the promotion, 11 samples are given away each day.
- B) It takes 11 days during the promotion to see 1,210 customers.
- C) It takes 11 days during the promotion until none of the samples are remaining.
- D) There are 11 samples available at the start of the promotion.

## 10- Sample test



A messenger delivered 10 packages on Monday before 11 a.m. and 4 packages per hour after 11 a.m. In which of the following equations does  $p$  represent the total number of packages the messenger had delivered on Monday  $h$  hours after 11 a.m.?

- A)  $p = 40h$
- B)  $p = 14h$
- C)  $p = 4 + 10h$
- D)  $p = 10 + 4h$

## 11- Sample test



$H = 1.880L + 32.010$  The formula above has been used to estimate the height of a person,  $H$ , in inches, using the length of the person's femur (thighbone),  $L$ , in inches. Which of the following is the best interpretation of the meaning of the number 1.880 in the context of this problem?

- A) The estimated increase, in inches, of femur length corresponding to an increase of 1 inch in height
- B) The estimated increase, in inches, of femur length for each increase of 32.010 inches in height
- C) The estimated increase, in inches, of height corresponding to an increase of 1 inch in femur length
- D) The estimated height, in inches, of a person whose femur has a length of  $L$  inches

## 12- Sample test



The cost of renting a bicycle is \$10 for the first hour, plus \$5 for each additional hour. If  $h$  represents the number of hours the bicycle is rented, which of the following functions gives the cost  $C(h)$ , in dollars, of renting the bicycle for  $h$  hours?

- A)  $C(h) = 10h - 5$
- B)  $C(h) = 10h + 5$
- C)  $C(h) = 5h + 10$
- D)  $C(h) = 5h + 5$

## 13- Sample test



Chirag was given a \$50 gift card to a local market. Each day, Chirag used the gift card to purchase only breakfast from the market. The total cost per breakfast, including taxes, was \$4.50, and no additional money was added to the card. Which of the following expressions represents the amount  $A$ , in dollars, left on the gift card after  $d$  days of use?

- A)  $A = 50 - 4.50d$
- B)  $A = 50 + 4.50d$
- C)  $A = 50d - 4.50$
- D)  $A = 50d + 4.50$

## 14- Sample test



Oona purchased  $p$  pounds of peanuts and  $a$  pounds of almonds. The peanuts cost \$2.45 per pound, and the almonds cost \$3.15 per pound. Oona spent a total of \$14.35 on peanuts and almonds. The equation below represents this situation.

$$2.45p + 3.15a = 14.35$$

What is the meaning of the term  $3.15a$  in this context?

- A) The total cost of almonds in Oona's purchase
- B) The total cost of peanuts in Oona's purchase
- C) The total pounds of almonds Oona purchased
- D) The total pounds of peanuts Oona purchased

## 15- Sample test



$$P = 0.1747 + 0.0639t$$

The equation above models the average price  $P$ , in dollars, of a loaf of white bread in the United States  $t$  years after 1970. According to the model, which of the following is the best interpretation of the coefficient 0.0639 in this context?

- A) In 1970, the predicted average price of a loaf of white bread was approximately \$0.0639.
- B) The predicted average price of a loaf of white bread  $t$  years after 1970 is 0.0639 times greater than the predicted average price of a loaf of white bread in 1970.
- C) Each year after 1970, the predicted average price of a loaf of white bread has increased by approximately \$0.0639.
- D) Every 0.0639 year after 1970, the predicted average price of a loaf of white bread has increased by \$1.

## 16- Sample test



The cost of renting a truck is \$75 per day plus \$0.30 per mile driven. Craig paid \$88.50 to rent the truck for one day. For how many miles of driving was Craig charged?

- A) 13
- B) 45
- C) 295
- D) 545

## 17- Sample test



The student government at a college gave out promotional T-shirts to incoming freshmen over a 30-day period. By the end of the 16th day, 32 percent of the T-shirts had been distributed, and after another 8 days, a total of 44 percent of the T-shirts had been distributed. The relationship between the day of the promotion in the 30-day period and the percent of T-shirts that had been distributed is linear from the end of the first day until the end of the promotion.

$$N = cd + k$$

In the formula above,  $N$  is the total number of T-shirts distributed by the end of day  $d$ , where  $c$  and  $k$  are constants. What does  $c$  represent?

- A) The percent of T-shirts distributed after the first day
- B) The percent of T-shirts distributed on day 1
- C) The number of T-shirts distributed per day after the first day
- D) The ratio of the total number of T-shirts distributed to the total number of days of the promotion

## 18- Sample test



Robert rented a truck to transport materials he purchased from a hardware store. He was charged an initial fee of \$20.00 plus an additional \$0.70 per mile driven. If the truck was driven 38 miles, what was the total amount Robert was charged?

- A) \$46.60
- B) \$52.90
- C) \$66.90
- D) \$86.50

## 19- Sample test



$$s = 9.8t$$

The equation above can be used to approximate the speed  $s$ , in meters per second (m/s), of an object  $t$  seconds after being dropped into a free fall.

Which of the following is the best interpretation of the number 9.8 in this context?

- A. The speed, in m/s, of the object when it hits the ground
- B. The increase in speed, in m/s, of the object for each second after it is dropped
- C. The speed, in m/s, of the object  $t$  seconds after it is dropped

## 20- Sample test



In economics, Okun's law states that the percentage change in the unemployment rate,  $\Delta r$ , from one quarter to the next is related to the quarterly percentage change in the gross domestic product (GDP),  $\Delta G$ , as defined by the equation below. What does  $-1.827$  refer to?

$$\Delta G = 0.856 - 1.827(\Delta r)$$

- A) The quarterly percentage change in the GDP for every 1% change in the unemployment rate
- B) The quarterly percentage change in the GDP to maintain the same unemployment rate
- C) The percentage change in the unemployment rate if the change in the GDP is 0%
- D) The percentage change in the unemployment rate for every 1% change in the GDP

## ANSWERS OF LESSON ( COORDINATE WORD PROBLEM )

NON CALCULATOR



Question	Answer
1	C
2	D
3	A
4	D
5	B
6	C
7	B
8	A
9	C
10	C
11	
12	
13	
14	
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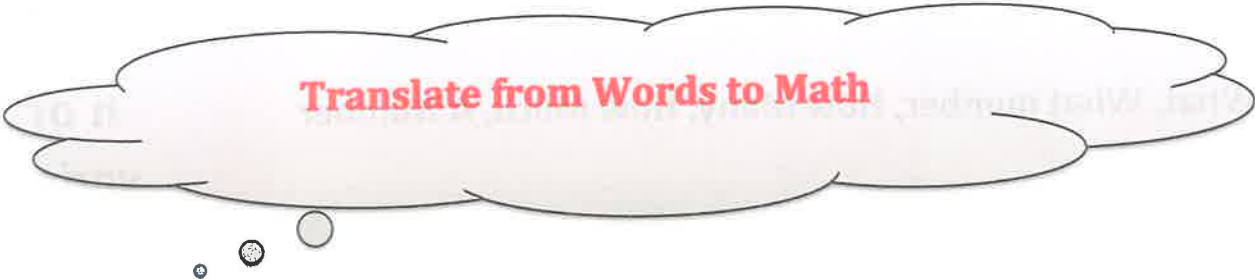
CALCULATOR



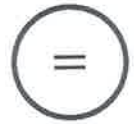
Question	Answer
1	C
2	B
3	A
4	A
5	B
6	-
7	B
8	A
9	C
10	D
11	C
12	D
13	A
14	A
15	C
16	B
17	B
18	A
19	B
20	A
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# Word Problem EQUATION


$$1+1=?$$



1 – Is, Was, Will be, Has, Equivalent, Equal, costs, adds up to, the same as, as much's



2 – More, Older, increased by, Exceeds, gained Further, Greater, Sum, from now, Plus, and combined, Total



3 – Fewer, Younger, less, decreased by, dominated gave away, Lost, Difference, Ago, Subtracted From smaller them, Difference between



4 – Of, Each, Product, Multiply, times of twice, double, by



5 – For, Per, out of, Quotient, Divided



6 – At Least



7 – At Most



8 – What, What number, How Many, How Much, A Number

**n OR x  
variable**

9 – What percent

$$\frac{n}{100} \text{ or } \frac{x}{100}$$

10 – 3 Consecutive Integers

$$x, x + 1, x + 2$$
$$x - 1, x, x + 1$$

11 – 3 Consecutive Even integers

$$x, x + 2, x + 4$$
$$x - 2, x, x + 2$$

12 – 3 Consecutive Odd Integers

$$x, x + 2, x + 4$$
$$x - 2, x, x + 2$$

13 – 3 Consecutive Multiple of 5

$$x, x + 5, x + 10$$
$$x - 5, x, x + 5$$

14 – What Fraction of Our Class is girls

$$\frac{\text{girls}}{\text{total}}$$

15 – Red Marbles Is  $\textcircled{3}$  Times as many as yellows = 1

$$\begin{array}{l} R : y \\ 3 : 1 \end{array}$$

3 Times as many red marbles as yellow

$$\begin{array}{l} R : y \\ 3 : 1 \end{array}$$

$$3y = R$$

$$\frac{R}{y} = \frac{3}{1}$$

# *Questions*



## 1- OCTOBER 2020 Q 8



A game consists of throwing a dart into a target divided into 2 sections: The inner section rewards a player with 5 points, while the outer section gets him 3 points only. Kurt throws 6 darts and hits the inner section  $x$  times. What is Kurt's total score in terms of  $x$ ?

- A.  $8x+24$
- B.  $2x+18$
- C.  $-2x+18$
- D.  $6x+4$

## 2 - DECEMBER 2020 Q 7



Ryan wants to calculate the amount of time he spends on social media which, for him, includes only Instagram and Facebook. To do this he uses a formula  $T = aI + bF$ , where  $I$  is the number of hours he spends on Instagram every day,  $F$  is the number of hours he spends on Facebook every day, and  $T$  is the total number of hours he spends on social media every week. If he spends the same amount of time on Instagram every day and the same amount of time on Facebook every day, which of the following could be the value of  $a + b$ ?

- A. 7
- B. 14
- C.  $\frac{1}{7}$
- D.  $\frac{1}{14}$

## 3 - MARCH 2021 / Q1



Ibrahim is  $x$  years old and Jamil is seven years younger. In five years, how old will Jamil be?

- A.  $x + 2$
- B.  $x - 2$
- C.  $2x - 2$
- D.  $x + 5$

## 4 - MAY 2021 Q 11



If the sum of half a number and 3 is smaller than twice the same number added to 3, which of the following could be the number?

- A. 1
- B. 0
- C.  $-0.5$
- D.  $-2$

## 5 - MAY 2021 Q 12



Given three consecutive even integers. If the sum of the first and three times the third is equal to 20, what is the sum of the three integers?

- A. 14
- B. 12
- C. 8
- D. 6

6 - MAY 2021 Q 17



Joanne is a saleswoman in a TV store. Her salary is 1,300 Egyptian pounds per month, in addition to 10 Egyptian pounds for each TV she sells if the quantity sold is less than or equal to 10 TVs per month. If she sells more than 10 TVs in one month, she will get an extra bonus of 10% of her initial salary. Last November, she sold 12 TVs. What was her salary at the end of the month? (grid-in)

7- AUGUST 2021 Q 3



Mathew paid  $X$  dollars for a play station that was only 30 dollars less than one third of the original price.

What was the original price in dollars?

- A.  $X - 30$
- B.  $X + 60$
- C.  $3X + 90$
- D.  $\frac{1}{3}X - 30$

8 - AUGUST 2021 Q 6



An enterprise conducted a study on its products and the results showed that when the unit selling price ( $P$ ) is raised, the number of units sold ( $U$ ) went down.

This result is modeled by the equation  $10P + 2U = 2500$ .

Based on this model, the manager decided to decrease the unit selling price from \$50 to \$45.

How many more items did he sell?

- A. 75
- B. 50
- C. 25
- D. 10

9 - OCTOBER 2021 Q 11



In order to prepare for the boxing tournament, Jamison needs to work out for at least 90 hours during the next 3 weeks. In the first week, he practiced for 42 hours, and decided to divide the rest of the hours equally over the next two weeks. How much should he practice minimum each week?

- A. 12 hours
- B. 24 hours
- C. 46 hours
- D. 48 hours

## 10 - DECEMBER 2021 Q 1



The difference between twice a number and two is three times the number. Which of the following represents the equation that can be used to solve the number?

- A.  $2x - 2 = 3(x - 2)$
- B.  $2 - 2x = 3$
- C.  $2x - 2 = 3x$
- D.  $2x - 3x = 3 + x$

## 11 - DECEMBER 2021 Q 3



İbrahim needs enough fencing to enclose a rectangular garden with a perimeter of 200 meters. If the length of his garden is to be 60 meters, which of the following equations can be used to solve the width of the garden?

- A.  $2x + 120 = 200$
- B.  $x + 60 = 200$
- C.  $2x - 200 = 120$
- D.  $2x + 60 = 200$

## 12 - DECEMBER 2021 Q 6



In June 2021, Peter wants to manage his time carefully to know the number of interviews,  $T$ , he can take. For each interview that he takes, he expects to spend 3.5 hours working on the candidate's application. In addition to this, he expects to spend an additional 5 hours to schedule interviews for all candidate. If Peter has 80 hours available in June, how many interviews can he take?

- A. 21
- B. 24
- C. 9
- D. 23

13 - MARCH 2022 / Q 12



Amanda paid  $\$a$  for a makeup bag set that was only \$15 less than half the original price. What was the original price, in dollars, of this set?

- A.  $2a + 30$
- B.  $a - 15$
- C.  $\frac{1}{2}a - 15$
- D.  $2a + 15$

14 - MARCH 2022 / Q 17



What positive number is twice as far from 9 as it is far from 3? (grid-in)

15 - SAMPLE TEST / Q 16



A taxi company charges \$0.25 for every one kilometer driven from the pick-up to the destination, with an extra \$2.5 fixed fee for every one route. If Sebastian took a taxi from his home to work, and then again from work to his home, and paid a sum of \$20, how many kilometers is his home away from work?

16 - SAMPLE TEST / Q 19



Allen needs \$10,000 to buy a new car. If he has \$2,000 saved in his bank account, sold his old car for \$3,200, and then started working as a cashier in a supermarket where he is paid \$5 for each hour, how many hours should he work in order to be able to buy the new car at the very least?

17 - JUNE 2022 ( cancelled ) / Q 5



The sum of three consecutive integers is 24. What is the product of the two greatest integers between them all?

- A. 27
- B. 56
- C. 72
- D. 504

18 - JUNE 2022 ( cancelled ) / Q 14



What number increased by 5 is equal to twice the same number minus 3?

- A. -8
- B. 3
- C. 5
- D. 8

## 1 - OCTOBER 2020 Q 1



The secret value,  $k$ , of a 4-digit pin code  $abcd$  is obtained by subtracting the triple of  $b$  from  $c$ , and dividing the resulting expression by half of the sum of  $a$  and  $d$ . What is the secret value,  $k$ , in terms of  $a, b, c$  and  $d$ ?

- A.  $k = \frac{c-3b}{2a+2d}$   
B.  $k = \frac{b-3c}{2a+2b}$   
C.  $k = \frac{2c-6b}{a+d}$   
D.  $k = \frac{6b-2c}{a+d}$

## 2 - OCTOBER 2020 Q 2



A library sells new and used books. If, out of the total of 474, there are twice as many new books as old ones. How many new books are there in the library?

- A. 316  
B. 158  
C. 352  
D. 238

## 3 - OCTOBER 2020 Q 23



A secretary types on her computer keyboard at an average speed of 1.75 words per second. Her manager asked her to type a document containing 16 pages with an average of 525 words per page. How long will she be actively typing this document?

- A. 1 hour, 10 minutes  
B. 1 hour, 20 minutes  
C. 2 hours, 5 minutes  
D. 4 hours, 5 minutes

## 4 - DECEMBER 2020 Q 2



Vanessa's company has a bonus policy. At the end of each month, based on his or her performance, every employee gets effort points. At the end of each year, each employee gets paid a fixed bonus amount of 400\$ and an additional bonus of 50\$ for each effort point earned by the employee. At the end of the year 2019, Vanessa got a bonus of 1000\$. How many effort points had she earned during the year 2019?

- A. 2  
B. 2.375  
C. 12  
D. 200

18 - JUNE 2022 ( cancelled ) / Q 14



What number increased by 5 is equal to twice the same number minus 3?

- A. -8
- B. 3
- C. 5
- D. 8

5 - DECEMBER 2020 Q 5



A company decides to let its employees work from home. The employer gathers the workers and wants to distribute the work documents among the workers so they can take them home. When he gives 2 documents to each employee, 20 are left over. Instead, he decides to take one himself and give 3 to each employee. This time 9 are left over. What is the number of documents?

- A. 44
- B. 11
- C. 10
- D. 40

6 - DECEMBER 2020 Q 19



In a certain chip manufacturing company, there are three operating machines A, B, and C. Every day, Machine A produces 30% more chips than machine B, and machine B produces twice as many chips as machine C. If on any particular day machine A produces  $x$  chips, what is the total number of chips produced by machines A, B, and C combined on that day in terms of  $x$ ?

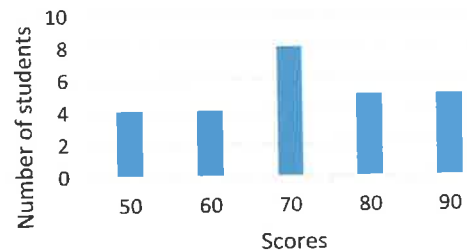
- A.  $x + 1.3x + 2.6x$
- B.  $x + 0.3x + 0.6x$
- C.  $x + \frac{x}{0.3} + \frac{x}{0.6}$
- D.  $x + \frac{x}{1.3} + \frac{x}{2.6}$

7 - DECEMBER 2020 Q 32



At a certain carnival booth, a trivia game can be played according to the following rule: the player wins 10 gold coins just for participating in the game; he then wins 3 gold coins for each correct answer and loses 1 gold coin for each wrong answer. At the end of the game when the time is up, the player gains money according to the equivalence: 1 gold coin = \$3. If Jad makes 4 mistakes and gains \$153 at the end of the game, how many correct answers does he have?

8 - MARCH 2021 Q 12



The above bar chart shows the scores of a philosophy test over 100.

If 5 is subtracted from each score, what do the new mean  $x'$  and standard deviation  $\alpha'$  become with respect to the original mean  $x$  and standard deviation  $\alpha$ ?

- A.  $x' = 5x ; \alpha' = \alpha$
- B.  $x' = x + 5 ; \alpha' = \alpha - 5$
- C.  $x' = x - 5 ; \alpha' = \alpha$
- D.  $x' = x - 5 ; \alpha' = \alpha - 5$

9 - MARCH 2021 Q 34



A sum of 7,200 \$ is to be divided equally among many people. If five people were excluded, each part would increase by 20\$. What is the number of people?

10 - MAY 2021 Q 32



The sum of twice a number  $x$  and eleven is equal to one third the difference of the same number and one. What is the value of  $(1 - x)$ ? (grid-in)

11 - JUNE 2021 Q 10



An oven costs \$150 less than 4 times the cost of a microwave. If the oven and the microwave cost together \$725, how much more does the oven cost than the microwave?

- A. \$175
- B. \$275
- C. \$375
- D. \$550

12 - JUNE 2021 Q 17



Anton has \$20 to spend on stationary. Pens ( $p$ ) cost \$1.4 each, coloring crayons ( $c$ ) are priced at \$3.5 per pack and highlighters ( $h$ ) sell for \$2 each. He must buy a notebook for \$5.5 as well. Which of the following describes how many highlighters Anton can buy?

- A.  $h \leq \frac{14.5 - 1.4p - 3.5c}{2}$
- B.  $h \leq \frac{14.5 + 1.4p + 3.5c}{2}$
- C.  $h \leq \frac{20 - 1.4p - 3.5c}{2} - 5.5$
- D.  $h \leq \frac{20 - 1.4p - 3.5c}{2}$

13 - AUGUST 2021 Q 5



Jack has  $k$  dollars. He spends  $\frac{3}{4}$  of his money on a T-shirt and  $\frac{1}{3}$  of what was left on a sandwich. If this left him with  $t$  dollars, which of the following is the value of  $k$  in terms of  $t$ ?

- A.  $6t$
- B.  $9t$
- C.  $12t$
- D.  $24t$

14 - AUGUST 2021 Q 14



Tom has horses, dogs and birds in his farm. The number of birds he has is four times the number of dogs, and he has three more dogs than horses.

Which of the following could be the total number of these animals?

- A. 25
- B. 26
- C. 27
- D. 28

15 - AUGUST 2021 Q 31



A supermarket has three branches A, B and C in three different cities. The head manager realized that, in average per day, branch A has 20% more customers than branch B and branch B has 20% less customers than branch C.

If the number of customers in branch A is 1200 on a random day, what is the estimated number of customers in branch C that same day?

16 - OCTOBER 2021 Q 8



The sum of two numbers is 119. The product of the two numbers is 3430. What is half the greater number?

- A. 24.5
- B. 35
- C. 49
- D. 70

17 - OCTOBER 2021 Q 28



A telecommunication company offers 4 different monthly packages of internet subscription to its customers. The first package is for \$12 in which the customer will benefit from 1200 MBs internet in addition to 400 MBs gift after 3 consecutive months of subscription.

The second package is for \$16 in which the customer will benefit from 2000 MBs internet in addition to 550 MBs gift after 3 consecutive months of subscription.

The third package is for \$25 in which the customer will benefit from 3400 MBs internet in addition to 800 MBs gift after 5 consecutive months of subscription.

The fourth package is for \$30 in which the customer will benefit from 4000 MBs internet with no addition. If Abdallah wants to choose the cheapest offer for him for the next 3 months, which one should he choose?

- A. First package
- B. Second package
- C. Third package
- D. Fourth package

18 - OCTOBER 2021 Q 33



A company decided to create brochures to introduce their products. The printing house responsible for designing and printing the brochures will charge the company \$79 for the design with 44 cents for each brochure printed.

If the company decided to print 2000 brochures, how much should they pay? (grid-in)

19 - OCTOBER 2021 Q 34



A company decided to create brochures to introduce their products. The printing house responsible for designing and printing the brochures will charge the company \$79 for the design with 44 cents for each brochure printed.

The maximum budget put by the company for the brochures is \$1,950. How many brochures at most can they print? (grid-in)

20 - MARCH 2022 / Q 12



Three friends divided a prize as follows: the youngest received  $\frac{3}{5}$  of the prize, the middle friend received  $\frac{1}{4}$  of the prize, and the eldest received the remaining \$57. What was the value, in dollars, of the prize?

- A. 380
- B. 420
- C. 140
- D. 270

21 - MARCH 2022 / Q 29



Sami has a website where he sells books and copybooks. He purchases his books for \$10.26 each and his copybooks for \$7.58 each. Sami pays \$1 to mail each book or copybook to his customers. He charges \$19.25 per book and \$11.58 per copybook plus a postage of \$1.25 per book or copybook. Which of the following represents his profit  $P$ , in dollars, on the sale of  $x$  books and  $y$  copybooks?

- A.  $P = 10.26x + 7.58y$
- B.  $P = 8.99x + 4y$
- C.  $P = 9.24x + 4.25y$
- D.  $P = 9.24x + 4y$

22 - MARCH 2022 / Q 31

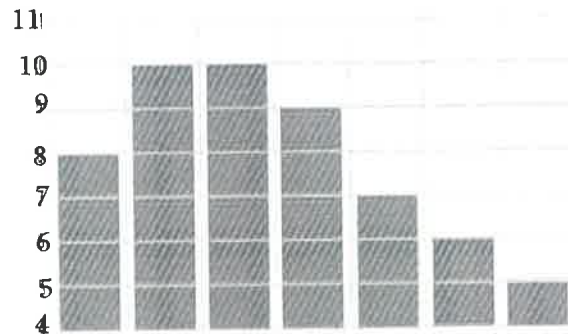


The sum of triple a number  $x$  and 6 is equal to half the difference of twice a number  $x$  and 5. What is the value of  $(1-4x)$ ? (grid-in)

23 - SAMPLE TEST / Q 7



The graph below shows how many eggs a chicken laid in a farm during a week.



Between the beginning of May and the end of June, they produced only t-shirts (5000 t-shirts) with a cost of \$10,122. In order to make the profit shown in the graph, what price should they sell each t-shirt for?

- A) \$1.78
- B) \$2.7244
- C) \$3.1244
- D) \$3.8044

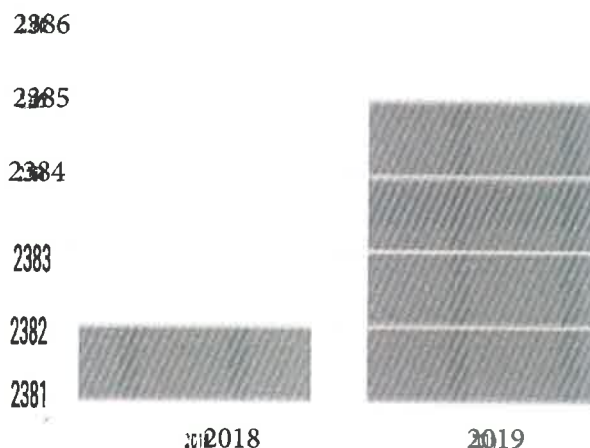
24 - SAMPLE TEST / Q 10



The healthy BMI formula (Body Mass Index) is a simple calculation recommended by the World Health Organization (WHO) in order to have a person find his/her ideal body weight which, if respected, can control any possible health complications. The ideal BMI range is between 18.5 and 25 for both male and female, and it can be found using the formula  $= \frac{m}{h^2}$ , where  $m$  is the mass of the person in kilograms, and  $h$  is its height in  $m$ . For Jason whose height is equal to 201  $cm$ , which of the following statements is ideal ?

- A) Jason can have a healthy life if his mass is between 60 and 74 Kg.
- B) Jason can have a healthy life if and only if his mass is less than 101 Kg.
- C) Jason can have a healthy life if his mass is between 75 and 101 Kg.
- D) Jason can have a healthy life if his mass is more than 102 Kg.

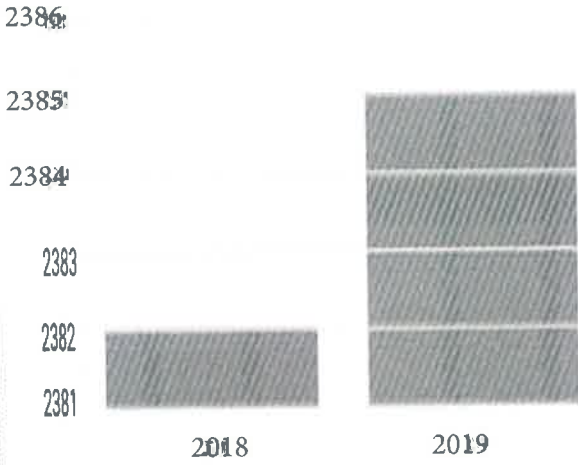
25 - SAMPLE TEST / Q 16



The production of cars in 2018 cost the company \$39,303 millions. How much each car should be sold for during that year so the company does not make a loss ?

- A) \$16,500
- B) \$15,500
- C) \$14,500
- D) \$13,500

26 - SAMPLE TEST / Q 17



If each car, regardless of its type or model, will make a profit of \$3,455 for the company, how much more profit did the company make in 2019 than in 2018 ?

- A) \$10,365
- B) \$8,240,175
- C) \$10,365,000
- D) \$8,240,175,000

27 - SAMPLE TEST / Q 21



On a multiple choice questions test at school, Raheem answered 70% of the questions correct. If his final score is 64 given that for each correct answer he gets 1.25 points and for each wrong answer, 0.25 points is subtracted, how many questions were there in the test ?

- A) 56 questions
- B) 58 questions
- C) 73 questions
- D) 80 questions

28 - SAMPLE TEST / Q 31



Given three consecutive odd integers, what is the greatest number if triple of the sum of thrice the third one and twice the first one is equal to 291 ?

29 - JUNE 2022 (cancelled) / Q 16



Citrus trees are fruit trees that require wet roots. These trees need a careful attention summarized by an excellent drainage and sandy soil. Adnan has a land in a village in Egypt. He decided to start a project of planting 205 citrus trees in it and getting a farmer to manage the land. He got each tree for 172 EGP, and the farmer asked for 100 EGP to plant each tree, in addition of 3994 EGP per month to manage the land and the drainage. How much will Adnan pay during the first year of his project?

- A. 103,688 EGP
- B. 100,388 EGP
- C. 83,288 EGP
- D. 59,754 EGP

## ANSWERS OF LESSON ( WORD PROBLEM EQUATION )

NON CALCULATOR



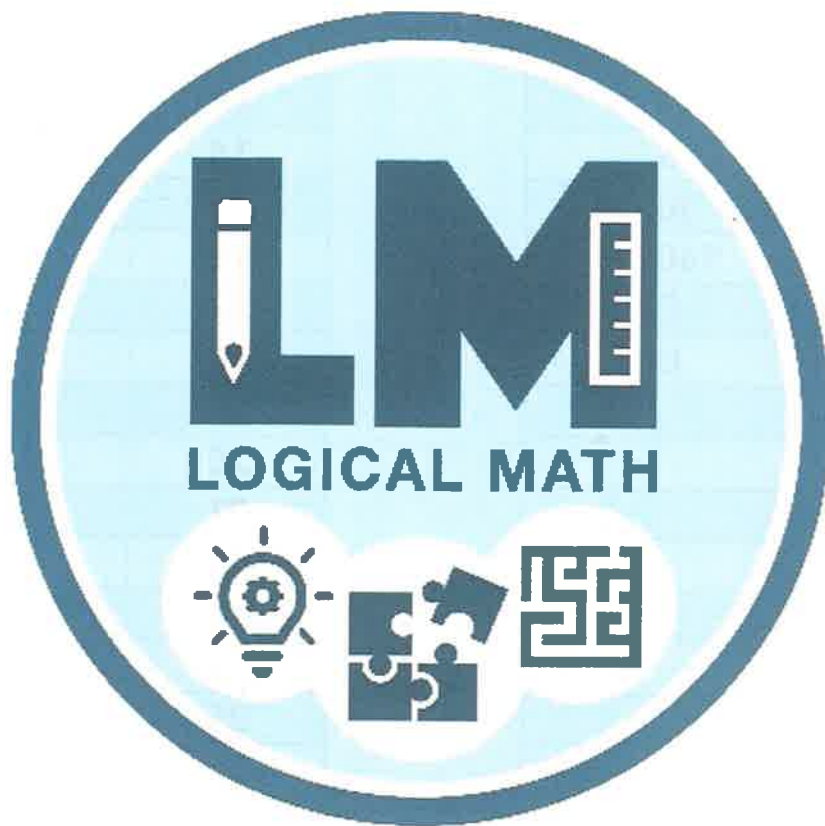
Question	Answer
1	B
2	B
3	B
4	A
5	B
6	1430
7	C
8	C
9	B
10	C
11	A
12	A
13	A
14	5
15	30
16	960
17	C
18	D
19	
20	
21	
22	
23	
24	
25	
26	
27	
28	
29	

CALCULATOR



Question	Answer
1	C
2	A
3	B
4	C
5	D
6	D
7	15
8	C
9	45
10	7.8 OR 39/5
11	C
12	A
13	A
14	C
15	1152
16	B
17	B
18	959
19	4252
20	A
21	C
22	18
23	C
24	C
25	A
26	C
27	D
28	21
29	A

# LOGIC



1- JUNE 2021 Q 3



The weekly salary  $S$  of Samantha is given by  $S = 7 \cdot h \cdot d + 75$  where  $h$  is the number of hours she works every day and  $d$  is the number of working days each week. If Samantha is to be promoted with a salary increase, which of the following terms must change?

- A. 7
- B.  $h$
- C.  $d$
- D. None of the above

1- OCTOBER 2020 Q 18



The ministry of finance conducted a survey to determine the average income rate in the industry of banking in a given country. So, a meeting was held in the presence of 150 bank managers to ask them about their annual income. Which conclusion can be drawn about the survey's reliability?

- A. The survey is reliable because it involves people from the banking industry.
- B. The survey is unreliable because the sample is too small.
- C. The survey is unreliable because the sample does not cover employees of different positions.
- D. The survey is reliable since it was made by the ministry of finance.

2- DECEMBER 2020 Q 25



A certain pharmaceutical company wants to test the efficiency of a vaccine that it recently developed against a certain virus. For this purpose, they administer the vaccine to 10 people from each neighborhood where the virus had been detected. They do this for 40 neighborhoods where the virus was detected, and discover that among the 400 subjects, only 15 got sick when exposed to the virus after receiving the vaccine. Which of the following statements can be true?

- A. If the entire country is vaccinated, only 3.75% are expected to get sick.
- B. The vaccine is effective against the virus.
- C. The sample was not chosen randomly and so it calls into question the results obtained.
- D. The sample size was too large.

3- MARCH 2021 Q 13



Which of the following variables are discrete?

- I. Number of players in a playground
- II. The speed in miles per hour of cars passing a certain point on a highway
- III. Academic rank in class
- IV. Height in inches
- V. Weight in kilograms

- A. I and II
- B. I, II, and III
- C. IV and V
- D. I and III

4- OCTOBER 2021 Q 20



How many different integers between 15 and 45 contain only digits from the following list: 1, 3, 5, 7, 9?

- A. 16
- B. 7
- C. 6
- D. 5

5- Sample test



A polling agency conducted a survey about public opinion on car-sharing services. The agency surveyed a random sample of adult residents from three large cities in the United States and reported that 73% support car-sharing services, with an associated margin of error of 4%. Based on the study design, what is the largest population to which these survey results can be generalized?

- A) All adult residents of the United States
- B) All adult residents of large cities in the United States
- C) All adult residents who support car-sharing services
- D) All adult residents of the three large cities in the survey

6- Sample test



A sample of 40 fourth-grade students was selected at random from a certain school. The 40 students completed a survey about the morning announcements, and 32 thought the announcements were helpful. Which of the following is the largest population to which the results of the survey can be applied?

- A) The 40 students who were surveyed
- B) All fourth-grade students at the school
- C) All students at the school
- D) All fourth-grade students in the county in which the school is located

7- Sample test



Voting Preference by Region

	Candidate A	Candidate B	Candidate C	Total
Region 1	37	124	85	246
Region 2	68	74	43	185
Region 3	103	94	62	259
Total	208		190	690

A political analyst wanted to determine voter preference for an upcoming election for the registered voters in a county with three regions. The analyst surveyed a random sample of registered voters in the county to obtain information on region and candidate preference. The table above shows the results of the survey.

If the same survey is conducted with another random sample of 690 registered voters in the county, which of the following statements is true about the number of respondents from that sample who would indicate preference for Candidate A in the upcoming election?

- A) The number of respondents who will indicate preference for Candidate A. must be 208.
- B) The number of respondents who will indicate preference for Candidate A must be greater than 208.
- C) The number of respondents who will indicate preference for Candidate A must be less than 208.
- D) Because of sample variability, the number of respondents who will indicate preference for Candidate A may be equal to 208, less than 208, or greater than 208.

## 8- Sample test



A town newspaper polled 500 voters selected at random from a list of all registered voters in the town. Of those polled, 41% approved of their state governor's performance. Which of the following is the largest population to which the results of the poll can be applied?

- A) All registered voters who receive the newspaper
- B) All registered voters who participated in the poll
- C) All registered voters in the state
- D) All registered voters in the town

## 9- Sample test



A development company is advertising that the mean area of the apartments in a new complex is 1,450 square feet. The complex consists of 10 buildings with a total of 1,000 apartments. A sample of 50 apartments will be selected from the complex to test the company's statement about the mean apartment area. Which of the following is an unbiased sampling method?

- A) Select the first 50 apartments built.
- B) Select the first 50 apartments that are occupied.
- C) Select at random 5 top-floor apartments from each of the buildings.
- D) Select at random 50 apartments from all the apartments in the 10 buildings.

## 10- Sample test



Do you think the Electoral College should no longer be used to elect the president?

A sample of 200 male students selected at random from a large university was asked the survey question shown above. Of those surveyed, 62 responded yes. For which of the following populations is 31 percent a reasonable estimate of the true proportion from that population that would respond yes to the survey question?

- A) All males
- B) All students
- C) All students who attend the large university
- D) All male students who attend the large university

## 11- Sample test



A political scientist wants to predict how the residents of New Jersey will react to a new bill proposed in the state senate. Which of the following study designs is most likely to provide reliable results for the political scientist?

- A. Mailing a questionnaire to each of 200 randomly selected residents of New Jersey
- B. Surveying a group of 300 randomly selected New Jersey residents
- C. Interviewing a group of students randomly selected from a large public university in New Jersey
- D. Surveying a group of 1,500 randomly selected US residents

## 12-Sample test



To determine if age and gender are related to pet ownership at his school, Mark selected a random sample of 50 male 14- to 15-year-old students from the school and a random sample of 60 female 17- to 18-year-old students from the school. For each student, he recorded the student's age, gender, and whether the student owned a pet. Which of the following provides the best explanation for why Mark cannot draw a valid conclusion from this study?

- A) The sample sizes are too small.
- B) The two samples are not of equal size.
- C) Mark will be unable to tell whether a difference in pet ownership is related to age because the two age groups are too close in age.
- D) Mark will be unable to tell whether a difference in pet ownership is related to gender because of the difference in age. Similarly, he will be unable to tell whether a difference in pet ownership related to age.

## 13- Sample test



A researcher randomly selected 36 second-grade boys from Wilson Elementary School to participate in a study about the effects of exercise on memory. At the end of the study, the researcher concluded that regular participation in moderate-level exercise has a positive effect on memory. The results of the study can be generalized to which of the following populations?

- A) All boys at Wilson Elementary School
- B) All students at Wilson Elementary School
- C) All second-grade boys at Wilson Elementary School
- D) All second-grade students at Wilson Elementary School

## 14- Sample test



One hundred park-district members will be selected to participate in a survey about selecting a new park-district coordinator. Which of the following methods of choosing the 100 members would result in a random sample of members of the park district?

- A. Obtain a numbered list of all park-district members. Use a random number generator to select 100 members from the list. Give the survey to those 100 members.
- B. Obtain a list of all park-district members sorted alphabetically. Give the survey to the first 100 members on the list.
- C. Tell all park-district members that volunteers are needed to take the survey. Give the survey to the first 100 members who volunteer.
- D. Obtain a list of all park-district members who are attending an upcoming event. Give the survey to the first 100 members on the list.

## 15- Sample test



The members of a city council wanted to assess the opinions of all city residents about converting an open field into a dog park. The council surveyed a sample of 500 city residents who own dogs. The survey showed that the majority of those sampled were in favor of the dog park. Which of the following is true about the city council's survey?

- A) It shows that the majority of city residents are in favor of the dog park.
- B) The survey sample should have included more residents who are dog owners.
- C) The survey sample should have consisted entirely of residents who do not own dogs.
- D) The survey sample is biased because it is not representative of all city residents.

**-16- Sample test**

A polling agency recently surveyed 1,000 adults who were selected at random from a large city and asked each of the adults, "Are you satisfied with the quality of air in the city?" Of those surveyed, 78 percent responded that they were satisfied with the quality of air in the city. Based on the results of the survey, which of the following statements must be true?

- I. Of all adults in the city, 78 percent are satisfied with the quality of air in the city.
  - II. If another 1,000 adults selected at random from the city were surveyed, 78 percent of them would report they are satisfied with the quality of air in the city.
  - III. If 1,000 adults selected at random from a different city were surveyed, 78 percent of them would report they are satisfied with the quality of air in the city.
- A) None
  - B) II only
  - C) I and II only
  - D) I and III only

**17- Sample test**

A researcher conducted a survey to determine whether people in a certain large town prefer watching sports on television to attending the sporting event. The researcher asked 117 people who visited a local restaurant on a Saturday, and 7 people refused to respond. Which of the following factors makes it least likely that a reliable conclusion can be drawn about the sports-watching preferences of all people in the town?

- A) Sample size
- B) Population size
- C) The number of people who refused to respond
- D) Where the survey was given

**18- Sample test**

In order to determine if treatment X is successful in improving eyesight, a research study was conducted. From a large population of people with poor eyesight, 300 participants were selected at random. Half of the participants were randomly assigned to receive treatment X, and the other half did not receive treatment X. The resulting data showed that participants who received treatment X had significantly improved eyesight as compared to those who did not receive treatment X. Based on the design and results of the study, which of the following is an appropriate conclusion?

- A) Treatment X is likely to improve the eyesight of people who have poor eyesight.
- B) Treatment X improves eyesight better than all other available treatments.
- C) Treatment X will improve the eyesight of anyone who takes it.
- D) Treatment X will cause a substantial improvement in eyesight.

**19- Sample test**

A market researcher selected 200 people at random from a group of people who indicated that they liked a certain book. The 200 people were shown a movie based on the book and then asked whether they liked or disliked the movie. Of those surveyed, 95% said they disliked the movie. Which of the following inferences can appropriately be drawn from this survey result?

- A) At least 95% of people who go see movies will dislike this movie.
- B) At least 95% of people who read books will dislike this movie.
- C) Most people who dislike this book will like this movie.
- D) Most people who like this book will dislike this movie.

## ANSWERS OF LESSON ( LOGIC )

**NON CALCULATOR**



Question	Answer
1	A
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**CALCULATOR**



Question	Answer
1	C
2	C
3	D
4	B
5	D
6	B
7	D
8	D
9	D
10	D
11	A
12	C
13	C
14	A
15	D
16	A
17	D
18	A
19	D
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# MENTAL MATH



1- OCTOBER 2020 Q 3



$$\sqrt{1.25} \times \sqrt{1.8}$$

The above expression can be written in the form of a rational number  $k$ . What is the value of  $k$ ?

- A.  $\frac{2}{3}$
- B.  $\frac{3}{2}$
- C.  $\frac{2}{5}$
- D.  $\frac{5}{3}$

2- DECEMBER 2020 Q 17



If  $\sqrt{2^m} = 8$ , what is the value of  $\sqrt{3^m}$  ?

3- MAY 2021 Q 15



If  $xy$  is a *positive* integer and  $xz$  is a negative integer, which of the following is true?

- I.  $yz$  is always positive.
  - II.  $xy - xz$  is always positive.
  - III.  $xyz$  is always negative.
- A. I only
  - B. II only
  - C. III only
  - D. I, II, and III

4 - JUNE 2022 ( cancelled ) / Q 4



In Egypt, a tourist can travel a distance of 5 km with just 15.57 EGP. Pedro needed to go to “San Pola” hospital in Cairo. He took a taxi from “Al Marazeek” bridge, which is approximately 35 Km away from the hospital. How much will Pedro pay for the driver, knowing that he gave him 10 extra EGP as tips?

- A. 554.95 EGP
- B. 477.1 EGP
- C. 118.99 EGP
- D. 109.09 EGP

5 - JUNE 2022 ( cancelled ) / Q 7



“Unou House”, located in Japan and built between 2010 and 2012, features a house with a floor of triangular shape and can be considered as an isosceles triangle. The area of the triangular floor is approximately  $84 \text{ m}^2$ . If we consider that the base of this triangle is  $12 \text{ m}$ , what is the dimension of one of the equal sides in this triangle?

- A.  $\sqrt{193} \text{ m}$
- B.  $2\sqrt{58} \text{ m}$
- C.  $14 \text{ m}$
- D.  $170 \text{ m}$

6- MAY 2021 Q 15



If  $xy$  is a *positive* integer and  $xz$  is a negative integer, which of the following is true?

- I.  $yz$  is always positive.
  - II.  $xy - xz$  is always positive.
  - III.  $xyz$  is always negative.
- A. I only
  - B. II only
  - C. III only
  - D. I, II, and III

7- Sample test



Which expression is equivalent to  $\frac{8x}{4}$  ?

- A)  $2x$
- B)  $4x$
- C)  $\frac{1}{2x}$
- D)  $\frac{x}{2}$

8- Sample test



$$(8,466 + 100y^2) - 10(11y^2 + 120)$$

The given expression can be written in the form  $ay^2 + b$ , where  $a$  and  $b$  are constants. What is the value of  $a + b$  ?

- A) 9,656
- B) 8,576
- C) 7,266
- D) 7,256

## 13- Sample test



A company offers its salespeople two different weekly compensation plans. Salespeople on Plan X earn \$1,000 plus a 10% commission on their sales each week. Salespeople on Plan Y earn \$500 plus a 20% commission on their sales each week. Which inequality models the amount in sales each week,  $d$  dollars, for which salespeople on Plan X earn more than salespeople on Plan Y?

- A)  $d < 5,000$
- B)  $d > 5,000$
- C)  $d < 1,500$
- D)  $d > 1,500$

## 14- Sample test



$$\begin{aligned} -3x + 4y &= 4 \\ 4x - 3y &= 0.5 \end{aligned}$$

The solution to the given system of equations is the ordered pair  $(x, y)$ . What is the value of  $y$ ?

## 15- Sample test



$$x^2 + y^2 + 6x + 5y = -\frac{45}{4}$$

The equation of a circle in the  $xy$ -plane is shown. What is the radius of the circle?

## 16- Sample test



$$r^q = t^s$$

The given equation relates the distinct positive real numbers  $q$ ,  $r$ ,  $s$  and  $t$ . Which equation correctly expresses  $t$  in terms of  $q$ ,  $r$ , and  $s$ ?

- A)  $t = r^{\frac{q}{s}}$
- B)  $t = r^{\frac{s}{q}}$
- C)  $t = r^{q-s}$
- D)  $t = \frac{r^q}{s}$

## 17- Sample test



Which polynomial is equivalent to  $(x^2 + 7)(12x^3 - 6)$ ?

- A)  $12x^6 - 42$
- B)  $12x^3 + x^2 + 1$
- C)  $12x^5 + 84x^3 - 6x^2 - 42$
- D)  $12x^6 + 84x^3 - 6x^2 - 42$

## 9- Sample test



What is the value of  $\sin\left(\frac{3\pi}{4}\right)$ ?

- A)  $-\frac{\sqrt{2}}{2}$   
 B)  $-\frac{\sqrt{3}}{2}$   
 C)  $\frac{\sqrt{2}}{2}$   
 D)  $\frac{\sqrt{3}}{2}$

## 10- Sample test



$$x^2 - 10x + 14 = 0$$

One solution to the given equation can be written as  $x = 5 + \sqrt{n}$ , where  $n$  is a constant. What is the value of  $n$ ?

## 11- Sample test



$$3x^2 - 7x - 1 = 0$$

What are the solutions to the given equation?

- A)  $x = \frac{7 \pm \sqrt{37}}{6}$   
 B)  $x = \frac{7 \pm \sqrt{61}}{6}$   
 C)  $x = \frac{-7 \pm \sqrt{37}}{6}$   
 D)  $x = \frac{-7 \pm \sqrt{61}}{6}$

## 12- Sample test



Which expression is equivalent to  $k^{\frac{5}{16}}(k^{\frac{3}{2}})^{\frac{5}{8}}$ , where  $k > 0$ ?

- A)  $\sqrt{k}$   
 B)  $\sqrt[4]{k^5}$   
 C)  $\sqrt[8]{k^5}$   
 D)  $\sqrt[15]{k^{16}}$

## 18- Sample test



Which expression is equivalent to  $\sin 50^\circ$ ?

- A)  $\cos 50^\circ$
- B)  $\cos 40^\circ$
- C)  $\tan 50^\circ$
- D)  $\sin 40^\circ$

## 19- Sample test



Kiara uses her propane grill for an average of 11 hours each week. Her grill can run an average of 18 hours per 20-pound tank. Kiara would like to reduce her weekly expenditure on propane by \$5. Assuming propane costs \$16 per 20-pound tank, which equation can Kiara use to determine how many fewer average hours,  $h$ , she should use her grill each week?

- A)  $\frac{18}{16}h = 6$
- B)  $\frac{18}{16}h = 5$
- C)  $\frac{16}{18}h = 6$
- D)  $\frac{16}{18}h = 5$

## 20- Sample test



Which of the following expressions is equivalent to  $(2\sqrt{x} - \sqrt{y})^2$ , where  $x > y$  and  $y > 0$ ?

- A)  $(4x - y)^5$
- B)  $\sqrt[5]{4x - y}$
- C)  $(4x - 4\sqrt{xy} + y)^{\frac{1}{5}}$
- D)  $\sqrt[5]{4x - 4xy + y}$

## 21- Sample test



$$2|4 - x| + 3|4 - x| = 25$$

What is the positive solution to the given equation?

## 22- Sample test



$$x^2 - 3x + 1 = 0$$

One solution to the given equation can be written as  $\frac{3 - \sqrt{n}}{2}$ , where  $n$  is a constant. What is the value of  $n$ ?

## 23- Sample test



The measure of angle  $A$  is  $\frac{7}{12}\pi$  radians greater than

the measure of angle  $B$ . How much greater is the measure of angle  $A$  than the measure of angle  $B$ , in degrees? (Disregard the degree symbol when entering your answer.)

## 24- Sample test



Which of the following expressions is equivalent to  $(\sqrt{2q} + \sqrt{r})^2$ , where  $q > 0$  and  $r < 0$ ?

- A)  $(2q + 2r)^3$
- B)  $\sqrt[3]{2q + 2r}$
- C)  $\sqrt[3]{2q + 2\sqrt{qr} + 2r}$
- D)  $\sqrt[3]{2q + 4\sqrt{qr} + 2r}$

## 25- Sample test



If  $\frac{2x}{3} - 2 = \frac{x}{3} + 1$ , what is the value of  $2x$ ?

## 26- Sample test



Points  $A$  and  $B$  lie on a circle with radius 4 meters, and arc  $\overline{AB}$  has length  $\frac{4\pi}{5}$  meters. The length  $\frac{4\pi}{5}$  of arc  $\overline{AB}$  is what fraction of the circumference of the circle?

## 1- sample question



If  $x$  and  $y$  are negative, then which of the following statements is/are always true?

I.  $x + y$  is positive II.  $xy$  is positive III.  $x y$  is positive

- A I only
- B II only
- C III only
- D I and III only

## 2- sample question



If  $x$  and  $y$  are negative, then which of the following statements is/are always true?

I.  $x + y$  is positive II.  $x \times y$  is positive III.  $x - y$  is positive

- A I only
- B II only
- C III only
- D I and III only

## 3- sample question



If  $x$  and  $y$  are negative then which of the following statements is/are always true?

I.  $x + y$  is positive  
II.  $xy$  is positive  
III.  $x - y$  is positive

- A I only
- B II only
- C III only
- D I and III only

## ANSWERS OF LESSON ( MENTAL MATH )

NON CALCULATOR



Question	Answer
1	B
2	27
3	B
4	C
5	B
6	B
7	A
8	D
9	C
10	11
11	B
12	B
13	A
14	2.5
15	2
16	A
17	C
18	B
19	D
20	C
21	9
22	5
23	103
24	D
25	18
26	0.1
27	
28	
29	

CALCULATOR



Question	Answer
1	B
2	B
3	B
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