



EST 2 LEVEL 1 CLASSIFIED

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POWER

1- If $3^{x+3} = 243$, what is the value of 5^{x-1} ?

- A. 5
- B. 25
- C. 125
- D. 625
- E. 3125

2- If $3^n \times 9^m \times 27^p = 1$, then which of the following is the correct expression of n in terms of m and p ?

- A. $n = \frac{1}{mp}$
- B. $n = -3m - 2p$
- C. $n = 1 - 2m - 3p$
- D. $n = -m - p$
- E. $n = -2m - 3p$

3- Which of the following is equal to $\frac{5^{202} + 5^{200}}{25^{100}}$?

- A. 25
- B. 26
- C. 2^{202}
- D. 5^{202}
- E. 10^{202}

4- The simplest form of $\frac{2^{y+4} - 2(2^y)}{2(2^{y+3})}$ is:

- A. $\frac{1}{4}$
- B. $\frac{1}{2}$
- C. $\frac{1}{8}$
- D. $\frac{5}{8}$
- E. $\frac{7}{8}$

5- What is the value of $2x^3$ if $3125 = 5^{3x-4}$?

- A. 3
- B. 6
- C. 27
- D. 54
- E. 250

6-Which of the following is equivalent to $f(x) = 343(7^{-2x})$?

A. $f(x) = 7^{2+3x}$

B. $f(x) = 7^{3-2x}$

C. $f(x) = 7^{6x}$

D. $f(x) = \frac{1}{7^{6x}}$

E. $f(x) = \frac{1}{7^{3-2x}}$

7-Which of the following expressions is equivalent to $\sqrt[3]{135x^5y^7} \cdot \sqrt{180x^3y}$?

A. $18x^3y^2 \cdot \sqrt[6]{5^5y^4x}$

B. $18x^2y^3 \cdot \sqrt[6]{5^5y^5x}$

C. $18x^2y^3 \cdot \sqrt[6]{5^5y^4x}$

D. $18x^3y^2 \cdot \sqrt[6]{5^5y^5x^2}$

E. $18x^3y^2 \cdot \sqrt[6]{5^5y^5x}$

EQUATIONS

1- Given the equation $x + 2y - 8i = 7 + 2xi + 8yi$, what real values of x and y satisfy the equation?

- A. $x = 4, y = -5.5$
- B. $x = 4, y = -1.5$
- C. $x = 10, y = -1.5$
- D. $x = 18, y = -5.5$
- E. $x = 8, y = -0.5$

2- If y varies directly with z and inversely with v , then which of the following could be a correct expression of z as a function of y and v ?

- A. $z = 3yv$
- B. $z = \frac{1y}{6v}$
- C. $z = \frac{7v}{6y}$
- D. $z = 8\frac{y}{v}$
- E. $z = \frac{1}{6}(y + v)$

3- If $\sqrt{a} + \sqrt{b} = 4.6$ and $a + b = 13.46$, then $ab =$

- A. 1.21
- B. 3.85
- C. 7.7
- D. 12.25
- E. 14.8225

4- Each day, Jack's donut shop starts with 100 donuts. Throughout the day, some donuts are sold, some are discarded, and some more is made according to the following principle: for every three donuts sold, one more is made. If on a particular day, Jack sold m donuts and discarded d donuts, and at the end of the day had no donuts left, which of the following gives the correct relation between m and d ?

- A. $2m + 3d = 300$
- B. $3m + 2d = 300$
- C. $3d - 2m = 300$
- D. $2d - 3m = 100$
- E. $m + d = 100$

5- If $3k - \frac{k}{k+1} = \frac{16}{k+1}$, what is a possible value of $k + 1$?

- A. $-\frac{8}{3}$
- B. $-\frac{5}{3}$
- C. 2
- D. 5
- E. 6

D

6- The equation $\frac{1+|x-1|}{|x-1|} = 5$ has two solutions. What is the sum of these two solutions?

- A. 0.75
- B. 1.25
- C. 2
- D. 2.5
- E. 3.25

7- If $a(b - 1) = 1$ and $12ab = 4$, what is the value of b ?

- A. -0.667
- B. -0.5
- C. 0.5
- D. 0.667
- E. 2

8- For how many strictly positive integer values of x is the following inequality satisfied?

$$2(3 - x) \geq -14$$

- A. 0
- B. 1
- C. 9
- D. 10
- E. 11

$$\begin{cases} 12x - 15y = 17 \\ x + 8y = 12 \end{cases}$$

9- What is the value of $46y - 22x$?

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

10- The remainder when $t^{16} + 5$ is divided by $t + 1$ is

- A. 6
- B. 0
- C. -1
- D. 4
- E. 1

11- What are all p such that $\frac{p+100}{p} \leq 1$?

- A. $p > 0$
- B. $p < 0$
- C. $p \leq 0$
- D. $-1 < p < 0$
- E. $-1 \leq p < 0$

12- The solution of $3x^2 - x y = 3$ and $6x - y = 10$ is

- A. $\frac{1}{3}$ and 3
- B. 8 and -8
- C. $\frac{1}{3}$ and -8
- D. 3 and 8
- E. $\frac{1}{3}$ and -8; 3 and 8

13- If $[\sqrt{2} (\cos 30^\circ + i \sin 30^\circ)]^2 = a + bi$, then $a = \dots$ and $b = \dots$

- A. $a = 2, b = \sqrt{3}$
- B. $a = \frac{3}{2}, b = \frac{1}{2}$
- C. $a = 1, b = -\sqrt{3}$
- D. $a = \frac{3}{2}, b = -\frac{1}{2}$
- E. $a = 1, b = \sqrt{3}$

14- The solution of the system $\begin{cases} 3 - x^2 \leq 0 \\ \frac{x - 11}{x - 4} \geq 2 \end{cases}$ is

- A. $x \in [-3, -\sqrt{3}] \cup [\sqrt{3}, 4[$
- B. $x \in]-3, -\sqrt{3}] \cup [\sqrt{3}, 4[$
- C. $x \in]-3, -\sqrt{3}[\cup]\sqrt{3}, 4[$
- D. $x \in [-3, -\sqrt{3}] \cup [\sqrt{3}, 4]$
- E. $x \in [-3, -\sqrt{3}] \cup]\sqrt{3}, 4[$

15- The real numbers m , n and p such that $P(x) = (x^2 - 2)(mx^2 + nx + p)$ will be identical to $x^4 - x^3 - 3x^2 + 2x + 2$ are:

- A. $m = 1, n = -1, p = -1$
- B. $m = -1, n = -1, p = -1$
- C. $m = 1, n = 1, p = 1$
- D. $m = 1, n = 1, p = -1$
- E. $m = -1, n = -1, p = 1$

16- The total price of one kilogram of sugar and one kilogram of salt is 20 EGP. During an economic crisis, the price of sugar increased by 12 % and that of salt decreased by 15% such that the total price of 1 Kg of sugar and 1 Kg of salt became 22 EGP.

Reem bought 5 Kg of sugar and 2 Kg of salt during the crisis. How much did she pay, rounded to the nearest integer?

- A. 106 EGP
- B. 100 EGP
- C. 120 EGP
- D. 96 EGP
- E. 48 EGP

17- A company runs three production lines that together have an output of 54 parts/ hour. Twice the production of the second line is equal to the combined output of the other two lines, and the output of the third line is three parts per hour more than the second line.

The production rate of the first line x , the production rate of the second line y and that of the third one z are:

- A. $x = 21, y = 18, z = 15$
- B. $x = 18, y = 21, z = 15$
- C. $x = 15, y = 21, z = 18$
- D. $x = 21, y = 15, z = 18$
- E. $x = 15, y = 18, z = 21$

18-. The solution of the system defined by $\begin{cases} x^2 - x - 2 \geq 0 \\ \frac{x-3}{x+2} \leq 0 \end{cases}$ is

- A. $] -\infty, -1] \cup [2, +\infty [$
- B. $] -2, 3]$
- C. $] -2, -1] \cup [2, 3 [$
- D. $] -2, -1] \cup [2, 3]$
- E. $[-2, -1] \cup [2, 3 [$

19-. $\lim_{x \rightarrow +\infty} \frac{\sqrt{x^2 + 4x + 1} - 1}{x}$ is

- A. 2
- B. $+\infty$
- C. 0
- D. 1
- E. $-\infty$

20- On a given day, a department store sold 40 shirts. The shirts come in three styles: Casual, sports and dress. A casual shirt costs \$20, a sports shirt costs \$40, and a dress shirt costs \$60. The store sold \$1080 worth of these shirts on that day and the number of casual shirts exceeded by 20 the combined numbers of the sports and dress shirts.

The number of shirts of each type is:

- A. 6 casual shirts, 30 sport and 4 dress shirts
- B. 30 casual shirts, 7 sport and 3 dress shirts
- C. 30 casual shirts, 6 sport and 4 dress shirts
- D. 4 casual shirts, 6 sport and 30 dress shirts
- E. 6 casual shirts, 4 sport and 30 dress shirts

21- If $f(x) = 2ax^2 + (3 - b)x + 7$ and $g(x) = (a - 1)x^2 + 2bx + 7$ are identical, what are the zeros of function f ?

- A. -1.54 and 4.54
- B. -2.19 and 3.19
- C. -1.27 and 2.77
- D. -1.44 and 2.44
- E. -2.44 and 1.44

22- If $x + 4y = -10$ and $2x = 35 + 3y$, what is the value of twice the quotient of x and y ?

- A. -4
- B. -2
- C. $\frac{1}{2}$
- D. 2
- E. 4

23- If $|x - 3| = 2x$, which of the following is the correct value of x ?

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

24- Which of the following is equivalent to the expression: $2a^2 - 3a + 4ba - 6b$?

- A. $(2a - 3)(a - 2b)$
- B. $(2a - b)(a + 3)$
- C. $(2 - b)(ab - 3)$
- D. $(2a - 3)(a + 2b)$
- E. $(2a + 3)(a - 2b)$

25- Which constant should be added to $3x^2 - 8x$ in order to be made into a perfect square?

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

26- Which of the following is not a solution of

$$|-8 + 3x| - 2 < 3 ?$$

- A. $\frac{108}{25}$
- B. $\frac{19}{5}$
- C. $\frac{16}{5}$
- D. 2
- E. $\frac{19}{20}$

27- The polynomial $2x^3 - ax^2 - 7x + 6$ has no remainder when it is divided by $x - 1$. What is the value of a ?

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

28- If $21x - i + 8y = 7xi + 2y - 1$, what real values of x and y satisfy the equation?

- A. $x = -\frac{1}{7}$ and $y = \frac{1}{3}$
- B. $x = \frac{1}{7}$ and $y = -\frac{1}{3}$
- C. $x = -\frac{1}{7}$ and $y = -\frac{1}{3}$
- D. $x = -7$ and $y = 3$
- E. $x = \frac{1}{7}$ and $y = \frac{1}{3}$

29- Which of the following expressions can never have a negative answer for any x ?

- A. $|2x - 3(x - 5)| - 1$
- B. $\frac{x^2 - x - 6}{x^4}$
- C. $(-2|x - 3|)^2 - 3$
- D. $\frac{x^2 + 3}{(x - 7)^2}$
- E. $(x - 1)^3$

30- Ahmad bought 7 pencils and 11 pens from a shop for \$11.2. The price of 5 pens is equal to the price of 7 pencils. What is the price of 3 pens?

- A. \$1.0
- B. \$1.4
- C. \$1.5
- D. \$2.1
- E. \$3.5

31- What is the value of x in the equality $2ix(i - 1) = (i - 1)^2 - 2$ knowing that $i = \sqrt{-1}$?

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

32- If $|x - 2| < 4$, then $|x - 3|$ is less than

- A. 4
- B. 2
- C. 3
- D. 5
- E. 0

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

- A. 4
- B. 8
- C. 2
- D. 0.5
- E. 16

34- $\ln(x^2 - 2x + 2) > 0$ is verified in:

- A. $] -\infty, +\infty[$
- B. $] 0, +\infty[$
- C. $] 0, 1]$
- D. $] -\infty, \frac{-1}{2}[\cup] 0, +\infty[$
- E. $] -\infty, 1[\cup] 1, +\infty[$

$$f(x) = \begin{cases} -8x - m & \text{for } x \leq 2 \\ 10x - 3 & \text{for } x > 2 \end{cases}$$

35- For what value of m , if any, is the function f above continuous at $x = 2$?

- A. 33
- B. 17
- C. 23
- D. -33
- E. Doesn't exist

36- If $x^2 = -2y - 5$ and $z = -8y^3$, what is x in terms of z ?

- A. $x = \sqrt[3]{z} - 5$
- B. $x = \pm \sqrt{\sqrt[3]{z} - 5}$
- C. $x = \pm (\sqrt[3]{z} - 5)$
- D. $x = \pm \sqrt[6]{z} - \sqrt{5}$
- E. $x = (\sqrt[3]{z} - 5)^2$

37- If a and b are real numbers, $i^2 = -1$, and $a + bi = (2 + 3i)^2$, then which of the following is the average of a and b ?

- A. 2.5
- B. 3
- C. 3.5
- D. 5
- E. 12.5

FUNCTION

- 1- If $f(x) = -3 \cos x$, $g(x) = 3\sqrt{7}$, and $h(x) = x^2 - 3$, find the value of $f[(h \circ g)(2)]$.
- A. -2.99
 - B. -1.5
 - C. 1
 - D. 5.94
 - E. 7.93
- 2- The sum of the roots of $(x - \sqrt{2})^2(2x - \sqrt{2})(x + \sqrt{2}) = 0$ is
- A. $\sqrt{2}$
 - B. 1
 - C. $\frac{3\sqrt{2}}{2}$
 - D. $\frac{\sqrt{2}}{2}$
 - E. $\frac{1}{2}$
- 3- In a graph of $y = -3^x$, which following statement/s is/are true?
- I. The graph is continuous and decreasing.
 - II. The graph passes through points $(0, -1)$ and $(-1, 0)$.
 - III. The range is $\{y \mid y < 0\}$.
- A. I only
 - B. I and II
 - C. II only
 - D. I and III
 - E. II and III
- 4- What is the domain of the function defined by $f(x) = \frac{x-3}{x^2-5x-14}$?
- A. All real numbers
 - B. All real numbers except 7
 - C. All real numbers except 0 and 7
 - D. All real numbers except 0 and -2
 - E. All real numbers except -2 and 7

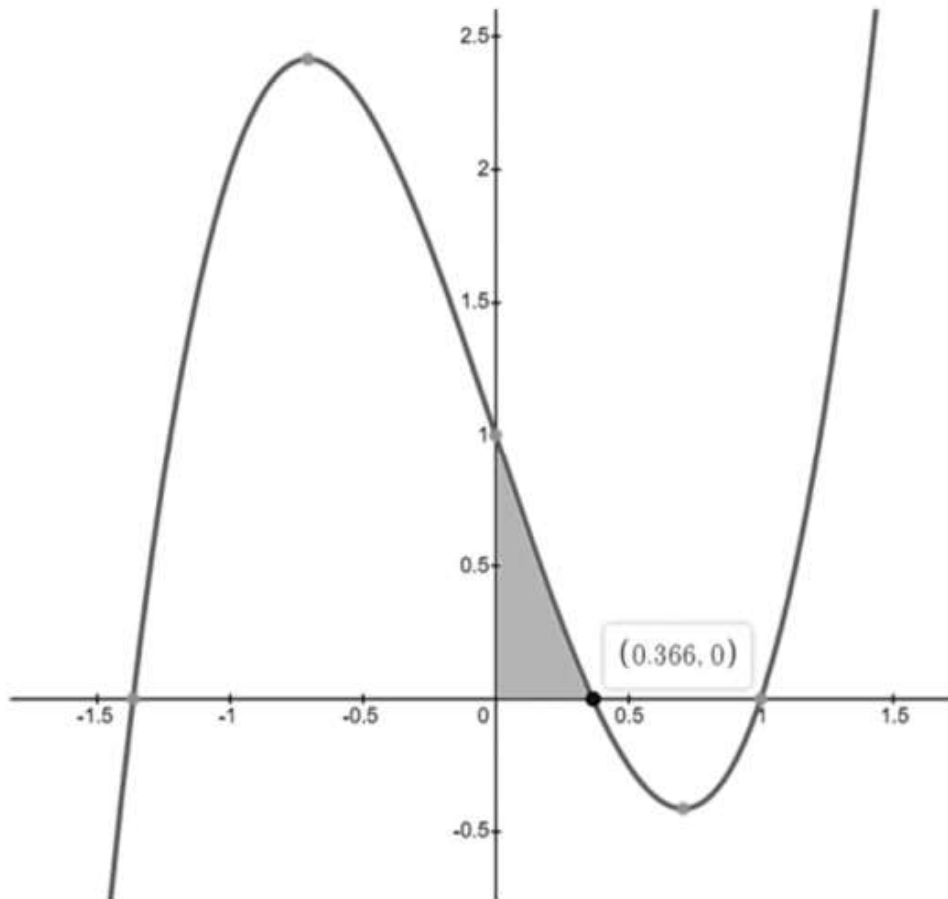
5- If $y = \frac{2x+1}{x} - 1$, what value does y approach as x gets infinitely large?

- A. -1
- B. 0
- C. 1
- D. 2
- E. y approaches a positive infinite number

6- Consider the function $f(x) = 2x^5 - 3x^3 + x$. Which of the following statement/s is/are true?

- I. It is an even function
- II. It is an odd function.
- III. It is symmetric about the x -axis.

- A. I only
- B. II only
- C. III only
- D. I and III
- E. II and III



7- In the figure above, the graph represents the function $f(x) = 2x^3 - 3x + 1$. How many roots does it have? Consider the shaded region is bound by the x -axis, y -axis, and a straight line passing through $(0, 1)$ and $(0.366, 0)$. What is the area of the shaded region?

- A. 2 roots, and 0.183 square units
- B. 3 roots, and 0.183 square units
- C. 2 roots, and 0.366 square units
- D. 3 roots, and 0.366 square units
- E. 4 roots, and 0.366 square units

8- Given the two functions: $f(x) = \begin{cases} x + 5, & x < 0 \\ 2x - 1, & x \geq 0 \end{cases}$, and $g(x) = \begin{cases} 3x - 1, & x < -3 \\ 2x + 3, & -3 \leq x < 5 \\ 4x + 1, & x \geq 5 \end{cases}$,

find the value of $(f \circ g)(-2)$.

- A. -3
- B. -2
- C. -1
- D. 4
- E. 9

9- Which translation in comparison to its parent function is true about the graph of $f(x) = 2x - 1$?

- A. The graph is translated 1 unit up, and it is stretched vertically.
- B. The graph is translated 1 unit up, and it is stretched horizontally.
- C. The graph is translated 1 unit down, and it is stretched vertically.
- D. The graph is translated 1 unit down, and it is stretched horizontally.
- E. The graph is translated 1 unit down only.

10- Given the two functions: $f(x) = x - 2$, and $g(x) = x + 2$, which of the following statement/s is/are true about graph f and g in the xy -plane?

- I. The two functions are inverse functions.
- II. They intersect at the origin.
- III. Both functions are parallel.

- A. I only
- B. II only
- C. III only
- D. I and II
- E. I and III

11- If f is the function defined by $f(x) = \frac{3x^2 - 4x + 1}{2x^2 + 7x - 9}$, then which of the following is a root of $f(x)$?

I. $-\frac{9}{2}$

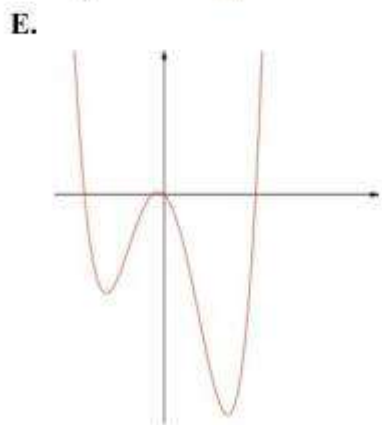
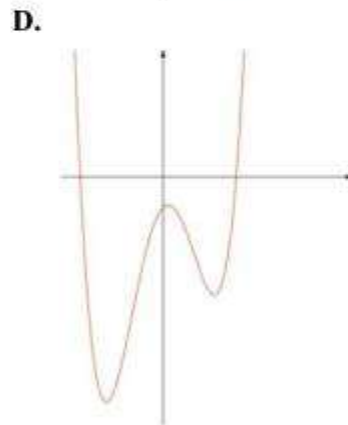
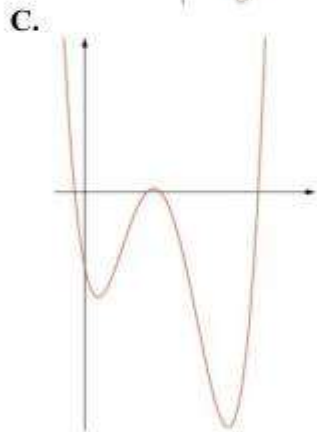
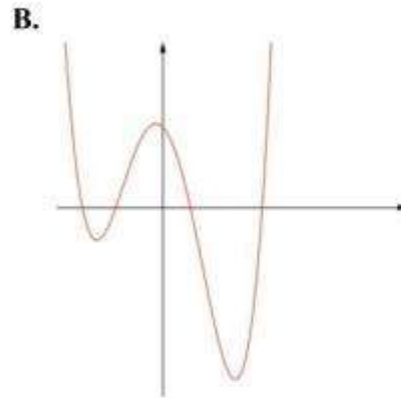
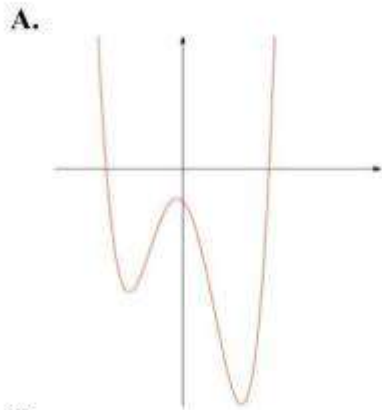
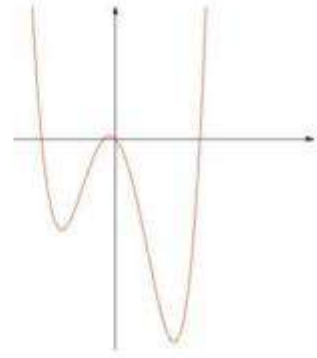
II. $\frac{1}{3}$

III. 1

- A. Only I
- B. Only II
- C. Only III
- D. II and III
- E. I, II, and III

- 12- When fidget spinners were first introduced in the market, Leonard decided to sell them in his toy shop. The number of spinners he sold every week is modeled by $N(w) = -w^2 + 10w$, where w is the number of weeks starting the first week of February and $N(w)$ is the number of spinners sold each week in hundreds. One particular week, Leonard realized that his sales were greater than the sales in any other week. What is this maximum number of sales?
- A. -2500
B. 500
C. 1000
D. 2500
E. 5000
- 13- Consider the function f defined by $f(x) = (m - 1)x^3 - 3m - 1$, where m is a real number. If the graph of f has a y -intercept of 2, then $f(1) =$
- A. -6.4
B. -1
C. 0
D. 1
E. 2.2
- 14- Let f be the function defined by $f(x) = x^4 - 3x^2 - k$ where k is a real number. For which values of k does the line d of equation $y = 1$ cut the graph of f in 4 distinct points?
- A. -3.7
B. -1.9
C. -1
D. 0
E. 1.2
- 15- Consider the parabola of equation $y = x^2 + 22x - 320$. What are the coordinates of the midpoint of the segment joining the two x -intercepts of the parabola?
- A. (-11, 0)
B. (0, -11)
C. (11, 0)
D. (0, 11)
E. (0, -160)

16-23. The adjacent graph is that of a function $f(x)$. The graph of the function g is obtained by translating the graph of f , that is $g(x) = f(x + a) + b$ for some real numbers a and b . Which of the graphs below cannot be that of $g(x)$ for any real values of a and b ?



- 17- If f is the function defined by $f(x) = (2x + 1)^3$, for which of the following values of x is $f(f(x)) = f(x)$?
- A. -2
 - B. -1
 - C. 0
 - D. 1
 - E. 2
- 18- The range of the function defined by $f(x) = |1 - x^2| + 2$ is:
- A. $f(x) > 2$
 - B. $f(x) > 3$
 - C. $f(x) < 2$
 - D. $f(x) \geq 2$
 - E. $f(x) \leq 2$
- 19- If $f(x) = x^2 - 4x + 1$, which of the following is also equal to $f(x)$?
- A. $f(x - 4)$
 - B. $f(2 - x)$
 - C. $f(4 - x)$
 - D. $f(4 + x)$
 - E. $f(4) - f(x)$
- 20- Let f be the function defined by $f(x) = mx^3 + px^2 + qx - 1$, where m , p , and q are real numbers. If the graph of f passes through the point $(1, 7)$, what is the average of m , p , and q ?
- A. $\frac{7}{3}$
 - B. 2
 - C. $\frac{8}{3}$
 - D. 3.5
 - E. 4

21- If m and n are the roots of the equation $ax^2 + bx + c = 0$, where a, b , and c are real numbers, which of the following quantities does not change when we vary a ?

- I. $m \cdot n$
 - II. $m + n$
 - III. $\frac{1}{m} + \frac{1}{n}$
- A. Only I
 - B. Only II
 - C. Only III
 - D. I and II
 - E. I, II, and III

22- If $f(x) = 1.6^x$ and $g(x) = 1.4^x$ and $f(g(0)) = A \times g(f(0))$, what is the value of A ?

- A. $\frac{7}{8}$
- B. 1
- C. $\frac{8}{7}$
- D. $\frac{25}{56}$
- E. $\frac{56}{25}$

Days d	1	2	3	4	5	6	7	8
Cases	100	350	250	600	723	702	750	790
N								

23- The table above shows the number of cases of individuals infected with the COVID-19 virus in a certain country every day after Sunday October 18 (so $d = 1$ is Monday October 19, and so on). The government uses a linear regression model and decides to impose total lockdown when the number of cases reaches 1000. Using the linear model, what is the predicted date at which the lockdown will be imposed?

- A. October 20
- B. October 23
- C. October 29
- D. October 31
- E. November 1

24- If $f(x) = x^2 + 1$ and $d(x) = \frac{f(x) - f(2)}{x - 2}$, then which of the following is true?

- A. $d(x) = f(x)$ for all values of x
- B. $d(x) = x - 2$ for all values of x
- C. $d(x) = x + 1$ for all values of x except 2
- D. $d(2) = f(2)$
- E. $d(x) = x + 2$ for all values of x except 2

25- If two roots of the equation $y^3 + a y^2 + b y + c = 0$ (with a , b , and c integers) are 1 and $2 - 8i$, then the value of a is

- A. $2 + 8i$
- B. -5
- C. 5
- D. $4 + 8i$
- E. $4 - 8i$

26- The root(s) of the equation $\sqrt{a + 6} = -a$ is / are:

- A. 3
- B. -2
- C. 3 and -2
- D. 3 or -2
- E. No Roots

27- The graph of $t^2 - \sqrt{5} t - 2$ has its minimum value at which the approximate value of t

- A. 83
- B. 1.12
- C. 1.21
- D. 1.35
- E. 2.47

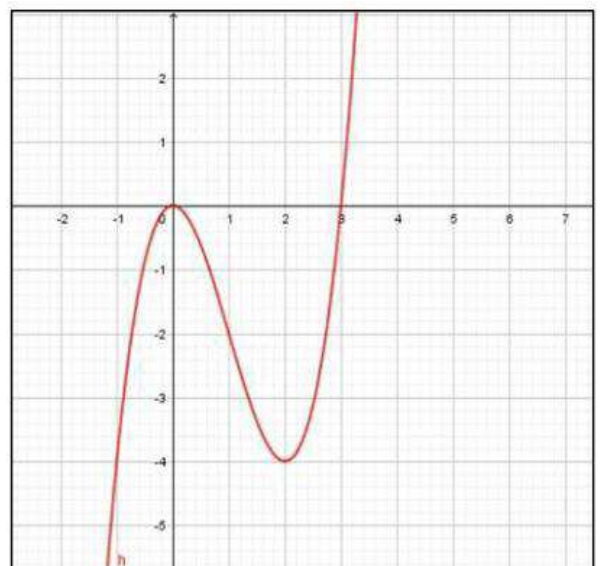
28- The largest real range of the function $y = 1 - \frac{1}{x}$ is

- A. $y > 0$
- B. All Real numbers for y except $y = 1$
- C. $y \neq 0$
- D. $y \geq 0$
- E. $y \leq 0$

29- Suppose that the adjacent curve (h) is the curve representing the function f defined by $f(x) = ax^3 + bx^2$.

Graphically,

- A. $a = 1$ and $b = -3$
- B. $a = -1$ and $b = -3$
- C. $a = -3$ and $b = 1$
- D. $a = 1$ and $b = 3$
- E. $a = 3$ and $b = -1$



30- If $f(x) = \sqrt{x-1}$ and $g(x) = x^2$, what is the domain of $(f \circ g)(x)$?

- A. All x such that $x \geq 1$
- B. All x such that $x \leq -1$
- C. All x such that $x \leq -1$ or $x \geq 1$
- D. All x such that $x \leq -1$ and $x \geq 1$
- E. All real numbers

31- What is the product of the solutions of $x^4 - 3x^2 = -2$?

- A. $-2\sqrt{2}$
- B. -2
- C. 1
- D. 2
- E. $2\sqrt{2}$

32- What are the transformations of $f(x) = x^2$ when the graph of $g(x) = 2x^2 - 2$ is sketched?

- A. It is vertically stretched with a vertical shift down 2 units
- B. It is vertically stretched with a horizontal shift right 2 units
- C. It is vertically compressed with a vertical shift down 2 units
- D. It is vertically compressed with a vertical shift up 2 units
- E. It is horizontally stretched with a vertical shift down 2 units

33- Which of the following is the inverse function of $f(x) = x^2 - 4x + 4$?

- A. $f^{-1}(x) = -4 \pm \sqrt{x}$
- B. $f^{-1}(x) = -2 \pm \sqrt{x}$
- C. $f^{-1}(x) = \pm \sqrt{x}$
- D. $f^{-1}(x) = 2 \pm \sqrt{x}$
- E. $f^{-1}(x) = 4 \pm \sqrt{x}$

34- Which of the following equations has roots equal to $2\sqrt{2}$ and $-\frac{7}{2}$?

- A. $0 = x^2 + x \left(\frac{-7 + 4\sqrt{2}}{2} \right) - 7\sqrt{2}$
- B. $0 = x^2 + x \left(\frac{7 - 4\sqrt{2}}{2} \right) - 7\sqrt{2}$
- C. $0 = x^2 + x \left(\frac{-7 + 4\sqrt{2}}{2} \right) + 7\sqrt{2}$
- D. $0 = x^2 + x \left(\frac{7 - 4\sqrt{2}}{2} \right) + 7\sqrt{2}$
- E. $0 = x^2 + x \left(\frac{7 - 2\sqrt{2}}{2} \right) - 7\sqrt{2}$

35- If $f(x) = 2 \cdot 3^x + 2$, which of the following statements is correct?

- A. The graph of $f(x)$ is increasing and the equation of the vertical asymptote is $x = 2$.
- B. The graph of $f(x)$ is increasing and the equation of the horizontal asymptote is $y = 2$.
- C. The graph of $f(x)$ is decreasing and the equation of the horizontal asymptote is $y = 2$.
- D. The graph of $f(x)$ is decreasing and the equation of the vertical asymptote is $x = 2$.
- E. The graph of $f(x)$ is increasing and there are no asymptotes.

36- Given $f(x) = 3x^2 - 6x + 1$. What is the product of the coordinates of the vertex of this function?

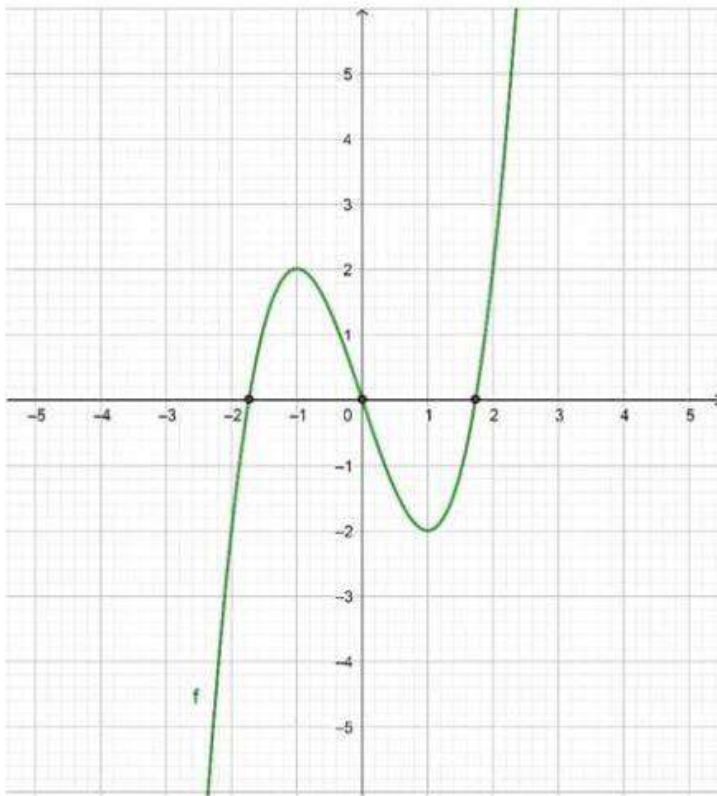
- A. -10
- B. -1
- C. -2
- D. 1
- E. 2

37- Using the two tables below, what is $(g \circ f)(-2)$?

x	$f(x)$
-2	-1
4	-2
5	4

x	$g(x)$
5	4
-1	2
3	6

- A. 3
- B. 5
- C. -2
- D. -1
- E. 2



38-. The figure above represents a function f that cuts the x -axis at three points of abscissas $-\sqrt{3}$, 0 and $\sqrt{3}$.

Consider the following intervals: $I =]-2, -\sqrt{3}[$, $K =]-1, 0[$, $L =]0, 1[$, $M =]1, \sqrt{3}[$ and $N =]\sqrt{3}, 2[$.

In what interval is the function f considered to be positive and decreasing function?

- A. I
- B. K
- C. L
- D. M
- E. N

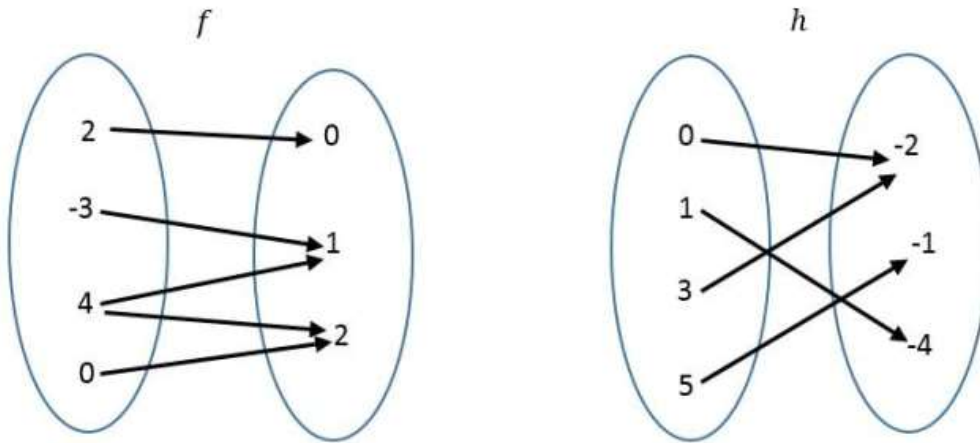
39- Consider $P(x) = ax^2 + bx + c$ ($a \neq 0$), a polynomial of second degree in which $P(0) = 1$.

If $P(x + 1) - P(x) = 4x$, what are the values of a , b and c ?

- A. $a = 2, b = 2, c = 0$
- B. $a = 2, b = 2, c = 1$
- C. $a = 1, b = 2, c = 1$
- D. $a = -2, b = -2, c = 1$
- E. $a = 2, b = -2, c = 1$

40- If m is a real parameter, what is the number of the real roots of the equation $x(x^2 + 1)(mx^2 - x - 2m) = 0$?

- A. 1
- B. 2
- C. 3
- D. 0
- E. 5



41-. Which of the two relations above is a function and why?

- A. f because input 4 has two images
- B. f because each input has exactly one output
- C. h because input -2 has two pre-images
- D. f or h because each relation is a function
- E. h because each input has only one image

42- Consider the functions below:

$$f(x) = 2x^3 - 4x + 1$$

$$g(x) = 3x^{0.5} + 3x^{-2} + 3$$

$$h(x) = -\sqrt{3}x^2 + 3x$$

$$k(x) = \frac{1}{3}x^2 + \frac{2}{x}$$

Which of these functions is a polynomial function?

- A. f and g
- B. h and g
- C. f and h
- D. f, h and g
- E. f, g, h and k

- 43- In the xy -plane the function f defined by $f(x) = x^3 + 4x - 5$ admits a graph (C). A computer program generated 5 graphs of which one is correct. The graphs are characterized by:

Graph 1	It admits 3 vertices.
Graph 2	It admits 2 maxima and 1 minimum.
Graph 3	It is strictly decreasing.
Graph 4	It is strictly increasing.
Graph 5	It is always positive.

Which graph is correct?

- A. Graph 1
- B. Graph 2
- C. Graph 3
- D. Graph 4
- E. Graph 5

- 44- If $f(x) = \sqrt[3]{x^3 + 3} + 3$ and $f^{-1}(x) = \sqrt[3]{-3}$, what is the value of x ?

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

- 45- What is the domain of definition of $\arcsin(3 - 4x)$?

- A. $\frac{-1}{2} \leq x \leq \frac{1}{2}$
- B. $\frac{-1}{2} \leq x \leq 1$
- C. $\frac{1}{2} \leq x \leq 1$
- D. $-1 \leq x \leq \frac{-1}{2}$
- E. $-1 \leq x \leq 1$

LINEAR FUNCTION

1- What is the slope of the line perpendicular to the line whose equation is $\frac{-x}{3} + \frac{7y}{2} = -1$?

- A. $\frac{2}{21}$
- B. $-\frac{21}{2}$
- C. $\frac{21}{2}$
- D. $-\frac{2}{21}$
- E. $-\frac{6}{7}$

2- If $f(x) = cx + b$ and $g(x) = -dx + e$ are the equations of two consecutive sides of a parallelogram, which of the following is true in order for the parallelogram to be a rectangle?

- A. $c = 2$
- B. $c = -d$
- C. $c = -\frac{1}{d}$
- D. $cd = 0$
- E. $cd = 1$

3- The three lines l , d , and t in the plane are such that they are parallel and d is equidistant from l and t . If the equation of l is $y = 2x + 70$ and the equation of d is $y = 2x + 10$, which of the following is the equation of line t ?

- A. $2x - y = -40$
- B. $2x - y = 50$
- C. $2x - y = 40$
- D. $x - 2y = 50$
- E. $x - 2y = -40$

4- A line in the plane passes through the 3 distinct points (a, b) , (c, d) , and (e, f) . Then all of the following give a correct relation between a, b, c, d, e , and f except:

- A. $\frac{c-a}{d-b} = \frac{c-e}{d-f}$
- B. $\frac{d-b}{d-f} \times \frac{c-e}{a-c} = 1$
- C. $\frac{d-b}{d-f} \times \frac{c-e}{c-a} = 1$
- D. $\frac{c-a}{d-b} + \frac{c-e}{f-d} = 0$
- E. $\frac{d-b}{d-f} - \frac{c-a}{c-e} = 0$

- 5- The two lines m and n of respective equations $3x - y = 1$ and $ax + by = 2$ are parallel, where $a < 0$ and b is a real number. Which of the following may be true about b ?
- I. $b = -2.31$
 - II. $b = 1.04$
 - III. $b = 0$
- A. Only I
 - B. Only II
 - C. I and III
 - D. II and III
 - E. I, II, and III
- 6- What is the equation of the tangent to the curve of function f defined by $f(x) = x^2 + 6x + 8$ at a point of abscissa 1 ?
- A. $y = -3x + 18$
 - B. $y = 8x + 18$
 - C. $y = 8x + 7$
 - D. $y = -3x + 7$
 - E. $y = 8x - 7$
- 7- What is the slope of the line perpendicular to the one passing through $(-4, 5)$ and $(3, 7)$?
- A. $-\frac{7}{2}$
 - B. -1
 - C. $-\frac{2}{7}$
 - D. $\frac{2}{7}$
 - E. $\frac{7}{2}$
- 8- Consider the two lines D and L of respective equations $2x - y - 1 = 0$ and $mx + (m - 1)y = 0$ where m is real number. For what value of m , line D is parallel to line L ?
- A. -1
 - B. 2
 - C. $\frac{3}{2}$
 - D. $\frac{2}{3}$
 - E. -2

- 9- A regression analysis between sales (Y) and advertising (X) across all the branches in Egypt of a major company resulted in the following equation $Y = 40,000 + 6.25 X$.
- If the advertising budgets of the two branches in Giza and Alexandria differ by 200,000 EGP, then what will be the predicted difference in their sales?
- A. 12.5 EGP
 - B. 80,000 EGP
 - C. 160,000 EGP
 - D. 250,000 EGP
 - E. 1,250,000 EGP

GEOMETRY

- 1- If we shade a region in a semi-sphere with radius r , what would be the area of the shaded region?
- A. $4\pi r$
 - B. $\frac{5}{2}\pi r^2$
 - C. $\frac{7}{2}\pi r^2$
 - D. $4\pi r^2$
 - E. $\frac{4}{3}\pi r^2$
- 2- Given two points $A(1, -2, 1)$ and $B(5, 6, z_B)$, find a value of z_B if the distance in space between the two points is equal to 9.
- A. 1
 - B. 2
 - C. 3
 - D. -1
 - E. -2
- 3- In rectangle $ABCD$, $AC = 5$ cm and $m\angle BAC = 25^\circ$. Find the perimeter of triangle ABC .
- A. 15 cm
 - B. 11.64 cm
 - C. 11 cm
 - D. 9.57 cm
 - E. 4.78 cm
- 4- $ABCD$ is a parallelogram such that the base $AB = 4h$, with h being the height of the parallelogram. Find the length of \overline{AB} if the area of the parallelogram is equal to 625 cm^2 .
- A. 50 m
 - B. 2500 m
 - C. 50 cm
 - D. 2500 cm
 - E. 100 cm

- 5- Which of the following cannot be the sides of an obtuse triangle?
- A. 9, 10, 13.6
 - B. 8, 12, 14.5
 - C. 6, 7, 10
 - D. 7, 9, 11
 - E. 9, 11.2, 15
- 6- What could be the area of a rectangle whose width is equal to $(2x - 1)$ in centimeters, and its length is triple its width? (Consider $x = 5$)
- A. 344 cm^2
 - B. 324 cm^2
 - C. 81 cm^2
 - D. 95 cm^2
 - E. 243 cm^2
- 7- ADF is an isosceles triangle at F inscribed in circle (C) of center O and diameter \overline{AD} . What is the value of $1 - \tan^2 A$ if the radius of the circle is equal to 6 cm ?
- A. 0
 - B. 1
 - C. $6\sqrt{2}$
 - D. 6
 - E. 12
- 8- $A(1, 3)$ and $B(4, 2)$ are two points on a xy -plane of origin O . \overrightarrow{Bx} is parallel to \overline{OA} , and T is a point on \overline{Bx} such that $OABT$ is a parallelogram. Find the area of triangle OTN with N as the intersection of \overline{BT} with the x -axis.
- A. 1.67
 - B. 3.33
 - C. 6.66
 - D. 10
 - E. 20

- 9- $FGHI$ is a parallelogram such as the base is equal to $(2x - 3)^2$ while the height is double the base. Which expression represents half the area of this parallelogram?
- A. $16x^4 - 96x^3 + 216x^2 - 216x + 81$
 - B. $2(16x^4 - 96x^3 + 216x^2 - 216x + 81)$
 - C. $3(16x^4 - 96x^3 + 216x^2 - 216x + 81)$
 - D. $4(16x^4 - 96x^3 + 216x^2 - 216x + 81)$
 - E. $8x^2 - 24x + 18$
- 10- A plane intersects a sphere of radius 4cm in a circle. Which of the following cannot be the area of this circle?
- A. $4\pi \text{ cm}^2$
 - B. $8\pi \text{ cm}^2$
 - C. $12\pi \text{ cm}^2$
 - D. $16\pi \text{ cm}^2$
 - E. $24\pi \text{ cm}^2$
- 11- The volume of a certain pyramid of rectangular base is 12. We alter its dimensions in such a way that the volume does not change. If the height has been doubled, which of the following could be possible alterations to the length L and the width W of the base of the pyramid?
- A. Multiply L by 12 and divide W by 6
 - B. Multiply L by 1 and divide W by 0.5
 - C. Multiply L by 9 and divide W by 18
 - D. Divide both L and W by 0.5
 - E. Multiply both L and W with 0.5
- 12- A circle inscribed in a square has an area of 36π . What is the length of the diagonal of the square?
- A. 8.485
 - B. 12
 - C. 16.97
 - D. 36
 - E. 50.912
- 13- C is a circle tangent to the two straight lines of equations $y = 2$ and $y = -4$. Which of the following could be the equation of the circle?
- A. $(x + 1)^2 + y^2 = 9$
 - B. $(x - 1)^2 + (y + 1)^2 = 3$
 - C. $(x + 4)^2 + (y + 2)^2 = 9$
 - D. $(x + 1)^2 + y^2 = 3$
 - E. $(x + 2)^2 + (y + 1)^2 = 9$

- 14- Consider all spheres of nonzero volume having as their center the point A in space. How many of these spheres can have a surface area whose value is numerically equal to the volume of the sphere?
- A. None
 - B. 1
 - C. 2
 - D. 3
 - E. Further information is required to determine the answer
- 15- A, C, E, and D are four collinear points in this order such that $AC = a$, $ED = b$, and $AE + CD = 12$. Which of the following is a correct expression of CE in terms of a and b .
- A. $CE = 6 - \frac{a+b}{2}$
 - B. $CE = \frac{a+b}{2}$
 - C. $CE = 12 - (a + b)$
 - D. $CE = 6 - (a + b)$
 - E. $CE = 12 - \frac{a+b}{2}$
- 16- The perimeter of a regular hexagon is 24 and the perimeter of a regular octagon is 5. What is the ratio of the length of one side of the hexagon to the length of one side of the octagon?
- A. 0.15625
 - B. 0.2083
 - C. 1.2
 - D. 2.75
 - E. 6.4
- 17- Circles C, P, and Q have radii 1, 2, and 3 respectively. If the three circles are tangent to each other, what is the nature of the triangle formed by joining the three centers of the circles?
- A. Isosceles
 - B. Right angled
 - C. Right isosceles
 - D. Equilateral
 - E. Cannot be determined with the information given
- 18- The diagonals of a parallelogram divide the figure into four triangles that are
- A. congruent
 - B. similar
 - C. equal in area
 - D. isosceles
 - E. equal in perimeter

- 19- A right circular cone is cut into two equal parts. The lateral surface area of one of the parts is equal to thrice the lateral surface area of a hemisphere with a radius equal to 8 cm. What is the area of the right circular cone?
- $768\pi \text{ cm}^2$
 - $512\pi \text{ cm}^2$
 - $384\pi \text{ cm}^2$
 - $192\pi \text{ cm}^2$
 - $128\pi \text{ cm}^2$
- 20- If A represents the set of rectangles and B the set of rhombi, then $A \cap B$ represents the set of
- Trapezoids
 - Parallelograms
 - Squares
 - Rectangles
 - Quadrilaterals
- 21- If the line of equation $5x + 12y - 60 = 0$ is tangent to the circle of equation $(x - 1)^2 + (y - 3)^2 = r^2$, then the value of r is
- $2\sqrt{3}$
 - $\sqrt{3}$
 - $\sqrt{10}$
 - $\frac{19}{13}$
 - $\frac{13}{12}$
- 22- The ratio of the diagonal of a cube to the diagonal of a face of this cube is
- $3: \sqrt{6}$
 - $2: \sqrt{6}$
 - $3: \sqrt{2}$
 - $6: \sqrt{2}$
 - $2: \sqrt{3}$
- 23- The intersection of the three lines of equations $x = 3y$, $y = 0$ and $3x + y = 7$ form a(n) _____ triangle
- Acute
 - Obtuse
 - Right
 - Isosceles
 - Equilateral

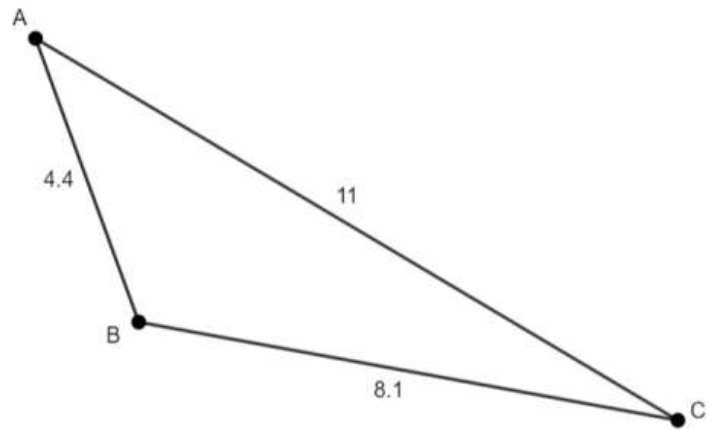
- 24- The distance AB between the points A(-3, 7) and B(6, -5) in a coordinate system in which the y-axis is inclined 60° to the positive x- axis is
- A. $\sqrt{117}$
 - B. $\sqrt{120}$
 - C. $\sqrt{189}$
 - D. $\sqrt{333}$
 - E. $\sqrt{108}$
- 25- A(-5.84, 2.27, 0) and G(-3, 2, 0) are two vertices of a cube AGCFEDBH. What is the surface area of this cube?
- A. 2.85 square units
 - B. 15.41 square units
 - C. 48.83 square units
 - D. 237.47 square units
 - E. 2384.46 square units
- 26- The height of a trapezoid is equal to $2x + 1$. Its small base is half the height, and the large base is triple the small one. What is the expression that represents the area of this trapezoid?
- A. $2x + 1$
 - B. $(2x + 1)^2$
 - C. $2(2x + 1)^2$
 - D. $2x - 1$
 - E. $4x^2 - 1$
- 27- The area of a parallelogram is $16 m^2$. The ratio of its height to base is 1:4. What is the dimension of its height?
- A. $2 m$
 - B. $4 m$
 - C. $8 m$
 - D. $16 m$
 - E. $64 m$
- 28- The perimeter of an equilateral triangle is equal to $3\sqrt{7} - 6$. What is the dimension of the height of the triangle?
- A. 0.16
 - B. 0.31
 - C. 0.56
 - D. 0.65
 - E. 1.25

- 29- Given $A(2, 3, -7)$ and $B(3m, -2m + 1, 6)$. What is the value of m if $AB^2 = 221$?
- A. -2
 - B. 0
 - C. 1
 - D. 2
 - E. 4
- 30- The point $K(1, -3)$ is rotated about the origin through an angle of 90° in an anti-clockwise direction. What are the coordinates of the image of K ?
- A. $(-1, -3)$
 - B. $(3, 1)$
 - C. $(-3, -1)$
 - D. $(-3, 1)$
 - E. $(1, 3)$
- 31- What is the nature of triangle ABC if $A(2, 3, 1)$, $B(-1, 3, 0)$ and $C(2, 3, -1)$?
- A. Isosceles
 - B. Right
 - C. Right isosceles
 - D. Equilateral
 - E. Scalene
- 32- A hollow cube of internal edge 20 cm is filled with identical spherical marbles of diameter 0.6 cm each, and it is assumed that $\frac{1}{8}$ th space of the cube remains unfilled. What is the number of marbles, rounded to the nearest integer, that the cube can accommodate?
- A. 70,000
 - B. 61,894
 - C. 70,736
 - D. 7,737
 - E. 65,235

GEOMETRY (GRAPH)

1- Find the measure of the obtuse angle in triangle ACB .

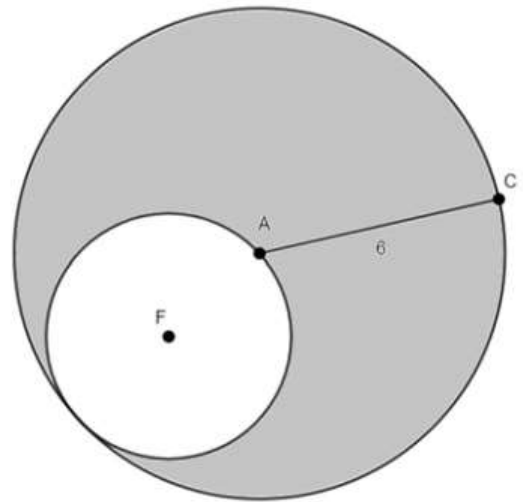
- A. 20.2
- B. 100.2
- C. 115
- D. 118.4
- E. 120.4



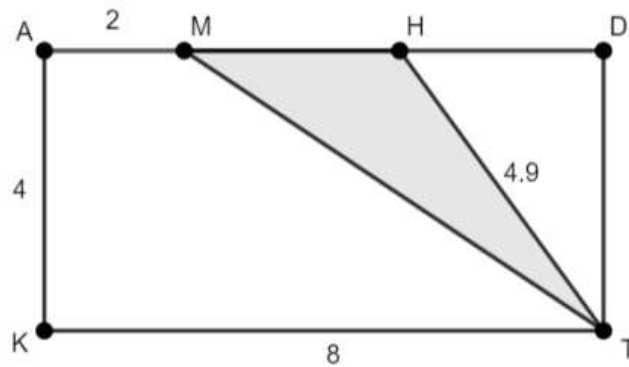
2- In the figure to the right, the two circles touch each other internally with A being the center of the big circle with a radius equal to 6 m , and F being the center of the small circle that passes through A .

Find the area of the shaded region in the figure.

- A. 141.37 m^2
- B. 9.42 m^2
- C. 84.823 cm^2
- D. 8482.3 cm^2
- E. 848230 cm^2

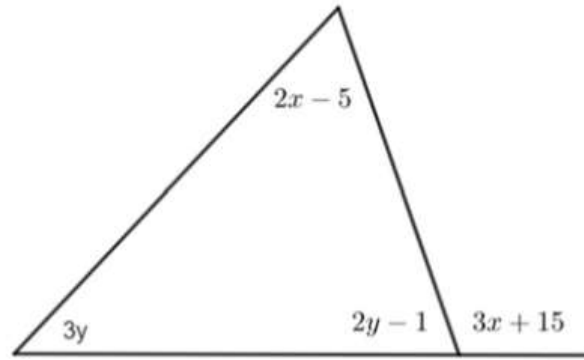


3- $ADTK$ is a rectangle. Find the area of triangle MHT .



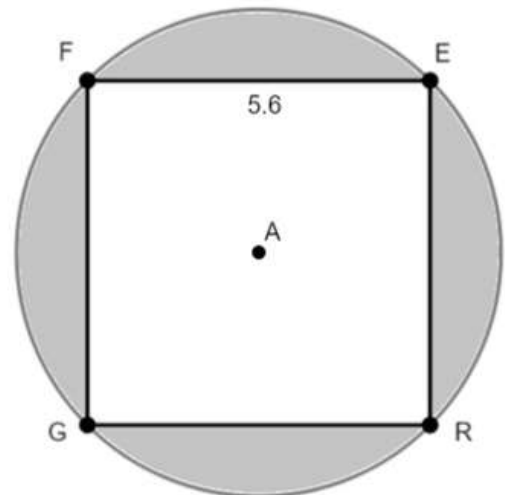
- A. 3.34
- B. 6.34
- C. 10.34
- D. 12
- E. 16

4- What are the values of x and y in the figure to the right?



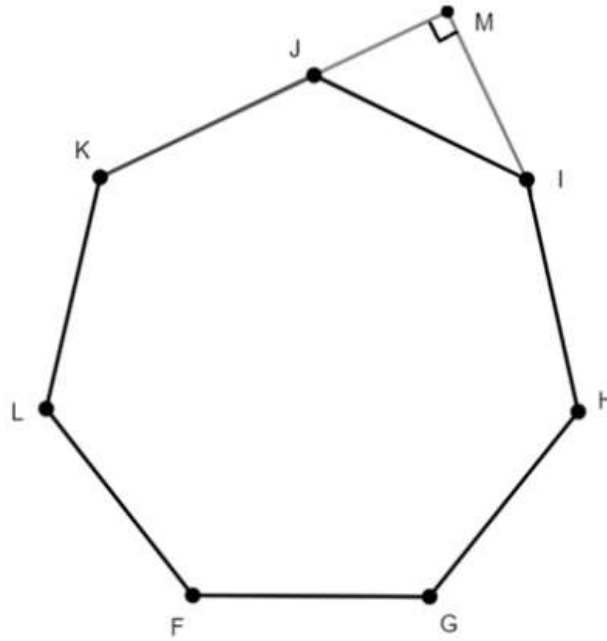
- A. $x = 20.54, y = 41.63$
- B. $x = 41.63, y = 20.54$
- C. $x = 55, y = 1$
- D. $x = 31, y = 17$
- E. $x = 17, y = 31$

5- $FERG$ is a square inscribed in the circle of center A . What is the area of the shaded region in the figure?

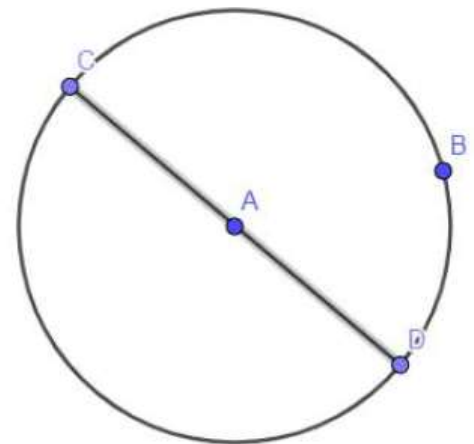


- A. 1.64
- B. 4.475
- C. 6.72
- D. 17.9
- E. 165.7

- 6- The figure to the right shows a regular heptagon and a right triangle MJI .
 If $m\angle KJI = \frac{1}{7}x - 10$ and $m\angle MIJ = 3y + 4$, what would be the values of x and y ?



- A. $x = 970$ and $y = 51.43$
 B. $x = 11.52$ and $y = 51.43$
 C. $x = 138.57$ and $y = 11.52$
 D. $x = 970$ and $y = 11.52$
 E. $x = 970$ and $y = 138.57$
- 7- In the adjacent figure, B is a point on the circle of center A and diameter DC such that $BC = 20$ and $BD = 15$. What is the perimeter of triangle BDC?



- A. 17.5
 B. 35
 C. 60
 D. 150
 E. 60π

- 8- Celine and Lia are standing on a horizontal track at points A and D respectively. Celine is 1.5m tall and Lia is 1.2m tall (that is $AC = 1.5\text{m}$ and $DL = 1.2\text{m}$). Celine's shadow occupies the length AB and Lia's shadow occupies the length BD on the ground so the two shadows meet at their heads. The angles between the ground and the ray from the top of the head of each individual to the touching point of the shadows is shown. How far apart are Celine and Lia standing?

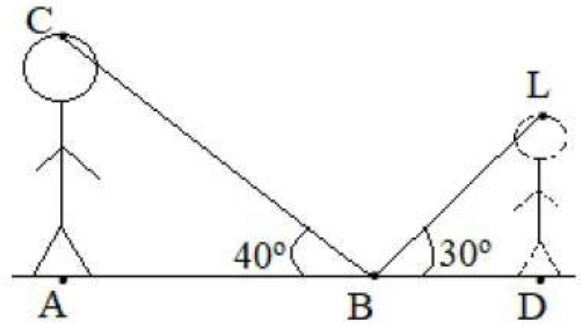
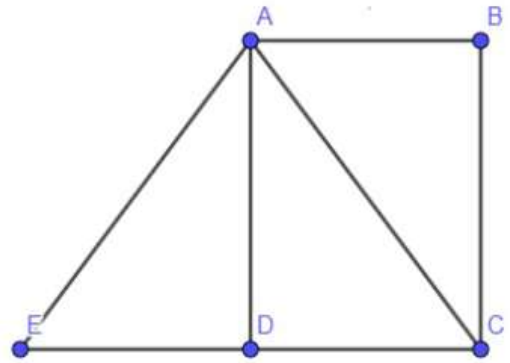
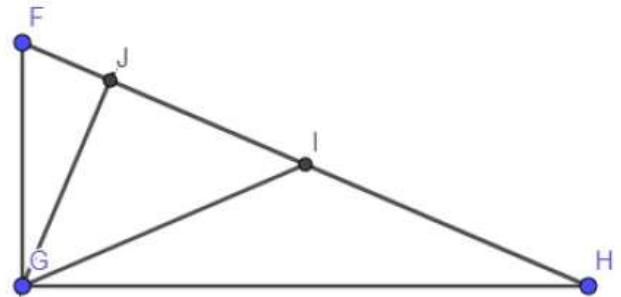


FIGURE IS NOT DRAWN TO SCALE

- A. 1.788 m
 B. 2.078 m
 C. 2.7 m
 D. 3.344 m
 E. 3.866 m
- 9- In the adjacent figure, ABCD is a rectangle such that $BC = 4$ and $AB = 3$, AEC is a triangle such that the two angles $\angle AEC$ and $\angle ACE$ are equal. What is the perimeter of triangle AEC?



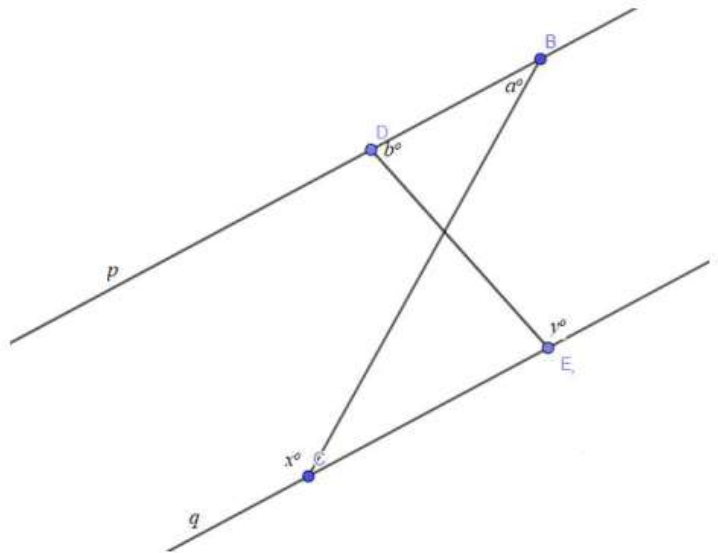
- A. 10
 B. 12
 C. 14
 D. 16
 E. 18
- 10- The triangle shown in the adjacent figure (not drawn to scale) is right angled at G with $GF = 4$ and $\angle GFH = 60^\circ$. I is the midpoint of segment FH an GJ is the altitude drawn from G to FH. What is the area of triangle GJI?



- A. 3.46
 B. 4.62
 C. 6
 D. 6.93
 E. 13.86

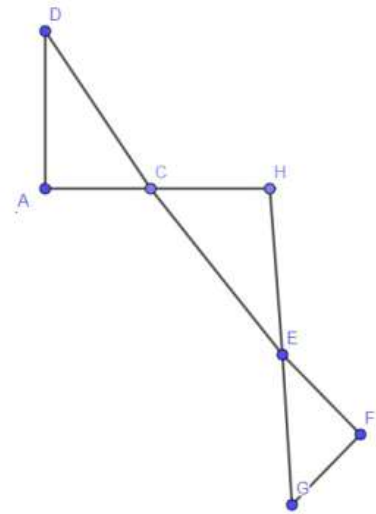
11- In the adjacent figure, p and q are two parallel lines. B and D are points on p ; C and E are points on q . Which of the following statements is true?

- I. $a^\circ + b^\circ = x^\circ + y^\circ$
 - II. $a^\circ, b^\circ, x^\circ,$ and y° can be the values of the four angles of a quadrilateral.
 - III. $a^\circ + x^\circ = b^\circ + y^\circ$
- A. Only I
 - B. Only II
 - C. Only III
 - D. I and II
 - E. II and III



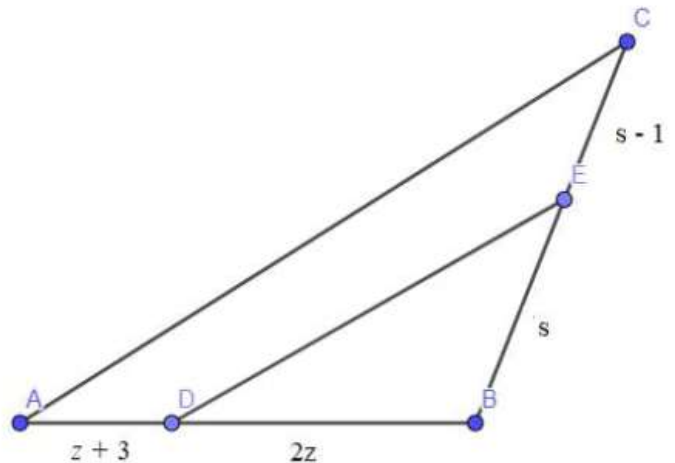
12- In the adjacent figure (not drawn to scale), segments AD and AH are perpendicular. The following degree measures are known in terms of b : $\angle ADC = b$, $\angle EGF = 2b + 30$, and $\angle EFG = 150 - 3b$. Which of the following conclusions must be true?

- A. The three triangles ADC, CHE, and EFG are right angled triangles.
- B. Triangle HCE is right angled at H.
- C. Triangles ADC and EFG are similar.
- D. Triangles ADC and HCD are similar.
- E. Only triangle ADC is right angled.



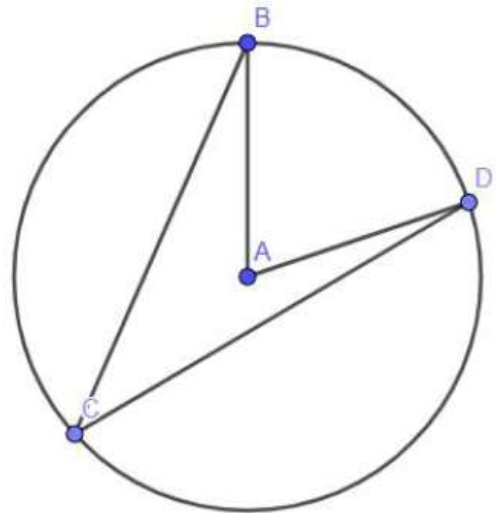
13- In the adjacent figure, lines AC and DE are parallel. The lengths of segments CE, BE, BD, and AD are given in terms of s and z . Which of the following is a correct expression of s in terms of z ?

- A. $s = \frac{2z}{z-3}$
- B. $s = 2 - \frac{3}{2z}$
- C. $s = \frac{z+3}{3-2z}$
- D. $s = \frac{3(z+1)}{z+3}$
- E. $s = \frac{z+3}{z} + 1$



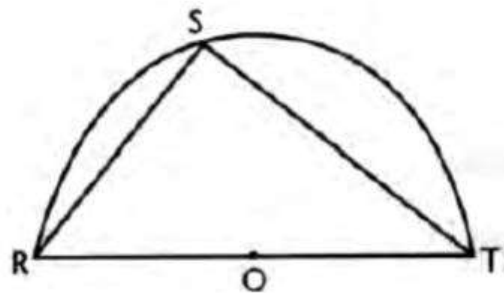
14- In the adjacent figure, the measure of angle $\angle BAD$ is 80° . Which of the following could be the measure of angle $\angle BCA$?

- A. 38.96°
- B. 40°
- C. 45.02°
- D. 60.13°
- E. 90°



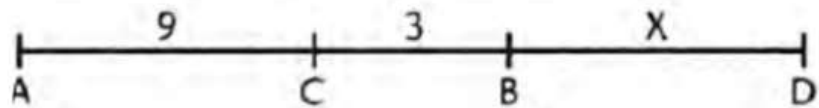
15- In the adjacent figure, \overline{RT} is a diameter of the semicircle. If $RS = 2$ and $ST = 3$, then the area of the semicircle is

- A. $\frac{13\pi}{2}$
- B. $\frac{13\pi}{4}$
- C. $\frac{\pi}{4}$
- D. $\frac{6}{13\pi}$
- E. $\frac{\pi}{8}$



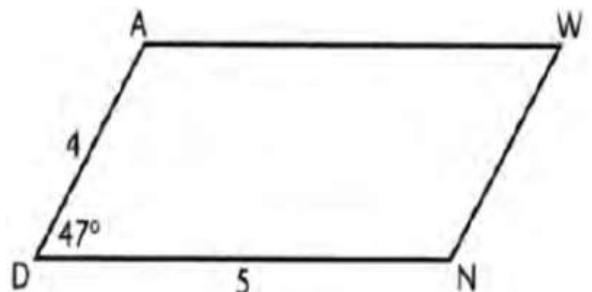
16- In the adjacent figure, $AC = 9$, D is three times as far from A as from B and $BC = 3$. What is BD ?

- A. 9
- B. 12
- C. 18
- D. 6
- E. 15



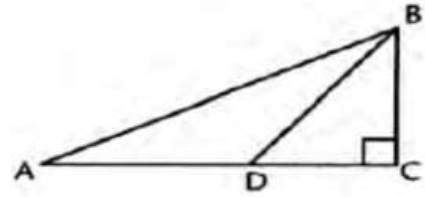
17- The approximate area of the parallelogram DAWN, in the adjacent figure, is

- A. 20
- B. 17.25
- C. 14.63
- D. 11.5
- E. 13.64



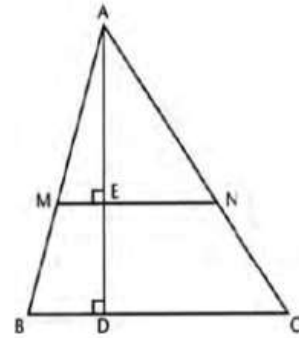
18- The length of \overline{AB} in the adjacent right triangle at C such that $AD = DB$, $DC = BC = 1$ is

- A. $\sqrt{10}$
- B. $2\sqrt{2}$
- C. $2\sqrt{10}$
- D. $\sqrt{4 + 2\sqrt{2}}$
- E. $4 + 2\sqrt{2}$



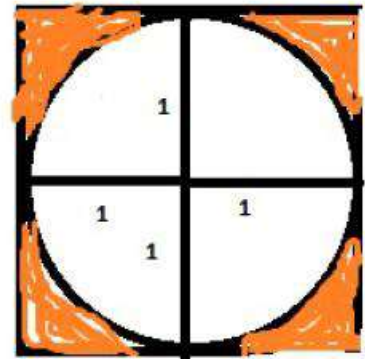
19- In the adjacent $\triangle ABC$, $AD = 10$, \overline{MN} is parallel to \overline{BC} and \overline{MN} bisects the area of $\triangle ABC$. The value of ED

- A. $10 - 5\sqrt{2}$
- B. $10 + 5\sqrt{2}$
- C. $5\sqrt{10 + 2\sqrt{2}}$
- D. $5\sqrt{2}$
- E. $2\sqrt{10}$



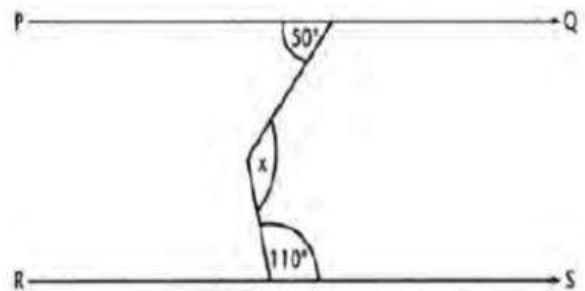
20- A circle is inscribed in the square as shown in the adjacent figure. The area of the shaded region is:

- A. $4 - \pi$
- B. $4 + \pi$
- C. $1 - \pi$
- D. $1 + \pi$
- E. $2 - \pi$



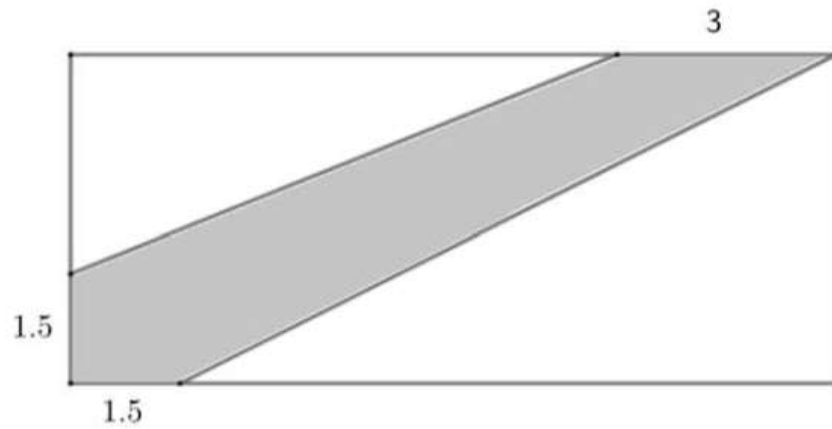
21- In the adjacent figure, if the two lines (PQ) and (RS) are parallel, then x is equal to

- A. 50°
- B. 110°
- C. 120°
- D. 60°
- E. 100°



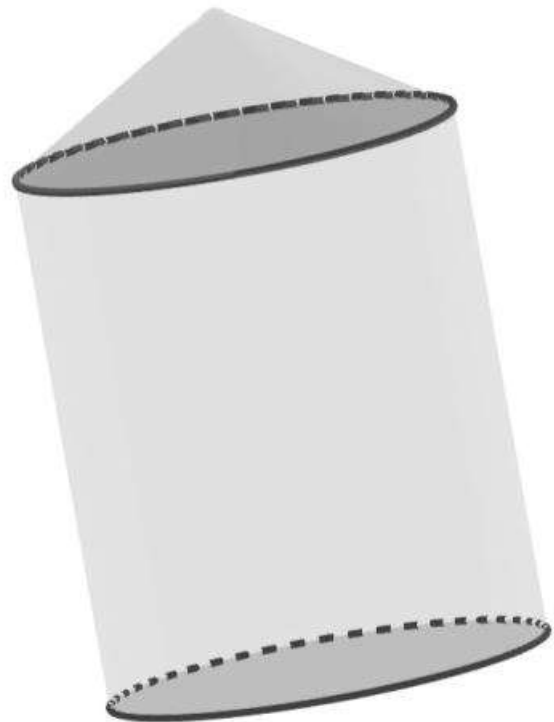
22- The length of the adjacent rectangle is equal to 14 cm , and the width is equal to 6 cm . What is the area of the shaded region? (figure is not drawn to scale)

- A. 4.5 cm^2
- B. 21.75 cm^2
- C. 24.75 cm^2
- D. 37.5 cm^2
- E. 84 cm^2

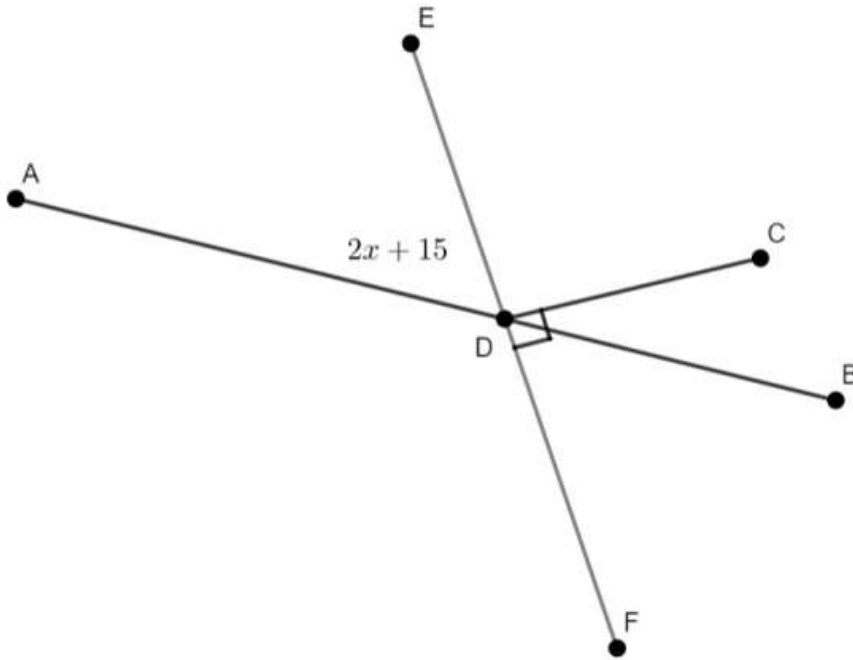


23- The adjacent figure at the right shows a shape made out of a cone and a cylinder. The total volume of this shape is 39π cubic units. If the height of the cylinder is 4 units, and the radius is 3 units, what is the height of the cone?

- A. 1 unit
- B. 2 units
- C. 3 units
- D. 4 units
- E. 5 units



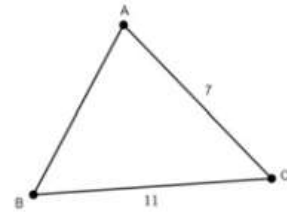
24-Using the diagram below, what is the measure of $\angle BDC$?



- A. $2x + 105$
- B. $2x + 75$
- C. $2x - 75$
- D. $105 - 2x$
- E. $75 - 2x$

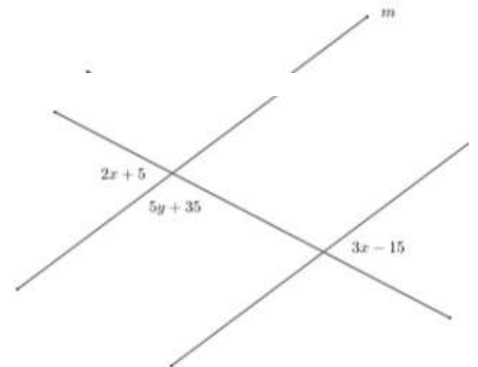
25-Which value for the dimension of segment AB could be true so that ABC can be a triangle?

- A. 0.5
- B. 1.5
- C. 2.5
- D. 3.5
- E. 4.5



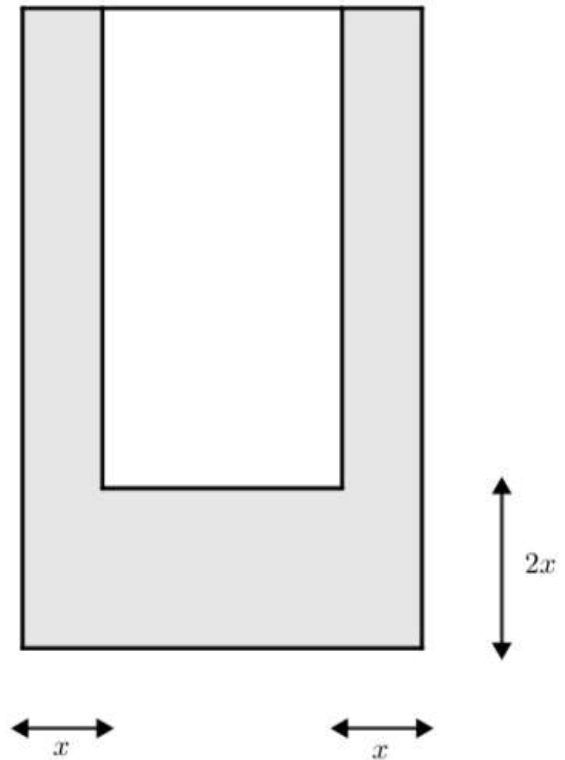
26-Using the adjacent diagram, if lines m and n are parallel, what is the value of y ?

- A. 100
- B. 80
- C. 60
- D. 40
- E. 20



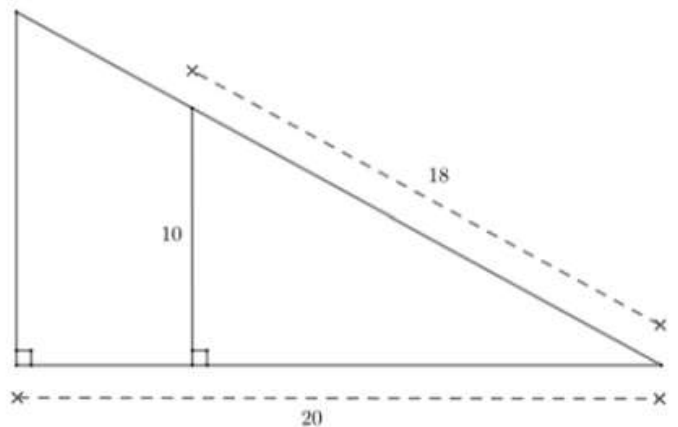
- 27- Using the adjacent figure, the length of the larger rectangle is $8x + 1$ while the width is equal to $4x + 3$. If the area of the shaded region is equal to 204 square units, what is the value of x ?

- A. $\frac{1}{2}$
- B. 2
- C. 3
- D. 6
- E. 9



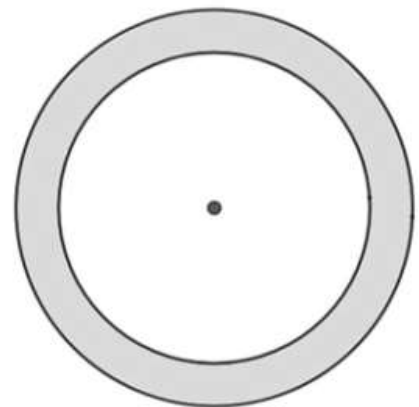
- 28- The adjacent figure shows two similar triangles. What is the area of the larger triangle?

- A. 100 square units
- B. 120.27 square units
- C. 133.63 square units
- D. 240.53 square units
- E. 267.2 square units



- 29- The area of the shaded region in the adjacent circle is equal to 42.75π square units. The circumference of the smaller circle is equal to 5π units. What is the radius of the larger circle?

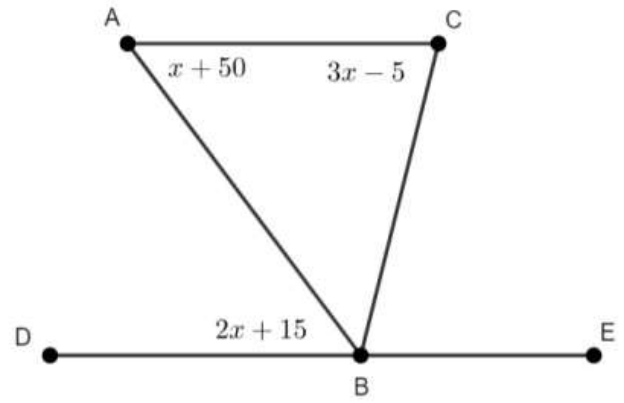
- A. 14 units
- B. 7 units
- C. 6.25 units
- D. 5 units
- E. 2 units



30- In the adjacent figure, $m\angle ABD = \frac{2}{3}m\angle CBE$.

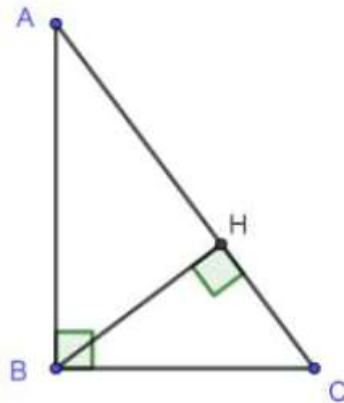
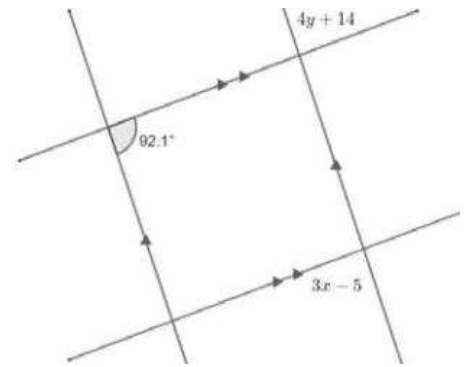
What is the value of x ?

- A. 3.75
- B. 7.5
- C. 15
- D. 30.8
- E. 42.5



31- Using the adjacent diagram, what is the value of $\frac{2x}{y}$?

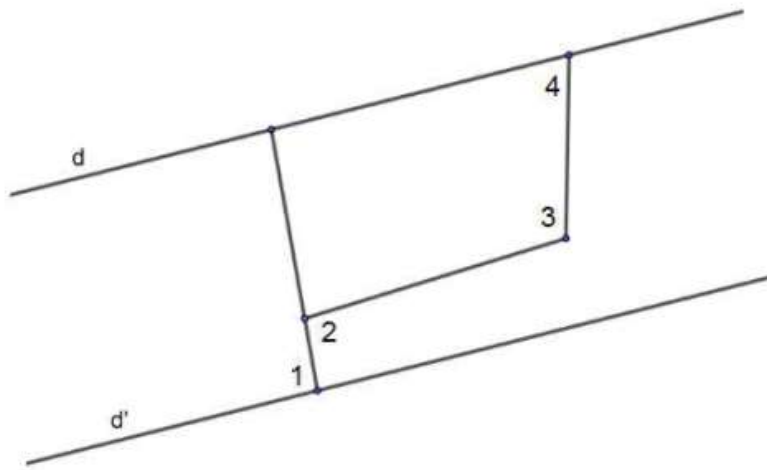
- A. 0.6
- B. 0.83
- C. 1.19
- D. 1.67
- E. 3.35



32- Triangle ABC is right angled at B such that $\hat{BAC} = \theta$ and H is the foot of the altitude drawn from B to $[AC]$. If $AC = 4$ and $\theta = 15^\circ$ then $BH =$

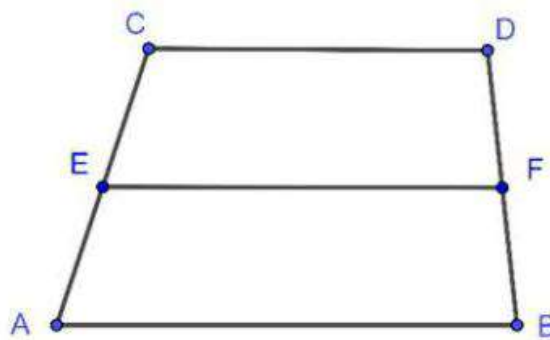
(The figure is not drawn to scale)

- A. $\frac{1}{3}$
- B. $\frac{1}{2}$
- C. 1
- D. $\frac{2}{3}$
- E. 2



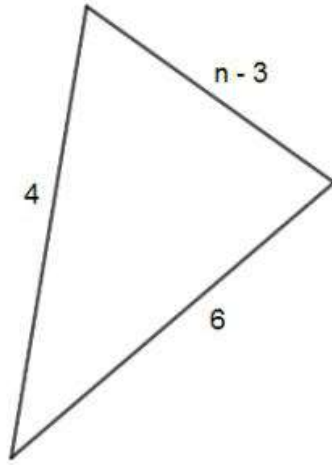
33-. In the figure above, d and d' are parallel lines, $\angle 1 = 93^\circ$, $\angle 3 = 107^\circ$ and $\angle 2 = 97^\circ$. What is the measure of angle 4? (The figure is not drawn to scale)

- A. 77°
- B. 63°
- C. 73°
- D. 83°
- E. 67°



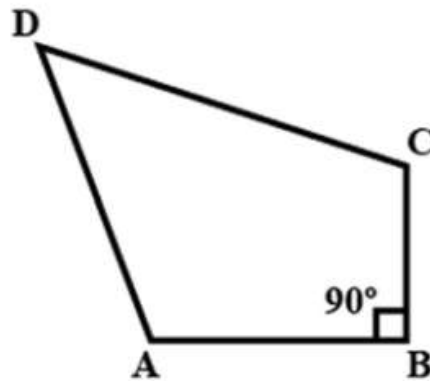
34- In the trapezoid above, $CD = y^2 + 1$, $AB = 3y - 1$ and $EF = 2$. If E and F are the midpoints of \overline{AC} and \overline{BD} , what is the value of y ? (The figure is not drawn to scale)

- A. -4
- B. 1
- C. 4
- D. 1 or -4
- E. 1 or 4



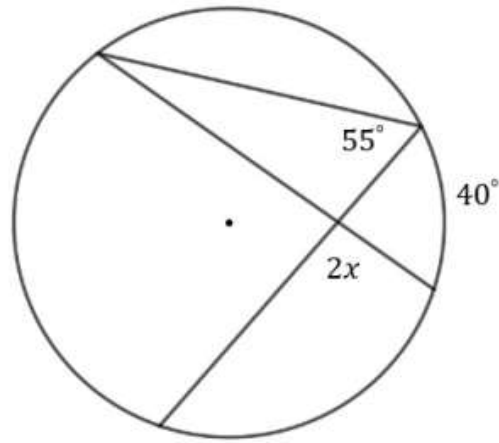
35-. Which of the following numbers 2, 4, 8, 10 and 14 cannot be a value of n in the triangle above? (The figure is not drawn to scale)

- A. 14
- B. 2 and 4
- C. 2 and 14
- D. 2, 4 and 14
- E. 8, 10 and 14



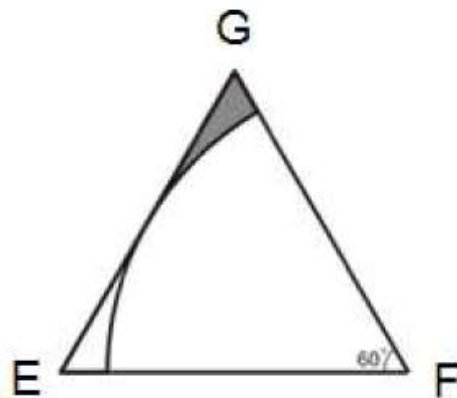
36-. In the quadrilateral ABCD above, $\angle C - \angle D = 60^\circ$ and $\angle A - \angle C - \angle D = 10^\circ$. Find $\angle A$, $\angle C$ and $\angle D$. (The figure is not drawn to scale)

- A. $\angle A = 140^\circ$; $\angle C = 95^\circ$; $\angle D = 35^\circ$
- B. $\angle A = 120^\circ$; $\angle C = 85^\circ$; $\angle D = 25^\circ$
- C. $\angle A = 95^\circ$; $\angle C = 140^\circ$; $\angle D = 80^\circ$
- D. $\angle A = 120^\circ$; $\angle C = 115^\circ$; $\angle D = 35^\circ$
- E. $\angle A = 140^\circ$; $\angle C = 35^\circ$; $\angle D = 95^\circ$



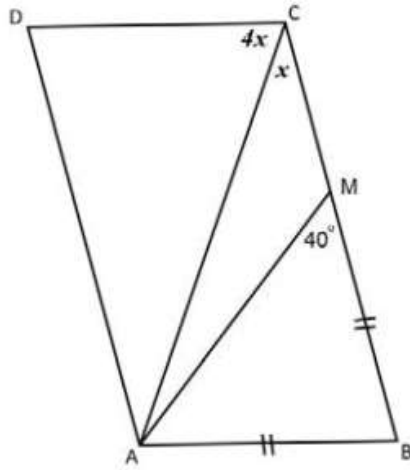
37- In the figure above, what is the value of $\frac{x}{2}$?

- A. 50°
- B. 66.25°
- C. 105°
- D. 52.5°
- E. 26.25°



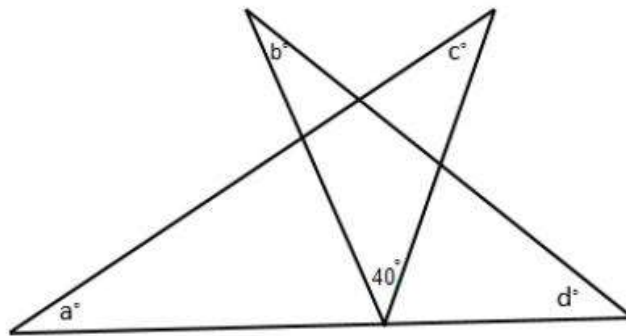
38- A circular region centered at F is inscribed in equilateral triangle EFG as shown above. If the area of the triangle EFG is $12\sqrt{3}$, what is the approximate area of the shaded region?

- A. 0.97
- B. 18.85
- C. 6.93
- D. 1.94
- E. 2.17



39- In the figure above, M is a point on side BC of parallelogram $ABCD$. What is the measure of $\angle CAM$? (The figure is not drawn to scale)

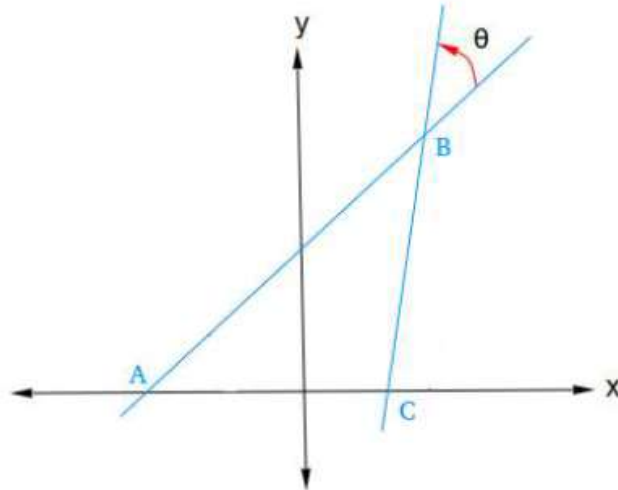
- A. 16°
- B. 24°
- C. 64°
- D. 104°
- E. 20°



40- What is the measure of $a + b + c + d$ in the figure shown above? (The figure is not drawn to scale)

- A. 140°
- B. 120°
- C. 160°
- D. 320°
- E. Can't be calculated

- 41- In the xy -plane, consider the points $A(-3, 0)$, $B(3, 5)$ and $C(2, 0)$ as shown in the figure below. What is the approximate measure, in degrees, of the angle θ ?



- A. 39°
- B. 40°
- C. 62°
- D. 79°
- E. 28°

PLUG IN

1- If $\frac{1}{x+1} - \frac{2}{x+3} > 2$, which of the following could not be a value for x ?

- A. -3.5
- B. -3.1
- C. -0.7
- D. -1
- E. -0.95

2- If $\vec{V} = 2\vec{i} + 7\vec{j}$ and $\vec{M} = -3\vec{i} + \vec{j}$, the resultant vector of $5\vec{V} + 2\vec{M}$ equals:

- A. $-11\vec{i} + 19\vec{j}$
- B. $4\vec{i} + 37\vec{j}$
- C. $16\vec{i} + 37\vec{j}$
- D. $4\vec{i} + 33\vec{j}$
- E. $16\vec{i} + 33\vec{j}$

3- If $x = 4(2i - 3)$, find x^3 .

- A. $2944i + 576$
- B. $2944i - 2496$
- C. $-192i + 80$
- D. $-192i + 208$
- E. $46i + 9$

4- The irrational number is

- A. $\frac{3\sqrt{18}}{2\sqrt{6}}$
- B. $\sqrt[3]{-27}$
- C. $\sqrt{2}(3\sqrt{2} + 2\sqrt{8})$
- D. $\frac{2\sqrt{5}}{\sqrt{45}}$
- E. $\sqrt{\frac{1}{2}} \cdot \sqrt{\frac{25}{2}}$

5- Consider the polynomial

$$E(x) = (2x - 1)^2 + (x - 2)(1 - 2x)$$

$$E(1 + \sqrt{2}) = c + d\sqrt{2}, \text{ where } c \text{ and } d \text{ are two integers such that}$$

- A. $c = d = 5$
- B. $c = 6, d = -5$
- C. $c = -6, d = -5$
- D. $c = -6, d = 5$
- E. $c = 6, d = 5$

6- Consider the three expressions:

$$A = (x - 1)(x - 2), B = (x - 2)(x - 3) \text{ and } C = (x - 3)(x - 4)$$

$A - 2B + C$ is equal to

- A. 1
- B. 2
- C. 3
- D. 4
- E. 5

7- If $a, b,$ and c are three positive numbers and if $a > b$, which of the following is not necessarily true?

- A. $a + c > b + c$
- B. $a - c > b - c$
- C. $\frac{a}{c} > \frac{b}{c}$
- D. $\frac{c}{a} > \frac{c}{b}$
- E. $\frac{a}{b} > 1$

8- A bicycle store finds that N , the number of bikes sold, is related to d , the number of dollars spent on advertising by the relation $N = 51 + 10 \ln\left(\frac{d}{10} + 2\right)$.

If the average profit is \$35 per bike, is it worthwhile to spend \$1000 on advertising?

- A. No, because the profit will be less than the amount spent on advertising.
- B. No, because the profit will be \$97.
- C. Yes, because advertisement is important.
- D. Yes, because the profit is bigger than \$1000.
- E. No, because the advertisement amount is big with respect to the product being advertised.

TRIGONOMETRY

1- . If $\sin\left(\frac{\pi}{2} - \theta\right) = 0.8$, what is the value of $\sin \theta \times \cot \theta$?

- A. 0.36
- B. 0.44
- C. 0.59
- D. 0.8
- E. 1

2- If $\cos x = 0.24$, what is the value of $\sin^2 x$?

- A. 0.97
- B. 0.9424
- C. 0.76
- D. 0.52
- E. 0.5

3- If $1 - 2 \sin^2 \theta = -\frac{1}{3}$, what is the value of $\frac{\sin \theta}{2 \cos 2\theta}$ ($0 \leq \theta \leq 90^\circ$)?

- A. -2.4
- B. -1.2
- C. $\frac{3}{2}$
- D. $-\frac{3}{2}$
- E. 1

4- Solve $4 \sin^2 x - 1 = 0$ for x .

- A. $x = -60^\circ$
- B. $x = 0^\circ$
- C. $x = 15^\circ$
- D. $x = 30^\circ$
- E. $x = 45^\circ$

- 5- If $0^\circ \leq \theta < 90^\circ$, then $\frac{1}{1-\sin\theta} =$
- A. $\frac{1}{\cos^2\theta} + \frac{\tan\theta}{\cos\theta}$
 B. $1 - \frac{1}{\sin\theta}$
 C. $1 + \sin\theta$
 D. $\tan^2\theta + \frac{\tan\theta}{\cos\theta}$
 E. $\frac{1}{\cos^2\theta} + \sin^2\theta$
- 6- The graph of the equation $y = 50 \cos 3x$ has a period, in radians, of
- A. 3π
 B. $\frac{2}{3}\pi$
 C. $\frac{2}{5}\pi$
 D. 50π
 E. $\frac{50}{3}\pi$
- 7- $2 \cos^3 B \sin B + 2 \sin^3 B \cos B$ is equal to
- A. $2 \sin B$
 B. $\cos^2 B$
 C. $\cos 2B$
 D. $\sin 2B$
 E. $2 \cos B$
- 8- If graphed on the same set of axes and $0 \leq x \leq 2\pi$, then $y = \sin x$ and $y = \cos x$ will intersect in quadrant(s)
- A. I only
 B. III only
 C. I and III
 D. II only
 E. I and II

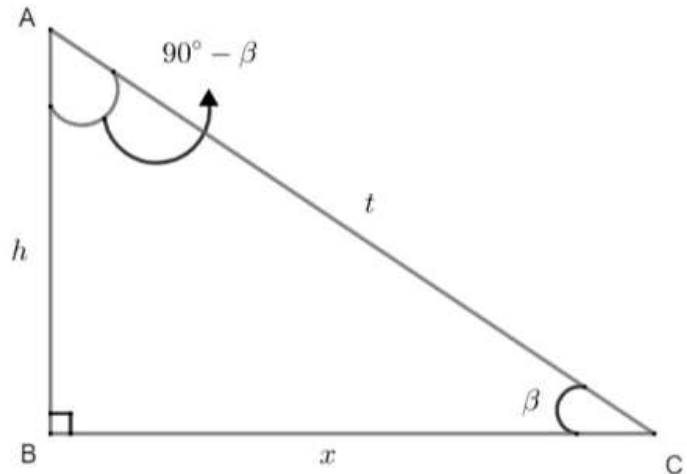
- 9- In the xy -plane, consider a straight line (D) passing through $A(-\sqrt{3}; -3 - 2\sqrt{3})$ and making an acute angle α with the x - axis such that $\cos \alpha = \frac{\sqrt{3}}{3} \times \sin \alpha$.

The value of $\sin \alpha$ and $\cos \alpha$ are respectively

- A. $-\frac{\sqrt{3}}{2}, \frac{\sqrt{3}}{2}$
 B. $\frac{\sqrt{3}}{2}, \frac{\sqrt{3}}{2}$
 C. $\frac{\sqrt{3}}{2}, \frac{1}{2}$
 D. $\frac{-\sqrt{3}}{2}, \frac{1}{2}$
 E. $\frac{\sqrt{3}}{2}, \frac{-1}{2}$

- 10- Using the adjacent diagram at the right, if $3 \tan \beta = 2$, what is the value of t ?

- A. $\frac{2}{3}$
 B. $\frac{3}{2}$
 C. $2\sqrt{13}$
 D. $\sqrt{\frac{2}{3}}$
 E. $\sqrt{13}$



- 11- In a triangle TRD , $m\angle T = 66^\circ$ while $\sec R = 1.887$. What is the measure of angle D ?

- A. 56°
 B. 58°
 C. 60°
 D. 62°
 E. 64°

- 12- What is the parity and periodicity of function f defined by $f(x) = 2 \sin\left(\frac{x}{2}\right)$?

- A. even and period 4π
 B. odd and period 4π
 C. even and period π
 D. odd and period π
 E. odd and period 2π

13- In the xy -plane, what quadrant(s) could point A lie in, if its x-coordinate and y-coordinate have opposite signs?

- A. Quadrant I
- B. Quadrant II
- C. Quadrants II and III
- D. Quadrants II and IV
- E. Quadrants III and IV

14- Triangle ABC is right at C . If $BC = x$, $AC = 2x$ where x is a positive real number and angle $B\hat{A}C = \theta$, then $\sin 2\theta =$

- A. $\frac{1}{5}$
- B. $\frac{2}{5}$
- C. $\frac{3}{5}$
- D. $\frac{4}{5}$
- E. 1

15- Which could be a value of $\sin \theta$ if $\frac{7\pi}{4} < \theta < 2\pi$?

- A. $\frac{-4}{5}$
- B. -1
- C. $\frac{-1}{2}$
- D. $\frac{1}{4}$
- E. $\frac{1}{2}$

16- If $\cos\left(\frac{\pi}{2} - \theta\right) = \frac{2}{\sqrt{3}}$, then what is the value of $\frac{\sin \theta}{\csc \theta}$?

- A. $\frac{2}{\sqrt{3}}$
- B. 1
- C. $\frac{4}{3}$
- D. $\frac{\sqrt{3}}{2}$
- E. $\frac{3}{4}$

PROBABILITY

- 1- In a Chemistry test, John has two papers, A and B, containing 7 and 11 questions respectively. He has to attempt 12 questions in total, selecting at least 4 from each paper. How many ways can John select a question?
- A. 1.52×10^{10}
B. 19041
C. 16401
D. 15939
E. 10164
- 2- Mr. Hernandez has 8 Christmas greeting cards and he wants to send them to 5 of his friends. How many ways can he send a greeting card?
- A. 6720
B. 3136
C. 112
D. 56
E. 40
- 3- The probability of getting 80 % or more of the questions correct on a 10- question true-false exam merely by guessing is
- A. $\frac{5}{32}$
B. $\frac{1}{16}$
C. $\frac{3}{16}$
D. $\frac{7}{128}$
E. $\frac{7}{32}$
- 4- A bag B_1 contains **two red balls numbered 0** and **three blue balls numbered 1, 2, 3**. A bag B_2 contains **three red balls numbered 2, 3, 4** and **one blue ball numbered 0**. One ball is selected from B_1 , then another ball is randomly selected from B_2 . Thus a 2-digit number is formed. The number of possible outcomes is
- A. 25
B. 12
C. 20
D. 16
E. 144

5- A fair die is tossed and a card is randomly chosen from a deck of 52 cards. The probability that “a multiple of three appears and a king or an ace is selected” is:

- A. $\frac{8}{312}$
- B. $\frac{16}{312}$
- C. $\frac{8}{52}$
- D. $\frac{16}{52}$
- E. $\frac{16}{36}$

6- In a given school, the class of grade 12 is divided into three sections: Sociology and economics (SE), Life Sciences (LS) and General Sciences (GS). The students of this class are distributed as follows:

Sections/Students	Boys	Girls	Total
SE	17	21	38
LS	13	14	27
GS	14	5	19
Total	44	40	84

The number of ways that three students can be selected from this class if exactly two of them are girls and if the order is respected is

- A. 205,920
- B. 68,640
- C. 411,840
- D. 70,400
- E. 211,200

7- How many 2-digit numbers are even but do not have a zero digit?

- A. 27
- B. 30
- C. 36
- D. 40
- E. 45

- 8- During the first 4 months of this academic year, Ross passed 70% of his math assignments and 55% of his chemistry assignments, independently one of another. What is the chance that on the next attempt of each subject, he will pass the math assignment but not the chemistry?
- A. 1
 - B. 0.385
 - C. 0.315
 - D. 0.165
 - E. 0.135
- 9- Jack bought a bag of 30-pieces of chocolates in which he found three different types of chocolate bars. If there are 11 bars of type A, 13 bars of type B, and the remaining are bars of type C, what is the probability that the first bar of chocolate that Jack will choose will be of type C?
- A. $\frac{4}{5}$
 - B. $\frac{1}{2}$
 - C. $\frac{1}{4}$
 - D. $\frac{1}{5}$
 - E. $\frac{1}{6}$
- 10- Ahmad bought 7 pencils and 11 pens from a shop for \$11.2. The price of 5 pens is equal to the price of 7 pencils. What is the price of 3 pens?
- A. \$1.0
 - B. \$1.4
 - C. \$1.5
 - D. \$2.1
 - E. \$3.5
- 11- The sum of two 2-digit numbers is a third 2-digit number. What is the maximum value of the product of these three numbers?
- A. 356,000
 - B. 238,392
 - C. 970,299
 - D. 239,580
 - E. 242,550

12- The registration plate of a car in a country begins with two letters, from the 26 letters in the English Alphabet, followed by four even digits. Neither the letters nor the digits can be repeated. In a certain city in this country, the first letter of every registration plate must be "A", while the last digits cannot be zero. How many possible different registration plates can exist in this city?

- A. 1,500
- B. 2,400
- C. 2,496
- D. 13,000
- E. 113,400

13- A survey is done in an enterprise having 20% administrators and 80% employees. We know that 5% of the administrators and 20% of the employees speak Spanish.

A person is chosen randomly from the enterprise, what is the probability that he/she speaks Spanish?

- A. 0.26
- B. 0.17
- C. 0.25
- D. 0.08
- E. 0.48

14- A box contains 24 marbles of red, green and yellow colors. If two marbles are drawn randomly and simultaneously from the box, the probability that both are red is $\frac{15}{92}$. What is the number of the non-red marbles?

- A. 10
- B. 16
- C. 14
- D. 20
- E. 18

STATISTICS

1- Consider the ages of your 6 cousins as follows:

6, 19, 14, 13, 7, 11

What is the standard deviation of their ages?

- A. 3.8
- B. 4.38
- C. 5.14
- D. 11.49
- E. 22

2- In the set of numbers: 5, 10, 20, 10, 30, 25, consider M as the median and m as the mode of the set. What is the average of M and m ?

- A. 10
- B. 12.5
- C. 13.33
- D. 13.75
- E. 16.25

3- Consider the set $\{-3, 0, 7, a, b, 20\}$ whose elements are arranged in increasing order, and a and b are real numbers. If the median of this set above is 12, which of the following is a possible value of b ?

- I. 8
 - II. 17
 - III. 20
- A. Only I
 - B. Only II
 - C. Only III
 - D. I and II
 - E. II and III

- 4- The municipality in a certain hospital administered a survey on diabetes. Blood tests for 150 patients gave the following results in millimoles per liter:

Level of glucose in <i>mmol/L</i>	[6 – 8[[8 – 10[[10 – 12[[12 – 14[[14 – 16[
Frequency	50	10	20	30	40

The Median is

- A. 11
 B. 10
 C. 11.5
 D. 10.5
 E. 12
- 5- A mining company extracts oil from an oilfield since the year 1963. The following table shows the quantity y_i , in tons, extracted during each year indicated by its rank x_i .

Year	1963	1968	1973	1978	1983	1988	1993	1998	2003	2008
Rank x_i	0	1	2	3	4	5	6	7	8	9
Quantity y_i (in tons)	18.1	15.7	13.3	11	9.3	7.8	7.1	6.1	5.2	4.3

The means \bar{x} and \bar{y} of the variables x and y respectively are

- A. $\bar{x} = 4.5$ $\bar{y} = 9.79$
 B. $\bar{x} = 4$ $\bar{y} = 9.79$
 C. $\bar{x} = 4.5$ $\bar{y} = 9$
 D. $\bar{x} = 5$ $\bar{y} = 9.79$
 E. $\bar{x} = 4.5$ $\bar{y} = 7.9$
- 6- Jimmy decided to spend an average of \$40 a week on buying clothes. He spent \$25 the first week, and \$66 the second week. How much can he equally spend the third and the fourth week without surpassing his budget?
- A. \$69
 B. \$54.5
 C. \$34.5
 D. \$45
 E. \$38

7- Lora went to the mall and purchased the items that are shown in the adjacent table. What is the sum of the mean and the median of the list shown?

<i>Items</i>	<i>Price</i>
Jeans	\$44.77
T-shirt	\$25.67
Sweatshirt	\$20.67
Backpack	\$24.67
Jacket	\$67.77
Hat	\$20.17

- A. 25.17
- B. 29.56
- C. 33.95
- D. 59.12
- E. 101.72

8- The adjacent table shows the heights of 10 randomly chosen buildings in Egypt. What is the sum of the interquartile range and the median of the data shown?

Building	Height (m)
Cairo Tower	187
Ministry of Foreign Affairs Building, Cairo	143
Nile City South Tower	142
El Maadi Residential Tower 16	140
Great Pyramid of Giza	138.8
National Bank of Egypt Tower 1	135
Residences Roda Island	118
Ramses Hilton & World Trade Center	110
Hilton World Trade Center Residences	110
Four Seasons Cairo at First Residence	103

- A. 32
- B. 110
- C. 136.9
- D. 142
- E. 168.9

9- If the mean of a normal distribution is 55 and the standard deviation is 5, then almost all of the scores are likely to fall between:

- A. 40 and 70
- B. 50 and 60
- C. 30 and 55
- D. 55 and 80
- E. 60 and 90

10- Which of the numbers below is not the mean, median, mode or range of the data set 5, 2, 4, 5, 10, 16, 12, 18, 15, 13?

- A. 10
- B. 11
- C. 5
- D. 8
- E. 16

AVERAGE SPEED

1- The driving distance from Giza to Ashmoun is 104 *Km*. On a road trip from Giza to Ashmoun, Wassim drove the first 50 *Km* at 65 *Km* per hour, then the next 50 *Km* at 80 *Km* per hour, and the rest at 54 *Km* per hour. What was his average speed, in *Km* per hour, for the entire trip?

- A. 6.3
- B. 23.6
- C. 66.3
- D. 70.8
- E. 78.5

SEQUENCE

- 1- $2k$, $3k + 1$, and 22 are the consecutive terms of an arithmetic sequence. What is the value of k ?
- A. -10
 - B. -1
 - C. 5
 - D. 10
 - E. 16
- 2- The product of three consecutive integers is equal to the middle integer. What is the smallest of these integers?
- A. $-1 - \sqrt{2}$
 - B. $1 + \sqrt{2}$
 - C. -1
 - D. 0
 - E. 1
- 3- $3m$, $2m + 5$, and $4m - 5$ are three consecutive terms of a geometric sequence. If m has a negative value, what is the value of the common ratio of this sequence?
- A. -10
 - B. -2
 - C. $-\frac{1}{2}$
 - D. $\frac{1}{2}$
 - E. 1
- 4- How many terms are there in the sequence $4, 8, 12, \dots, 2020$?
- A. 505
 - B. 504
 - C. 510
 - D. 503
 - E. 700
- 5- (U_n) is a sequence such that $U_0 = 2$ and $U_{n+1} = (U_n - 3)^2$. What is the value of U_2 ?
- A. -4
 - B. 4
 - C. 2
 - D. 0
 - E. 6

CIRCLE-

ELIPSE-

HYPERPOLA

1- Which of the following could be the asymptote of $\frac{(y-3)^2}{16} - \frac{x^2 - 14x + 49}{25} = 1$

A. $y = \frac{-5x + 47}{4}$

B. $y = \frac{-4x + 43}{5}$

C. $y = \frac{-5x + 43}{4}$

D. $y = \frac{-4x + 47}{5}$

E. $y = \frac{-5x - 23}{4}$

2- Find the coordinates of the foci of $\frac{(x-3)^2}{9} + \frac{y^2}{49} = 1$.

A. $(3, 2\sqrt{10})$ and $(3, -2\sqrt{10})$

B. $(3 - 2\sqrt{10}, 0)$ and $(3 + 2\sqrt{10}, 0)$

C. $(3, 2\sqrt{10})$ and $(3 - 2\sqrt{10}, 0)$

D. $(0, 3 - 2\sqrt{10})$ and $(0, 3 + 2\sqrt{10})$

E. $(0, 0)$ and $(3, 2\sqrt{10})$

3- The equation circle (C) is $(x - 3)^2 + (y + 2)^2 = r^2$. It passes through G (6, 3). Find the circumference of the circle.

A. 7.58

B. 15.17

C. 17.77

D. 18.32

E. 36.63

4- $x^2 - 6x + y^2 - 4y + 2 = 0$ represents the equation of a circle (C). What is the radius of this circle?

A. $\sqrt{2}$

B. 2

C. $\sqrt{11}$

D. 5.5

E. 11

5- What is the equation of the line parallel to the line with equation $\sqrt{2}x - 3y = 1$ and passing through the center of the circle with equation $(x - 3\sqrt{2})^2 + (y^2 - 8y + 16) = 25$?

A. $y = \frac{\sqrt{2}}{3}x + 2$

B. $y = \frac{\sqrt{2}}{3}x - 2$

C. $y = \frac{\sqrt{2}}{3}x$

D. $y = -\frac{\sqrt{2}}{3}x + 2$

E. $y = -\frac{\sqrt{2}}{3}x - 2$

A

C

6- In the xy - plane, (C) is a circle of center A(1, 0) and radius 2. (d) is the line of equation $x + m = 0$. For what values of m does the line (d) cut circle (C) in two distinct points?

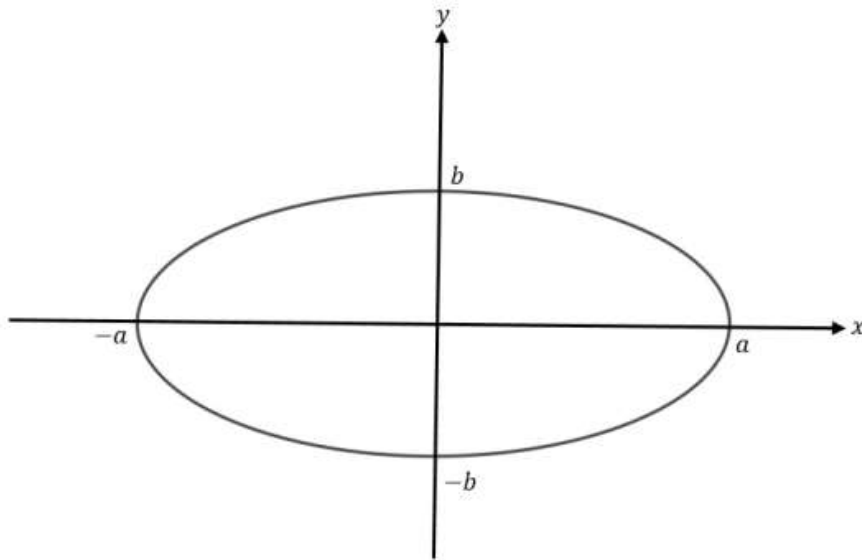
A. $m < 2$

B. $-1 < m < 3$

C. $-3 < m < 1$

D. $-2 \leq m \leq 2$

E. $m > 3$



7- Knowing that the area of the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ is $A = \pi ab$, what is the equation of the ellipse if $a + b = 12$ and $A = 35\pi$?

- A. $\frac{x^2}{25} + \frac{y^2}{49} = 1$
- B. $\frac{x^2}{8^2} + \frac{y^2}{4^2} = 1$
- C. $\frac{x^2}{7^2} + \frac{y^2}{5^2} = 1$
- D. $\frac{x^2}{35^2} + \frac{y^2}{12^2} = 1$
- E. $\frac{x^2}{7^2} - \frac{y^2}{5^2} = 1$

ASYMPTOTE

1- Find the coordinates of the foci of $\frac{(x-3)^2}{9} + \frac{y^2}{49} = 1$.

- A. $(3, 2\sqrt{10})$ and $(3, -2\sqrt{10})$
- B. $(3 - 2\sqrt{10}, 0)$ and $(3 + 2\sqrt{10}, 0)$
- C. $(3, 2\sqrt{10})$ and $(3 - 2\sqrt{10}, 0)$
- D. $(0, 3 - 2\sqrt{10})$ and $(0, 3 + 2\sqrt{10})$
- E. $(0, 0)$ and $(3, 2\sqrt{10})$

2- The function f defined by $f(x) = \frac{x^2 - 3x - 3}{x - 4}$ admits the center of symmetry

- A. $(-4, 5)$
- B. $(4, -5)$
- C. $(-4, -5)$
- D. $(5, 4)$
- E. $(4, 5)$

3- 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. $y = 1.5x + 2$

RATIO

- 1- Patrick organized a sports event at his village. 243 people joined the tournaments in which they had to choose to play ping-pong, boxing, or golf. The ratio of ping-pong to boxing to golf was 9: 10: 8. How many people joined the boxing tournament?
- A. 72
 - B. 81
 - C. 90
 - D. 99
 - E. 100
- 2- In a certain country, the ratio of male individuals who got infected by the COVID-19 virus to the female individuals who got infected by the same virus is 6 to 4. Moreover, it was observed that only 9% of the males and 5% of the females who get infected by the virus got severe symptoms. If the number of COVID-19 cases in the country is 1200, how many females have severe symptoms?
- A. 24
 - B. 162
 - C. 600
 - D. 1200
 - E. 1800

PERCENT

- 1- In 2018, the population in China was 1,427,647,786. According to data, China's population growth rate is 0.59% per year. What will the population be in China in 2021?
- A. 8,423,121
 - B. 1,436,070,908
 - C. 1,444,543,726
 - D. 1,452,917,152
 - E. 1,453,142,111
- 2- In a certain company of 400 employees, 70% wear face masks at all times. Out of those who do not wear face masks, 15% got the disease. Out of those who do wear a mask, only 5% got the disease. If an employee is chosen at random from this company, what is the probability that he or she got the disease?
- A. 0.35
 - B. 0.08
 - C. 0.09
 - D. 0.12
 - E. 0.35
- 3- . A car moved a distance of x meters to a distance of y meters. The percent of increase was
- A. $\frac{100(y-x)}{y}$
 - B. $\frac{100(x-y)}{y-x}$
 - C. $\frac{y-x}{x}$
 - D. $\frac{x}{x-y}$
 - E. $\frac{100(y-x)}{x}$

- 4- On a science exam of 40 multiple choice questions, Elvis got 80% of the 15 biology questions correct, 60% of the 15 chemistry questions wrong and 20% of the 10 physics questions wrong. Knowing that Elvis answered all the questions, what percentage of all the questions did he get wrong?
- A. 35%
 - B. 65%
 - C. 50%
 - D. 72.5%
 - E. 54%
- 5- The value, in US dollars, of a car is given by $V = \beta e^{-\alpha t}$ where t represents the age of the car in years and β and α are real numbers. The initial price of the car was \$8000, and its price after one year becomes \$6000. Then the value of α is:
- A. $\ln\left(\frac{1}{4}\right)$
 - B. $\ln\left(\frac{1}{3}\right)$
 - C. $\ln\left(\frac{2}{3}\right)$
 - D. $\ln\left(\frac{3}{4}\right)$
 - E. $\ln\left(\frac{4}{3}\right)$

LOGARITHM

1- If $2^{\log_2 x} + \log_3 3^{4x} = 25$, then $x = ?$

- A. 5
- B. 0.83
- C. -1.66
- D. 1.78
- E. 1.92

2- If $\log_2 16 = x + y$ and $\log_x 4 = 2$, then what is $\log_2 y$?

- A. 0
- B. 1
- C. 2
- D. 3
- E. 4

MATRIX

1- Which matrix equation represents the system : $\begin{cases} 3y + 1 = 2x \\ 3x - 4y = 1 \end{cases}$

A. $\begin{bmatrix} 3 & 1 \\ 3 & -4 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 2 \\ 1 \end{bmatrix}$

B. $\begin{bmatrix} 3 & -2 \\ 3 & -4 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} -1 \\ 1 \end{bmatrix}$

C. $\begin{bmatrix} -2 & 3 \\ 3 & -4 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} -1 \\ 1 \end{bmatrix}$

D. $\begin{bmatrix} 3 & -2 \\ -4 & 3 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} -1 \\ 1 \end{bmatrix}$

E. $\begin{bmatrix} -2 & 3 \\ 3 & -4 \end{bmatrix} \begin{bmatrix} x & y \end{bmatrix} = \begin{bmatrix} -1 \\ 1 \end{bmatrix}$

2- Given $A = \begin{bmatrix} 3 & 1 \\ 0 & 5 \\ 2 & 4 \\ 3 & 4 \end{bmatrix}$ and $B = \begin{bmatrix} -2 & 4 \\ 5 & 3 \\ 9 & 6 \\ 3 & -2 \end{bmatrix}$. What is the matrix representing $A + 2B$?

A. $\begin{bmatrix} -1 & 9 \\ 10 & 11 \\ 20 & 16 \\ 9 & 0 \end{bmatrix}$

B. $\begin{bmatrix} 1 & -3 \\ 5 & 8 \\ 11 & 10 \\ 6 & 2 \end{bmatrix}$

C. $\begin{bmatrix} 7 & -1 \\ 11 & 10 \\ 16 & 20 \\ 0 & 9 \end{bmatrix}$

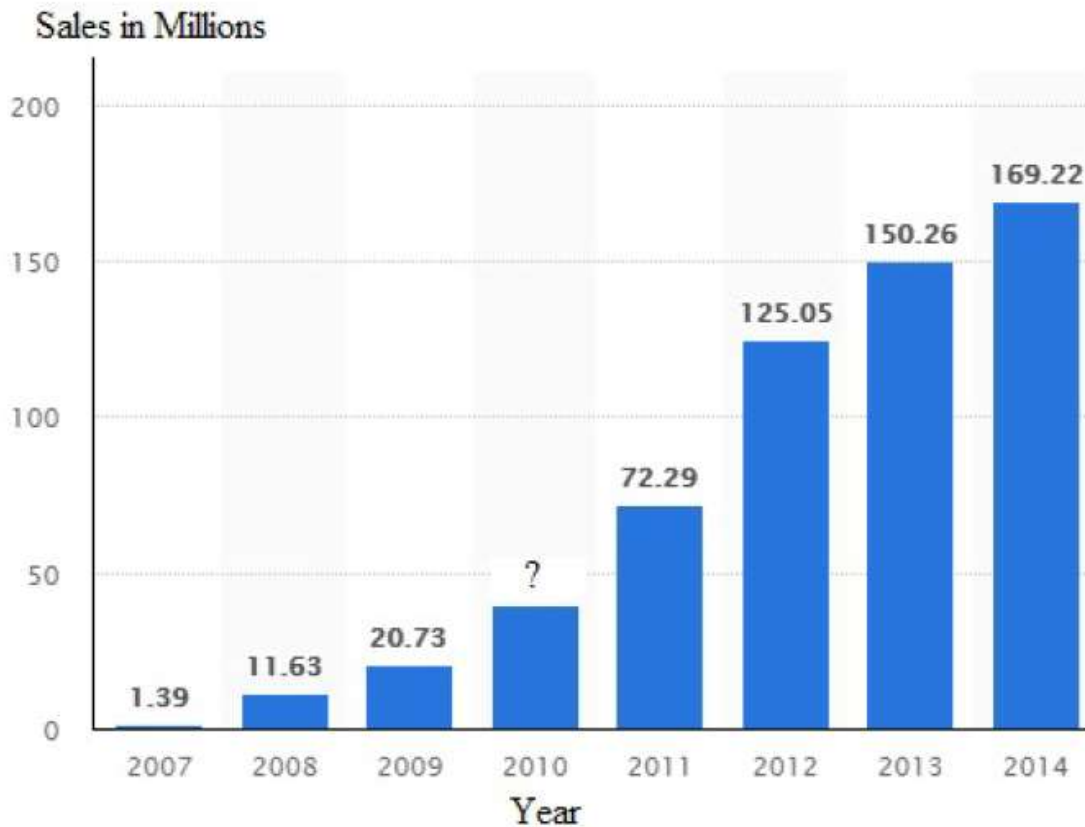
D. $\begin{bmatrix} 7 & -7 \\ -10 & -1 \\ -16 & -8 \\ -3 & 8 \end{bmatrix}$

E. $\begin{bmatrix} 9 & 0 \\ 20 & 16 \\ 10 & 11 \\ -1 & 7 \end{bmatrix}$

3-Consider the two matrices $A_{4 \times 6}$ and $B_{2 \times m}$. What should be m so that $B \cdot A$ defined?

- A. 2
- B. 4
- C. 6
- D. 5
- E. 4×2

GRAPH



1- The bar graph given above shows the number of smart phones sold in millions from 2007 when it was first introduced into the market till 2014 except for the year 2010. Knowing that the percent increase from the year 2010 to 2011 for the number of smart phones sold is four times the percent increase from the year 2013 to 2014, what is the approximate number of smart phones sold, in millions, in the year 2010?

- A. 14.458
- B. 32.35
- C. 40.161
- D. 25.73
- E. 71.52

2–The following table gives information about a population of smokers and of those having lung diseases due to smoking.

	Men		Men and Women	
	Smokers	Sick	Smokers	Sick
20 - 40 years	2500	30	4500	50
40 - 60 years	3000	50		75
60 - 80 years	2000		4000	
Total		160	13500	265

An individual is selected at random from this population. The probability that this individual is sick knowing that he/she is between 60 and 80 years old is

- A. $\frac{265}{13500}$
- B. $\frac{140}{4000}$
- C. $\frac{80}{2000}$
- D. $\frac{140}{13500}$
- E. $\frac{265}{4000}$

PARAMETRIC EQUATIONS

1- If $a \neq b$, then $x = a \sin t$ and $y = b \cos t$ represent the parametric equations of a(n):

- A. Circle
- B. Ellipse
- C. Straight line
- D. Parabola
- E. Hyperbola

Power

1-

1	A
2	E
3	B
4	E
5	D
6	B
7	E

2-Equations

1	D	23	D
2	A	24	D
3	E	25	B
4	A	26	E
5	B	27	D
6	C	28	A
7	B	29	D
8	D	30	D
9	A	31	E
10	A	32	D
11	B	33	C
12	E	34	E
13	E	35	D
14	A	36	B
15	A	37	C
16	A		
17	E		
18	D		
19	D		
20	C		
21	D		
22	A		

3-FUNCTION

1	B	29	A
2	C	30	C
3	D	31	D
4	E	32	A
5	C D	33	D
6	B	34	B
7	B	35	B
8	D	36	C
9	C	37	E
10	E	38	B
11	B	39	E
12	D	40	C
13	C	41	E
14	B	42	C
15	A	43	D
16	D	44	D
17	B	45	C
18	D		
19	C		
20	C		
21	C		
22	C		
23	C		
24	E		
25	B		
26	B		
27	B		
28	B		

4- Linear Function

1	B
2	B
3	B
4	B
5	B
6	C
7	A
8	D
9	E

5- Geometry

1	E	27	A
2	B	28	C
3	B	29	D
4	C	30	B
5	D	31	A
6	E	32	B
7	A		
8	A		
9	A		
10	E		
11	C		
12	C		
13	E		
14	B		
15	A		
16	E		
17	B		
18	C		
19	A		
20	C		
21	D		
22	A		
23	C		
24	A		
25	C		
26	B		

6- Geometry (GRAPH)

1	E	28	C
2	E	29	B
3	B	30	B
4	B	31	E
5	D	32	C
6	D	33	A
7	C	34	B
8	E	35	D
9	D	36	A
10	A	37	E
11	E	38	A
12	B	39	B
13	A	40	A
14	A	41	A
15	D		
16	D		
17	C		
18	D		
19	A		
20	A		
21	C		
22	B		
23	A		
24	E		
25	E		
26	E		
27	C		

7- PLUG IN

1	D
2	B
3	A
4	A
5	E
6	B
7	D
8	D

8- Trigonometry

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

9- PROBABILITY

1	C
2	A
3	D
4	B
5	B
6	A
7	C
8	C
9	D
10	B
11	E
12	B
13	B
14	C

10- Statistics

1	B
2	B
3	E
4	C
5	A
6	C
7	D
8	E
9	A
10	D

11- AVERAGE SPEED

1 D

12- SEQUENCE

1	C
2	C
3	B
4	A
5	B

13- Circle-ELIPSE-HYPERPOLA

1	B
2	A
3	E
4	C
5	A
6	C
7	C

14- ASYMPTOTE

1	C
2	E
3	B

15- RATIO

1	C
2	A

16- Percent

1	E
2	B
3	E
4	A
5	E

17- Logarithm

1	A
2	B

18- Matrix

1	C
2	A
3	B

19- Graph

1	C
2	B

20- PARAMETRIC EQUATIONS

1 B