1) Jay can paint his parent's living room in 8 hours alone using a traditional brush and roller. His brother, Jon, buys a new paint system and new ladder and is able to paint the same room in 5 hours alone. If each continues to paint by his own method, in how many hours could they paint the living room together? Which statement describes this time?

    A   Between 1 and 2 hours.

    B   Between 3 and 4 hours.

    C   Between 4 and 5 hours.

    D   Less than 1 hour.

    E   Between 2 and 3 hours.

2) Find the values of x and y as described below, where i is the imaginary unit.

$$x = (1+6i) - (-2-5i)$$
$$y = (1+6i)(-2-5i)$$

    A $x = -1 + i,$ $y = -32 - 17i$

    B $x = 3 + i,$ $y = 28 + 7i$

    C $x = 3 + 11i,$ $y = 28 - 17i$

    D $x = 3 + 11i,$ $y = -32 - 17i$

    E $x = -1 + 11i,$ $y = -28 - 17i$

3) After completing the square, the equation $x^2 - 7x - 1 = 0$ becomes which of the following?

    A $\left(x - \dfrac{7}{2}\right)^2 = \dfrac{51}{2}$

    B $(x-7)^2 = 50$

    C $\left(x + \dfrac{7}{2}\right)^2 = \dfrac{25}{2}$

    D $\left(x - \dfrac{7}{2}\right)^2 = \dfrac{53}{4}$

    E $\left(x + \dfrac{7}{2}\right)^2 = \dfrac{49}{4}$

4)   Solve this equation. Which choice is **one** of the simplified solutions?

$$a^2 + 4a - 8 = 0$$

A $a = -2 + 4\sqrt{3}$

B $a = -4 - 2i$

C $a = -2 - 2\sqrt{3}$

D $a = -2 + 2i$

E $a = -4 - i$

5)   Which quadratic equation(s) would yield **two rational** solutions?

I	$2a^2 - 4a - 9 = 0$
II	$x^2 - 12x + 20 = 0$
III	$2y^2 - 13y - 7 = 0$

A   II only

B   I and II only

C   II and III only

D   I only

E   III only

6)   A picture frame's **outside dimensions** are 30 inches by 24 inches and it has uniform width. The area of the picture that shows through the frame is 475 square inches. (See the picture below.) If x represents the width of the frame, which **simplified equation** could be used to find x?

A $4x^2 - 108x + 245 = 0$

B $4x^2 + 108x + 245 = 0$

C $x^2 - 54x + 245 = 0$

D $x^2 + 54x + 245 = 0$

E   None of the above.
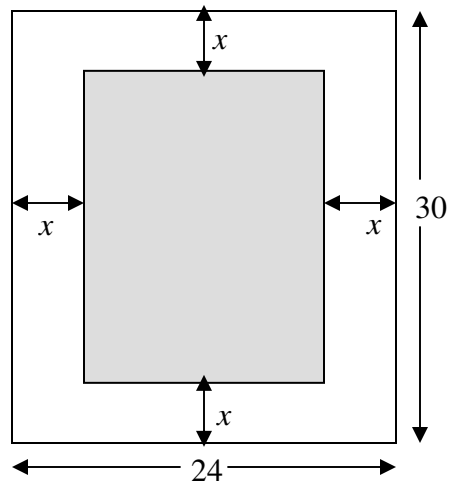
7)   The **height** above ground of an object launched upward with an initial velocity of
       72 feet per second from a platform 40 feet high on level ground is given by
       $h = -16t^2 + 72t + 40$, where h is the height of the object in feet and t is the time in
       seconds. In how many seconds after launch will the object return to earth (height
       0 feet)?

       A   4 seconds

       B $3\frac{1}{2}$ seconds

       C $5\frac{1}{2}$ seconds

       D $4\frac{1}{2}$ seconds

       E   5 seconds

8)   Solve and describe the solution(s). $\sqrt{3-2x} = x+6$

       A   There is one solution and it is positive.
       B   There is one solution and it is negative.
       C   There are two solutions and both are negative.
       D   There are two solutions, one is positive and the other is negative.
       E   There are two solutions and both are positive.

9)   Find all real or complex solutions of this equation. $x^4 - 10x^2 + 24 = 0$

       A $x = 2, -2$ only
       B $x = 2i, -2i, \sqrt{6}, -\sqrt{6}$ only
       C $x = 4, 6$ only
       D $x = 2, -2, 6$ only
       E $x = 2, -2, \sqrt{6}, -\sqrt{6}$ only

10)   Solve this inequality. Select a correct solution. $|3x - 6| \geq 12$

     A $[-2, 6]$

     B

     C $(-\infty, -6) \cup (2, \infty)$

     D
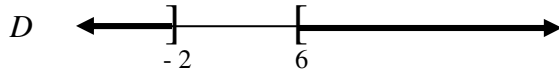
     E $-6 \leq x \leq 2$

11)   Find the distance between the two points below **and** the midpoint of the line segment connecting the two points.

         $(0, -2)$ and $(-4, 8)$

     A   distance: $2\sqrt{29}$,   midpoint: $(-2, 3)$
     B   distance: $2\sqrt{13}$,   midpoint: $(-2, 3)$
     C   distance: $2\sqrt{21}$,   midpoint: $(2, -5)$
     D   distance: $2\sqrt{29}$,   midpoint: $(2, -5)$
     E   distance: $2\sqrt{13}$,   midpoint: $(-2, 5)$

12)   If $f(x) = x^2 - 2x + 1$, find $f(x + 3)$.

     A $f(x + 3) = x^3 + x^2 - 5x + 3$
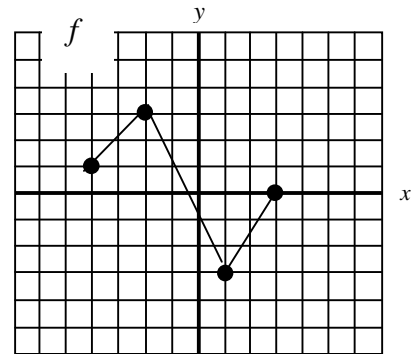   B $f(x + 3) = x^3 - x^2 + 5x - 3$
     C $f(x + 3) = x^2 + 4x + 13$
     D $f(x + 3) = x^2 + 4x + 4$
     E $f(x + 3) = x^2 - 2x + 4$

13)   Use the function f shown in the graph below. Assume each hash mark is one unit. Find the value of $f(1)$ and the range of the function in interval notation.

       A $f(1) = -3$,   Range: $[-3, 3]$

       B $f(1) = -4$,   Range: $[-3, 3]$

       C $f(1) = -3$,   Range: $[-4, 3]$

       D $f(1) = -4$,   Range: $[-4, 3]$

       E   None of the above.

14)   Function g is defined as below. Find the values of $g(1)$ and $g(3)$.

$$g(x) = \begin{cases} 2x - 3 & \text{if } x < 1 \\ 3x - 5 & \text{if } 1 \le x < 3 \\ 1 - x & \text{if } x \ge 3 \end{cases}$$

       A $g(1) = -2$, $g(3) = -2$

       B $g(1) = -2$, $g(3) = 4$

       C $g(1) = -1$, $g(3) = 4$

       D $g(1) = -1$, $g(3) = -2$

       E $g(1) = -1$, $g(3) = 4$

15)   Line 1 passes through the points $(8, 10)$ and $(3, 14)$. Line 2 has an equation $6y = -2x + 8$. What are the slopes of these lines?

       A   line 1: $m = -\dfrac{5}{4}$,   line 2: $m = -\dfrac{1}{3}$

       B   line 1: $m = -\dfrac{4}{5}$,   line 2: $m = -2$

       C   line 1: $m = \dfrac{4}{5}$,   line 2: $m = -2$

       D   line 1: $m = -\dfrac{5}{4}$,   line 2: $m = -3$

       E   line 1: $m = -\dfrac{4}{5}$,   line 2: $m = -\dfrac{1}{3}$