Quadratic Functions, Equations
MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

Use the zero-factor property to solve the equation.
1) \( x^2 + 2x - 15 = 0 \)
   A) \([-3, 5]\)  B) \([-5, 3]\)  C) \([5, 3]\)  D) \([-5, -3]\)  
   
2) \( 2x^2 - 6x + 4 = 0 \)
   A) \([-2, -1]\)  B) \([1, 2]\)  C) \([-2, 1]\)  D) \([-1, 2]\)  
   
Use the square root property to solve the equation.
3) \( x^2 = 49 \)
   A) \([24.5]\)  B) \([8, -8]\)  C) \([7, -7]\)  D) \([7]\)  
   
4) \( 8x^2 - 512 = 0 \)
   A) \([8]\)  B) \([258]\)  C) \([8, -8]\)  D) \([9, -9]\)  
   
5) \( y^2 = 18 \)
   A) \(\{3\sqrt{2}, -3\sqrt{2}\}\)  B) \(\sqrt{18}\)  C) \([324]\)  D) \([9]\)  
   
6) \( (x + 4)^2 = 25 \)
   A) \([1]\)  B) \([-29]\)  C) \([-9, 1]\)  D) \([9, -1]\)  
   
7) \( (3s + 8)^2 = 36 \)
   A) \(\left\{\frac{2}{3}, \frac{14}{3}\right\}\)  B) \(\left\{\frac{28}{3}\right\}\)  C) \(\left\{-\frac{2}{3}, 0\right\}\)  D) \(\left\{-\frac{2}{3}, -\frac{14}{3}\right\}\)  
   
Solve the problem using Galileo's formula, \( d = 16t^2 \). Round your answer to the nearest tenth.
8) Eric has a treehouse 28 ft above the ground. How long would it take a water balloon dropped from the treehouse to fall to the ground?
   A) 1.3 sec  B) 12,544 sec  C) 3.1 sec  D) 5.3 sec  
   
9) A young boy is delighted to drop various objects from a hotel balcony to the ground below. If he is 177 ft above the ground, how long does it take for one of the objects to fall to the ground?
   A) 177.0 sec  B) 3.3 sec  C) 11.1 sec  D) 13.3 sec  
   
Solve the equation by completing the square.
10) \( a^2 - 10a + 21 = 0 \)
   A) \([7, 3]\)  B) \([18, 3]\)  C) \([-7, -3]\)  D) \([5, -5]\)  
   
11) \( z^2 + 16z + 44 = 0 \)
   A) \(\left\{8 + 2\sqrt{11}, 8 - 2\sqrt{11}\right\}\)  B) \(\left\{-16 + 2\sqrt{11}\right\}\)  C) \(\left\{8 + 2\sqrt{5}\right\}\)  D) \(\left\{-8 + 2\sqrt{5}, -8 - 2\sqrt{5}\right\}\)
12) Solve for \( x \). Assume that \( a \) and \( b \) represent positive real numbers.

\[ 4x^2 - 3x - 7 = 0 \]

A) \( \left\{ \frac{4}{7}, 0 \right\} \)
B) \( \left\{ \frac{7}{4}, -1 \right\} \)
C) \( \left\{ \frac{4}{7}, 1 \right\} \)
D) \( \left\{ \frac{4}{7}, -1 \right\} \)

13) \( 64x^2 = 169a \)

A) \( \left\{ -13a, 13a \right\} \)
B) \( \left\{ -13a, 13a \right\} \)
C) \( \left\{ -13a, -13a \right\} \)
D) \( \left\{ -13a, 13a \right\} \)

14) Use the quadratic formula to solve the equation. (All solutions are real numbers.)

\[ a^2 + 14a + 40 = 0 \]

A) \( \left\{ 2\sqrt{10}, -2\sqrt{10} \right\} \)
B) \( \{-20, -8\} \)
C) \( \{-10, -4\} \)
D) \( \{4, 10\} \)

15) \( 7x^2 - 2x - 9 = 0 \)

A) \( \left\{ \frac{7}{9}, -1 \right\} \)
B) \( \left\{ \frac{9}{7}, -1 \right\} \)
C) \( \left\{ \frac{7}{9}, 0 \right\} \)
D) \( \left\{ \frac{7}{9}, 1 \right\} \)

16) \( x^2 = 9 - 4x \)

A) \( \left\{ 2 + \sqrt{13} \right\} \)
B) \( \left\{ 2 - \sqrt{13}, -2 + \sqrt{13} \right\} \)
C) \( \left\{ 2 - \sqrt{13}, -2 - \sqrt{13} \right\} \)
D) \( \left\{ 2 + 2\sqrt{13}, -2 - 2\sqrt{13} \right\} \)

17) Use the quadratic formula to solve the equation.

\[ 2x^2 = -5x - 7 \]

A) \( \left\{ \frac{5 + \sqrt{31}}{4}, \frac{5 - \sqrt{31}}{4} \right\} \)
B) \( \left\{ -\frac{5 + i\sqrt{31}}{4}, -\frac{5 - i\sqrt{31}}{4} \right\} \)
C) \( \left\{ \frac{5 + i\sqrt{31}}{4}, \frac{5 - i\sqrt{31}}{4} \right\} \)
D) \( \left\{ -\frac{5 + i\sqrt{31}}{4}, \frac{5 + i\sqrt{31}}{4} \right\} \)

18) Use the discriminant to determine whether the equation has two rational solutions, one rational solution, two irrational solutions, or two nonreal complex solutions. Do not actually solve.

\[ s^2 + 3s - 4 = 0 \]

A) One rational solution
B) Two irrational solutions
C) Two nonreal complex solutions
D) Two rational solutions

19) \( t^2 + 8t + 16 = 0 \)

A) Two irrational solutions
B) Two nonreal complex solutions
C) Two rational solutions
D) One rational solution

20) \( v^2 + 7v - 2 = 0 \)

A) Two nonreal complex solutions
B) One rational solution
C) Two irrational solutions
D) Two rational solutions
21) \( w^2 - 3w + 4 = 0 \)
   A) One rational solution  B) Two irrational solutions
   C) Two nonreal complex solutions  D) Two rational solutions

Find the value of \( k \) so that the equation will have exactly one rational solution.

22) \( 16x^2 + kx + 25 = 0 \)
   A) 40 or -40  B) 20 or -20  C) 40i or -40i  D) None

23) \( 25x^2 - 10x + k = 0 \)
   A) None  B) 1  C) 0  D) -1

Solve the equation.

24) \( x - 2 = \frac{3}{x} \)
   A) \( \left\{ \frac{1}{3}, 1 \right\} \)  B) \( \{-1, 3\} \)  C) \( \left\{ -\frac{1}{3}, 1 \right\} \)  D) \( \{-3, 1\} \)

25) \( \frac{18}{x - 2} = 1 + \frac{20}{x + 2} \)
   A) \( \{-8, 10\} \)  B) \( \emptyset \)  C) \( \{-20, 10\} \)  D) \( \{8, -10\} \)

26) \( s = 128 + 8\sqrt{s} \)
   A) \{256\}  B) \{128\}  C) \{192\}  D) \{512\}

27) \( 16y = \sqrt{1 - 24y} \)
   A) \( \left\{ \frac{1}{16} \right\} \)  B) \( \left\{ -\frac{1}{8} \right\} \)  C) \( \left\{ \frac{1}{32} \right\} \)  D) \( \left\{ \frac{1}{8} \right\} \)

28) \( \sqrt{14y - 21} = y + 2 \)
   A) \{5\}  B) \{7\}  C) \{-5\}  D) \{-4\}

29) \( \sqrt{x + 3} = x - 3 \)
   A) \{6\}  B) \{1, 13\}  C) \{6, 13\}  D) \{1, 6\}

30) \( (3m - 7)^2 + 3(3m - 7) - 18 = 0 \)
   A) \( \left\{ \frac{13}{3}, -\frac{4}{3} \right\} \)  B) \( \left\{ \frac{1}{3}, \frac{10}{3} \right\} \)  C) \( \left\{ \frac{1}{3}, -\frac{10}{3} \right\} \)  D) \( \left\{ -\frac{13}{7}, \frac{4}{3} \right\} \)

31) \( (3p - 9)^2 = -2(3p - 9) + 15 \)
   A) \( \left\{ \frac{4}{3}, -4 \right\} \)  B) \( \left\{ \frac{4}{3}, 4 \right\} \)  C) \{-5, 3\}  D) \( \left\{ -\frac{14}{3}, -2 \right\} \)

32) \( (m - 2)^{2/3} - 5(m - 2)^{1/3} + 4 = 0 \)
   A) \{-3, 66\}  B) \{3, 6\}  C) \{-3, 0\}  D) \{3, 66\}
Solve the equation for the indicated variable. (Leave ± in your answer, when appropriate.)

33) \( E = mc^2 \) for \( c \)
A) \( c = \frac{E}{m} \)  
B) \( c = Em \)  
C) \( c = \pm \sqrt{\frac{Em}{m}} \)  
D) \( c = \pm \sqrt{Em} \)  

34) \( A = \frac{1}{3} \pi r^2 \) for \( r \)
A) \( r = 3\sqrt{A\pi} \)  
B) \( r = \pm \frac{\sqrt{3A\pi}}{3\pi} \)  
C) \( r = \frac{3\pi}{A} \)  
D) \( r = \pm \frac{\sqrt{3A\pi}}{\pi} \)  

35) \( r = \sqrt{\frac{A}{2\pi}} \) for \( A \)
A) \( A = \pm 2\pi\sqrt{r} \)  
B) \( A = 2\pi r^2 \)  
C) \( A = 2\pi r \)  
D) \( A = \pm \sqrt{2\pi r} \)  

Solve the problem.

36) Two cars leave an intersection. One car travels north; the other east. When the car traveling north had gone 12 mi, the distance between the cars was 4 mi more than the distance traveled by the car heading east. How far had the eastbound car traveled?
A) 24 mi  
B) 20 mi  
C) 12 mi  
D) 16 mi  

37) A ladder is resting against a wall. The top of the ladder touches the wall at a height of 18 ft. Find the length of the ladder if the length is 6 ft more than its distance from the wall.
A) 30 ft  
B) 36 ft  
C) 18 ft  
D) 24 ft  

Solve the problem, if possible. Round your answer to the nearest tenth, when appropriate.

38) The length of a rectangle is 4 in. more than its width. If 2 in. are taken from the length and added to the width, the figure becomes a square with an area of 192 in.². What are the dimensions of the original figure?
A) 12.9 in. by 16.9 in.  
B) 10.9 in. by 14.9 in.  
C) 11.9 in. by 15.9 in.  
D) Cannot be determined without additional information  

Solve the problem. Round your answer to the nearest tenth, when appropriate.

39) A ball is thrown downward from a window in a tall building. Its position at time \( t \) in seconds is given by \( s(t) = 16t^2 + 32t \), where \( s \) is in feet. How long will it take the ball to fall 236 ft?
A) 2.8 sec  
B) 9.0 sec  
C) 3.0 sec  
D) 3.8 sec  

40) A rock falls from a tower that is 102.9 m high. As it is falling, its height is given by the formula \( h = 102.9 - 4.9t^2 \). How many seconds will it take for the rock to hit the ground (\( h = 0 \))?
A) 4.6 sec  
B) 2160.9 sec  
C) 9.9 sec  
D) 10.1 sec  

Identify the vertex of the given parabola.

41) \( f(x) = (x + 3)^2 + 3 \)
A) (3, 0)  
B) (0, 3)  
C) (-3, -3)  
D) (-3, 3)  

42) \( f(x) = -(x + 2)^2 - 2 \)
A) (2, 2)  
B) (2, -2)  
C) (-2, -2)  
D) (-2, 2)  

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43) \( f(x) = x^2 - 5 \)
   A) (1, 0)  B) (5, 0)  C) (0, 5)  D) (0, -5)

Find the vertex of the parabola.

44) \( f(x) = 2x^2 - 20x + 48 \)
   A) (5, -2)  B) (-2, 5)  C) (2, -5)  D) (-5, 2)

45) \( f(x) = 3x^2 + 12x + 16 \)
   A) (2, -4)  B) (4, -2)  C) (-2, 4)  D) (-4, 2)

Sketch the graph of the parabola.

46) \( y = 6x^2 + 6 \)
47) $y = 4(x - 4)^2 - 2$

Solve the inequality, and graph the solution set.

48) $p^2 - 8p + 12 > 0$
49) \( s^2 - 5s - 14 < 0 \)

A) \((-2, 7)\)

B) \((-\infty, -2) \cup (7, \infty)\)

C) \((-\infty, -2)\)

D) \((7, \infty)\)

Solve the problem, if possible. Round your answer to the nearest tenth, when appropriate.

50) The area of a square is 81 cm\(^2\). If the same amount is added to one dimension and removed from the other, the resulting rectangle has an area 9 cm\(^2\) less than the area of the square. How much is added and subtracted?

A) 9 cm
B) 3 cm
C) 4 cm
D) Cannot be determined without additional information