SAT Exercise Quadratics

1

Which of the following is an equivalent form of the expression $(6 - 5x)(15x - 11)$?

Ⓐ $-75x^2 + 35x - 66$

Ⓑ $-75x^2 + 145x - 66$

Ⓒ $90x^2 - 141x + 55$

Ⓓ $90x^2 + 9x + 55$

2

Which of the following is equivalent to $\frac{x^2 - 10x + 25}{3x^2 - 9x - 30}$?

Ⓐ $\frac{3(x-2)}{(x+5)}$

Ⓑ $\frac{3(x+2)}{(x-5)}$

Ⓒ $\frac{(x-5)}{3(x+2)}$

Ⓓ $\frac{(x+5)}{3(x-2)}$

3

For what positive value of x is the equation $\frac{3}{2x^2 + 4x - 6} = 0$ undefined?

______

4

What is the sum of the roots of $3x^2 + 9x = 54$?

Ⓐ -6

Ⓑ -3

Ⓒ 3

Ⓓ 6

5

$f(x) = (1.3x - 3.9)^2 - (0.69x^2 - 0.14x - 9.79)$

Which of the following functions is equivalent to the function given?

Ⓐ $f(x) = (x - 5)^2$

Ⓑ $f(x) = x^2 + 10.28x + 5.42$

Ⓒ $f(x) = 0.61x^2 + 0.14x + 25$

Ⓓ $f(x) = 1.3(x - 3)^2 - 0.69x^2 + 0.14x + 9.79$

6

For all a and b, what is the sum of $(a - b)^2$ and $(a + b)^2$?

Ⓐ $2a^2$

Ⓑ $2a^2 - 2b^2$

Ⓒ $2a^2 + 2b^2$

Ⓓ $2a^2 + 4ab + 2b^2$

7

What is the positive difference between the roots of the equation $y = \frac{1}{3}x^2 - 2x + 3$?

______

8

$$f(x) = \frac{3}{(x-7)^2 + 6(x-7) + 9}$$

For which value of x is the function $f(x)$ undefined?

______

9

A rectangle has an area of $x^4 - 196$. If the width of the rectangle is $x^2 - 14$, what is the length? (The area of a rectangle is its length times its width.)

Ⓐ $x + 14$

Ⓑ $x^2 + 14$

Ⓒ $x^2 - 14$

Ⓓ $x - 14$

10

In the expression $2x^2 - 28x + 98 = a(x - b)^2$, $a > 1$ and both a and b are constants. Which of the following could be the value of b?

Ⓐ -7

Ⓑ 7

Ⓒ 14

Ⓓ 49

11

Which of the following is a value of x that satisfies the equation $x^2 + 2x - 5 = 0$?

Ⓐ -1

Ⓑ $1 - \sqrt{6}$

Ⓒ $1 + \sqrt{6}$

Ⓓ $-1 - \sqrt{6}$

12

$$a^2 - 12a - 72 = 0$$

Which of the following is the greatest possible value of a?

Ⓐ $12\sqrt{3}$

Ⓑ $36\sqrt{3}$

Ⓒ $6 + \sqrt{3}$

Ⓓ $6(1 + \sqrt{3})$

13

$$x^2 - (6\sqrt{5})x = -40$$

What is the sum of the possible values of x in the given equation?

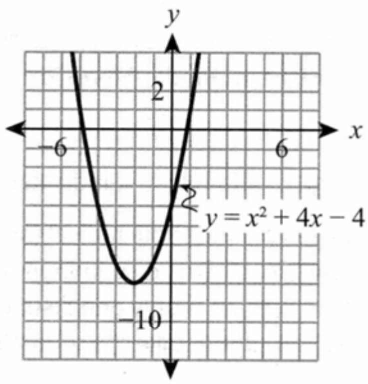
Ⓐ 15

Ⓑ $4\sqrt{5}$

Ⓒ $6\sqrt{5}$

Ⓓ 60

14



Which of the following is equivalent to the equation of the graph shown?

Ⓐ $(x - 2)^2 - 8$

Ⓑ $(x + 2)^2 - 8$

Ⓒ $(x - 2)^2 + 8$

Ⓓ $(x + 2)^2 + 8$

15

Given the equation $2x^2 + 8x + 4 + 2z = 0$, for what value of z is there exactly one solution for x?

____

16

The product of all the solutions to the equation $3v^2 + 4v - 2 = 0$ is M. What is the value of M?

Ⓐ -3

Ⓑ $-\frac{2}{3}$

Ⓒ $-\frac{1}{3}$

Ⓓ $\frac{4}{3}$

17

What are the solutions to the equation $4x^2 - 24x + 16 = 0$?

Ⓐ $x = 3 \pm \sqrt{5}$

Ⓑ $x = 4 \pm \sqrt{6}$

Ⓒ $x = 5 \pm \sqrt{3}$

Ⓓ $x = 5 \pm 2\sqrt{2}$

18

$$3x^2 = m(5x + v)$$

What are the values of x that satisfy the equation above, where m and v are constants?

Ⓐ $x = -\frac{5m}{6} \pm \frac{\sqrt{25m^2 + 12mv}}{6}$

Ⓑ $x = \frac{5m}{6} \pm \frac{\sqrt{25m^2 + 12mv}}{6}$

Ⓒ $x = -\frac{5m}{3} \pm \frac{\sqrt{12m^2 + 25mv}}{3}$

Ⓓ $x = \frac{5m}{3} \pm \frac{\sqrt{25m^2 + 12mv}}{3}$

19

$$x(dx + 10) = -3$$

The equation shown, where d is a constant, has no real solutions. The value of d could be which of the following?

Ⓐ -12

Ⓑ 4

Ⓒ 8

Ⓓ 10

20

Which equation has no real solutions?

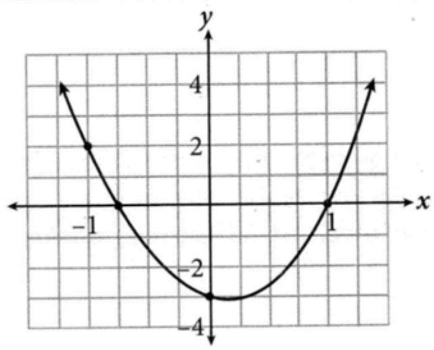
Ⓐ $x^2 + 8x - 12 = 0$

Ⓑ $x^2 - 8x + 12 = 0$

Ⓒ $x^2 - 9x + 21 = 0$

Ⓓ $x^2 + 100x - 1 = 0$

21



The following quadratic equations are all representations of the graph shown. Which equation represents the exact values of the x-intercepts of the graph?

Ⓐ $y = (4x - 3)(x + 1)$

Ⓑ $y = (4x + 3)(x - 1)$

Ⓒ $y = (3x - 4)(x + 1)$

Ⓓ $y = (3x + 4)(x - 1)$

22

Which equation represents the axis of symmetry for the graph of the quadratic function $f(x) = -\frac{11}{3}x^2 + 17x - \frac{43}{13}$?

Ⓐ $x = -\frac{102}{11}$

Ⓑ $x = -\frac{51}{22}$

Ⓒ $x = \frac{51}{22}$

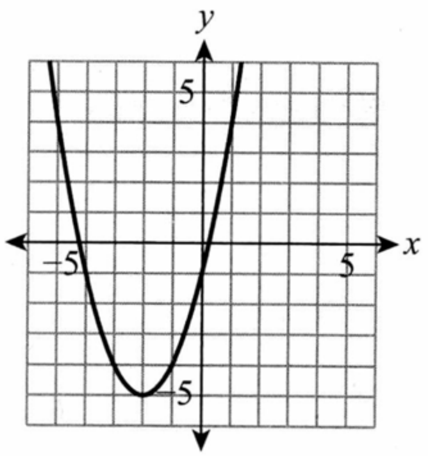
Ⓓ $x = \frac{102}{11}$

23

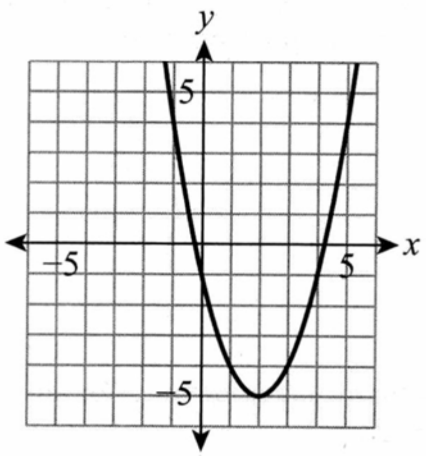
$$fx = -(x - p)^2 + q$$

Which of the following represents the graph of $y = f(x)$ if $p < 0$ and $q > 0$?

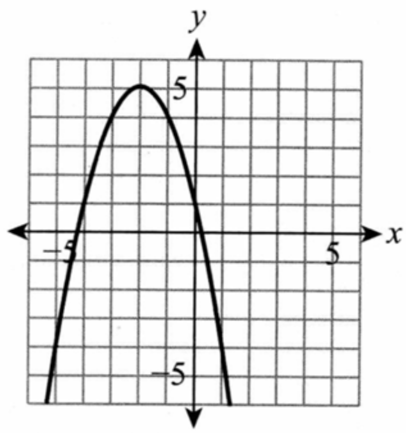
Ⓐ



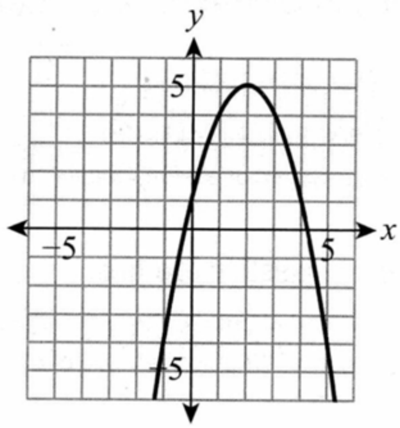
Ⓑ



Ⓒ



Ⓓ



24

The graph of $y = a(x + 1)(x - 6)$ has a vertex at (h, k). What is the value of h?

25

A toy rocket is fired from ground level. The height of the rocket with respect to time can be represented by a quadratic function. If the toy rocket reaches a maximum height of 34 feet 3 seconds after it was fired, which of the following functions could represent the height, h, of the rocket t seconds after it was fired?

Ⓐ $h(t) = -16(t - 3)^2 + 34$

Ⓑ $h(t) = -16(t + 3)^2 + 34$

Ⓒ $h(t) = 16(t - 3)^2 + 34$

Ⓓ $h(t) = 16(t + 3)^2 + 34$

26

$$\begin{cases} a = b^2 + 4b - 12 \\ a = -12 + b \end{cases}$$

The ordered pair (a, b) satisfies the system of equations shown. What is one possible value of b?

Ⓐ -6

Ⓑ -3

Ⓒ 2

Ⓓ 3

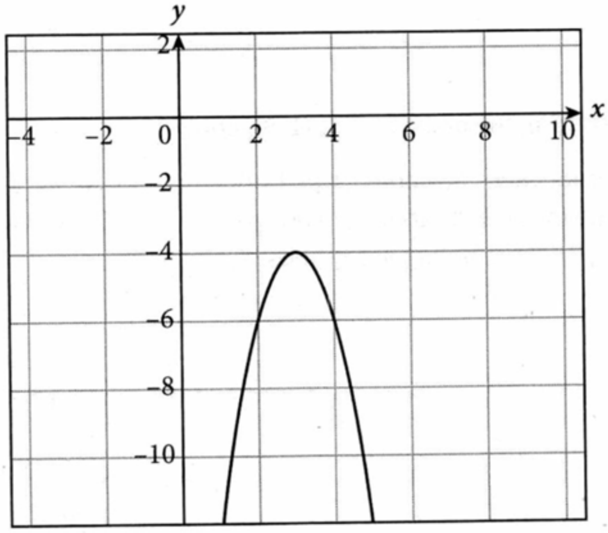
27

In the xy-coordinate plane, the graph of $y = 5x^2 - 12x$ intersects the graph of $y = -2x$ at points $(0, 0)$ and (a, b). What is the value of a?

28

The graph of $f(x) = x^2 + x$ intersects the graph of $g(x) = d$, where d is a constant, at exactly one point. What is the value of d?

29



The graph of the function f, defined by $f(x) = -2(x - 3)^2 - 4$, is shown in the xy-plane. The function g (not shown) is defined by $g(x) = 2x - 10$. If $f(c) = g(c)$, what is one possible value of c?

Ⓐ -6

Ⓑ -4

Ⓒ 2

Ⓓ 4

30

On the xy-plane, points P and Q are the two points where the parabola with the equation $y = 3x^2 + \frac{14}{3}x - \frac{73}{3}$ and the line with the equation $y = -\frac{4}{3}x - \frac{1}{3}$ meet. What is the distance between point P and point Q?

Ⓐ 5

Ⓑ 8

Ⓒ 10

Ⓓ 12

SAT Exercise Quadratics Answers

1. B

Difficulty: Easy

Category: Advanced Math

Getting to the Answer: FOIL the binomials $(6-5x)(15x-11)$. First: $(6)(15x)=90x$. Outer: $(6)(-11)=-66$. Inner: $(-5x)(15x)=-75x^2$. Last: $(-5x)(-11)=55x$. Combining like terms gives $90x-66-75x^2+55x=-75x^2+145x-66$. The correct answer is **(B)**.

2. C

Difficulty: Easy

Category: Advanced Math

Getting to the Answer: First, factor out a 3 in the denominator to make that quadratic a bit simpler. Next, factor the numerator and denominator using reverse-FOIL to reveal an $x-5$ term that will cancel out.

$$\frac{x^2-10x+25}{3x^2-9x-30}=\frac{x^2-10x+25}{3(x^2-3x-10)}$$
$$=\frac{\cancel{(x-5)}(x-5)}{3\cancel{(x-5)}(x+2)}=\frac{x-5}{3(x+2)}$$

The correct answer is **(C)**.

3. 1

Difficulty: Medium

Category: Advanced Math

Getting to the Answer: An expression is undefined when it involves division by 0, so the key to the question is to recognize that the denominator will be 0 if either of the factors of the quadratic are 0. Factoring 2 out of the denominator leaves a relatively easy-to-factor quadratic:

$$\frac{3}{2x^2+4x-6}=0$$
$$\frac{3}{2(x^2+2x-3)}=0$$
$$\frac{3}{2(x+3)(x-1)}=0$$

The denominator will be 0 if the value of x is either 1 or -3. Because the question asks for a positive value of x, enter **1**.

4. B

Difficulty: Medium

Category: Advanced Math

Getting to the Answer: Set the equation equal to zero and then divide by 3 to remove the x^2 coefficient:

$$3x^2+9x-54=0$$
$$x^2+3x-18=0$$
$$(x-3)(x+6)=0$$
$$x=3 \text{ or } -6$$

The question asks for the sum of the roots, which is $3+(-6)=-3$. The correct answer is **(B)**.

5. A

Difficulty: Hard

Category: Advanced Math

Strategic Advice: The question asks for an equivalent expression, so ignore the function notation and focus on simplifying the polynomial so that it looks more like the answer choices.

Getting to the Answer: Expand the polynomial and distribute as necessary so that all of the parentheses are eliminated:

$$(1.3x-3.9)^2-(0.69x^2-0.14x-9.79)$$
$$(1.3x-3.9)(1.3x-3.9)-0.69x^2+0.14x+9.79$$
$$1.69x^2-10.14x+15.21-0.69x^2+0.14x+9.79$$

Combine like terms:

$$x^2-10x+25$$

Then factor the polynomial by finding two integers that multiply to 25 and add up to -10: $x^2-10x+25=(x-5)(x-5)=(x-5)^2$. **(A)** is correct.

6. C

Difficulty: Easy

Category: Advanced Math

Getting to the Answer: Expand both classic quadratics and combine like terms to find the sum:

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

This matches **(C)**.

7. 0

Difficulty: Medium

Category: Advanced Math

Getting to the Answer: To find the roots, set the equation equal to 0, factor it, and then solve. Clear the fraction the same way you do when solving equations, multiplying both sides of the equation by the denominator of the fraction:

$$0 = \frac{1}{3}x^2 - 2x + 3$$
$$3(0) = 3\left(\frac{1}{3}x^2 - 2x + 3\right)$$
$$0 = x^2 - 6x + 9$$
$$0 = (x-3)(x-3)$$

The equation has only one unique solution ($x = 3$), so the positive difference between the roots is $3 - 3 = 0$. Enter **0**.

8. 4

Difficulty: Hard

Category: Advanced Math

Getting to the Answer: A fraction is undefined when the denominator equals 0. To find the value of x where $f(x)$ is undefined, set the denominator equal to 0 and solve for x.

The equation $(x-7)^2 + 6(x-7) + 9 = 0$ is the expansion of the classic quadratic $a^2 + 2ab + b^2 = (a+b)^2$, where $a = (x-7)$ and $b = 3$, so the denominator will factor as $[(x-7)+3]^2$. That's equivalent to $(x-4)^2$. Set this expression equal to 0 to find that the function is undefined when $x - 4 = 0$, or $x = 4$. Enter **4**.

9. B

Difficulty: Medium

Category: Advanced Math

Getting to the Answer: Start by noticing that $x^4 - 196$ is a difference of perfect squares. Use the pattern for difference of squares $a^2 - b^2 = (a+b)(a-b)$ where $x^4 - 196 = (x^2+14)(x^2-14)$. Because area is length times width ($A = lw$) and the width is $x^2 - 14$, the length must be $x^2 + 14$. Choice **(B)** is correct.

10. B

Difficulty: Medium

Category: Advanced Math

Strategic Advice: Recognizing the classic quadratic $(x-y)^2 = x^2 - 2xy + y^2$ will save you time when factoring.

Getting to the Answer: In this question, the goal is to manipulate the polynomial so that it matches the factored form given. First, recognize that 2 can be factored out. The resulting expression is then $2(x^2 - 14x + 49)$. Notice that $\sqrt{49} = 7$ and factor the quadratic to get $2(x-7)(x-7) = 2(x-7)^2$. Now the expression is in the same form as $a(x-b)^2$. Therefore, $b = 7$, so **(B)** is correct.

11. D

Difficulty: Medium

Category: Advanced Math

Getting to the Answer: Factoring won't work here because no two factors of -5 sum to 2. However, the coefficient of x^2 is 1, so try completing the square:

$$x^2 + 2x - 5 = 0$$
$$x^2 + 2x = 5$$
$$\left(\frac{b}{2}\right)^2 = \left(\frac{2}{2}\right)^2 = 1^2 = 1$$
$$x^2 + 2x + 1 = 5 + 1$$
$$(x+1)^2 = 6$$
$$x + 1 = \pm\sqrt{6}$$
$$x = -1 \pm \sqrt{6}$$

(D) matches one of the two possible values of x, so it's correct.

12. D

Difficulty: Medium

Category: Advanced Math

Getting to the Answer: To complete the square, restate this as $a^2 - 12a = 72$. One-half of the x-coefficient is -6, which, when squared, becomes 36. So, $a^2 - 12a + 36 = 108$. Factor to find that $(a-6)^2 = 108$ and then take the square root of both sides to get $a - 6 = \pm\sqrt{108}$. Since $108 = 36 \times 3$, the radical simplifies to $6\sqrt{3}$.

Since the question asks for the root with the greatest value, you can ignore the root with the minus sign, so $a = 6 + 6\sqrt{3} = 6(1 + \sqrt{3})$. **(D)** is correct.

13. C

Difficulty: Hard

Category: Advanced Math

Getting to the Answer: The radical looks as if it will make the calculation difficult, but it will drop out when you complete the square. The coefficient, b, is $6\sqrt{5}$, so $\left(\frac{6\sqrt{5}}{2}\right)^2 = \left(\frac{36 \times 5}{4}\right) = 45$. Adding 45 to both sides of the equation gives you $x^2 - (6\sqrt{5})x + 45 = 5$, so the factored form is $(x - 3\sqrt{5})^2 = 5$. Take the square root of both sides to get $x - 3\sqrt{5} = \pm\sqrt{5}$. The two possible values of x are $3\sqrt{5} + \sqrt{5} = 4\sqrt{5}$ and $3\sqrt{5} - \sqrt{5} = 2\sqrt{5}$. The question asks for the sum of these values, which is $4\sqrt{5} + 2\sqrt{5} = 6\sqrt{5}$. **(C)** is correct.

14. B

Difficulty: Medium

Category: Advanced Math

Getting to the Answer: Rewrite the equation of the graph by completing the square. The coefficient, b, is 4, so $\left(\frac{4}{2}\right)^2 = 2^2 = 4$. Completing the square gives you $y + 4 = x^2 + 4x + 4 - 4$. Isolate y and then factor.

$$y = x^2 + 4x + 4 - 4 - 4$$
$$y = (x + 2)^2 - 8$$

(B) is correct.

In the upcoming lesson, Graphs of Quadratics, you'll see how to solve this question by noting that in this form, the vertex of the parabola can be read: $(-2, -8)$.

15. 2

Difficulty: Hard

Category: Advanced Math

Strategic Advice: Recall that when the value of the discriminant, $b^2 - 4ac$, is 0, there is exactly one solution to the quadratic equation.

Getting to the Answer: The given equation is $2x^2 + 8x + 4 + 2z = 0$, but there is a common factor of 2 in all the terms, so this becomes $x^2 + 4x + 2 + z = 0$. Thus, $a = 1$, $b = 4$, and $c = 2 + z$. Set the discriminant $4^2 - 4(1)(2 + z)$ equal to 0 so that there is only one solution. Expand the equation to $16 - 8 - 4z = 0$. Thus, $8 = 4z$, and $z = 2$. Enter **2**.

16. B

Difficulty: Hard

Category: Advanced Math

Getting to the Answer: The question presents a quadratic equation that cannot be easily factored. Therefore, use the quadratic formula to solve. The quadratic formula states that $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$.

In this case, $a = 3$, $b = 4$, and $c = -2$. Plug in these values to get:

$$x = \frac{-4 \pm \sqrt{4^2 - 4(3)(-2)}}{2(3)}$$
$$= \frac{-4 \pm \sqrt{16 - (-24)}}{6}$$
$$= \frac{-4 \pm \sqrt{40}}{6}$$

Thus, the solutions to the equation are $\frac{-4 + \sqrt{40}}{6}$ and $\frac{-4 - \sqrt{40}}{6}$. The question asks for their product, so multiply the solutions:

$$\left(\frac{-4 + \sqrt{40}}{6}\right)\left(\frac{-4 - \sqrt{40}}{6}\right)$$
$$= \frac{16 + 4\sqrt{40} - 4\sqrt{40} - 40}{36}$$
$$= \frac{-24}{36}$$
$$= -\frac{2}{3}$$

(B) is correct.

17. A

Difficulty: Medium

Category: Advanced Math

Strategic Advice: When all of the coefficients in a quadratic equation are divisible by a common factor, simplify the equation by dividing all terms by that factor before solving.

Getting to the Answer: The given equation is $4x^2 - 24x + 16 = 0$, but there is a common factor of 4 in all the terms, so this becomes $x^2 - 6x + 4 = 0$.

The radicals in the answer choices are a strong clue that the quadratic formula is the way to solve this equation. The quadratic formula is $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$, and after you plug in the coefficients, $a = 1$, $b = -6$, and $c = 4$, you get:

$$\begin{aligned} x &= \frac{-(-6) \pm \sqrt{(-6)^2 - 4(1)(4)}}{2(1)} \\ &= \frac{6 \pm \sqrt{36 - 16}}{2} \\ &= \frac{6 \pm \sqrt{20}}{2} \end{aligned}$$

This doesn't resemble any of the answer choices, so continue simplifying:

$$\begin{aligned} &\frac{6 \pm \sqrt{20}}{2} \\ &= \frac{6 \pm \sqrt{4}\sqrt{5}}{2} \\ &= \frac{6 \pm 2\sqrt{5}}{2} \\ &= \frac{6}{2} \pm \frac{2\sqrt{5}}{2} \\ &= 3 \pm \sqrt{5} \end{aligned}$$

Hence, **(A)** is correct.

18. B

Difficulty: Hard

Category: Advanced Math

Getting to the Answer: A glance at the radicals in the answer choices suggests that using the quadratic formula to solve is appropriate. Because there are so many variables, it might help to write down the quadratic formula on your scratch paper as a guide: $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$.

Begin by reorganizing the quadratic into the standard form $ax^2 + bx + c = 0$:

$$\begin{aligned} 3x^2 &= m(5x + v) \\ 3x^2 &= 5mx + mv \\ 3x^2 - 5mx - mv &= 0 \end{aligned}$$

In this case, $a = 3$, $b = -5m$, and $c = -mv$. Now solve:

$$\begin{aligned} x &= \frac{-(-5m) \pm \sqrt{(-5m)^2 - 4(3)(-mv)}}{2(3)} \\ &= \frac{5m \pm \sqrt{25m^2 - (-12mv)}}{6} \\ &= \frac{5m \pm \sqrt{25m^2 + 12mv}}{6} \\ &= \frac{5m}{6} \pm \frac{\sqrt{25m^2 + 12mv}}{6} \end{aligned}$$

Therefore, **(B)** is correct.

19. D

Difficulty: Medium

Category: Advanced Math

Getting to the Answer: Get the equation $x(dx + 10) = -3$ into the form $ax^2 + bx + c = 0$. Multiply out the left side of the equation $x(dx + 10) = -3$ to get $dx^2 + 10x = -3$. Add 3 to both sides to obtain $dx^2 + 10x + 3 = 0$.

The equation $ax^2 + bx + c = 0$ (when $a \neq 0$) does not have real solutions if the discriminant, which is $b^2 - 4ac$, is negative. In the equation $dx^2 + 10x + 3 = 0$, $a = d$, $b = 10$, and $c = 3$. The discriminant in this question is $10^2 - 4(d)(3) = 100 - 12d$.

Since you're looking for a negative discriminant, that is, $b^2 - 4ac < 0$, you need $100 - 12d < 0$. Solve the inequality $100 - 12d < 0$ for d:

$$\begin{aligned} 100 - 12d &< 0 \\ 100 &< 12d \\ \frac{100}{12} &< d \\ \frac{25}{3} &< d \\ 8\frac{1}{3} &< \mathrm{d} \end{aligned}$$

Among the answer choices, only 10 is greater than $8\frac{1}{3}$, so **(D)** is correct.

20. C
Difficulty: Medium

Category: Advanced Math

Getting to the Answer: Recall that when a quadratic equation has no real solutions, its discriminant, which is $b^2 - 4ac$, will be less than 0. Calculate the discriminant of each answer choice and pick the one that's negative. You don't need to actually solve for x.

(A): $8^2 - 4(1)(-12) = 64 + 48 > 0$. Eliminate.

(B): $(-8)^2 - 4(1)(12) = 64 - 48 > 0$. Eliminate.

(C): $(-9)^2 - 4(1)(21) = 81 - 84 = -3 < 0$. Pick **(C)** and move on. For the record:

(D): $(100)^2 - 4(1)(-1) = 10{,}000 + 4 > 0$. Eliminate.

21. B
Difficulty: Easy

Category: Advanced Math

Getting to the Answer: The factored form of a quadratic equation makes it easy to find the solutions to the equation, which graphically represent the x-intercepts. The graph shows x-intercepts at $x = -\frac{3}{4}$ and $x = 1$. For each answer choice, set each factor equal to 0 and quickly solve to find the x-intercepts and see which ones agree with the graph.

(A): $x = \frac{3}{4}$ and $x = -1$. This does not match the graph; eliminate.

(B): $x = -\frac{3}{4}$ and $x = 1$. This matches the graph, so **(B)** is correct. You do not need to check the remaining choices.

22. C
Difficulty: Medium

Category: Advanced Math

Getting to the Answer: An axis of symmetry splits a parabola in half and travels through the vertex. Use the formula to find h, plug in the correct values from the equation, and simplify:

$$\begin{aligned} x &= -\frac{b}{2a} \\ &= -\frac{17}{2\left(\frac{-11}{3}\right)} \\ &= -\frac{17}{\left(\frac{-22}{3}\right)} \\ &= -17 \cdot \frac{-3}{22} \\ &= \frac{51}{22} \end{aligned}$$

The correct answer is **(C)**. Note that you could have also graphed the function on your calculator to determine the axis of symmetry. Use the approach that is best for you.

23. C
Difficulty: Medium

Category: Advanced Math

Getting to the Answer: The given function is in vertex form, $y = a(x - h)^2 + k$, where (h, k) is the vertex and the sign of a indicates whether the parabola opens up or down. Since $a = -1$ for $f(x) = -(x - p)^2 + q$, the parabola opens downward. Eliminate (A) and (B). The vertex is (p, q), and the question tells you that p is negative, so **(C)** is correct.

24. 5/2 or 2.5
Difficulty: Easy

Category: Advanced Math

Getting to the Answer: The factored form of the equation $y = a(x + 1)(x - 6)$ tells you that the x-intercepts of the parabola are -1 and 6. The x-coordinate of the vertex (h) is the axis of symmetry, which is halfway between the x-intercepts. Thus, $h = \frac{-1+6}{2} = \frac{5}{2}$. Enter **5/2** or **2.5**.

25. A
Difficulty: Hard

Category: Advanced Math

Getting to the Answer: The answer choices are all similar, so pay careful attention to their differences and see if you can eliminate any choices logically. A rocket goes up and then comes down, which means that the graph will be a parabola opening downward. The equation, therefore, should have a negative sign in front. Eliminate (C) and (D).

To evaluate the two remaining choices, recall the *vertex form* of a quadratic, $y = a(x - h)^2 + k$, and what it tells you: the vertex of the graph is (h, k). The h is the x-coordinate of the maximum (or minimum) and k is the y-coordinate of the maximum (or minimum). In this situation, x has been replaced by t, or time, and y is now $h(t)$, or height. The question says that the maximum height occurs at 3 seconds and is 34 feet, so h is 3 and k is 34. Substitute these values into vertex form to find that the correct equation is $y = -16(x - 3)^2 + 34$. The function that matches is **(A)**.

26. B

Difficulty: Medium

Category: Advanced Math

Strategic Advice: Because each of the two expressions containing b is equal to a, the two expressions must be equal to each other.

Getting to the Answer: Set the two expressions equal to each other and then solve for b:

$$\begin{aligned} b^2+4b-12&=-12+b \\ b^2+4b&=b \\ b^2+3b&=0 \\ b(b+3)&=0 \end{aligned}$$

If $b(b+3)=0$, then $b=0$ or $b=-3$. Of these two values, only -3 is among the answer choices, so **(B)** is correct.

27. 2

Difficulty: Medium

Category: Advanced Math

Getting to the Answer: The points of intersection of the graphs are the points at which the equations are equal. Since (a, b) is the label for an (x, y) point, set the two equations equal to each other and solve for the value of x to find the value of a:

$$\begin{aligned} -2x&=5x^2-12x \\ 0&=5x^2-10x \\ 0&=5x(x-2) \end{aligned}$$

Thus, $x=0$ or $x=2$. The question states that the intersection points are $(0, 0)$ and (a, b), so a must equal 2. Enter **2**.

Alternatively, you could graph the two equations on the calculator to determine the point of intersection.

28. −1/4, −0.25, or −.25

Difficulty: Hard

Category: Advanced Math

Getting to the Answer: Since $f(x)$ and $g(x)$ intersect, set the equations equal to each other: $x^2+x=d$. Then subtract d from both sides to set the quadratic equal to 0: $x^2+x-d=0$.

Recall that when there is exactly one solution, the discriminant, b^2-4ac, equals 0. In the equation $x^2+x-d=0$, $a=1$, $b=1$, and $c=-d$. Therefore, $1^2-4(1)(-d)=0$. Solving for d gives $d=-\frac{1}{4}$. Enter **−1/4, −0.25,** or **−.25**

29. C

Difficulty: Hard

Category: Advanced Math

Getting to the Answer: Because the question states that $f(c)=g(c)$, set the two functions equal to each other and solve for x. To make calculations easier, begin by converting $f(x)$ into standard form:

$$\begin{aligned} f(x)&=-2(x-3)^2-4 \\ &=-2(x-3)(x-3)-4 \\ &=-2(x^2-6x+9)-4 \\ &=-2x^2+12x-18-4 \\ &=-2x^2+12x-22 \end{aligned}$$

Now set the two functions equal to each other:

$$-2x^2+12x-22=2x-10$$

Simplify by dividing all terms by -2:

$$x^2-6x+11=-x+5$$

Next, combine like terms and solve for x:

$$\begin{aligned} x^2-6x+11&=-x+5 \\ x^2-5x+6&=0 \\ (x-2)(x-3)&=0 \end{aligned}$$

Therefore, $x=2$ or $x=3$, which means that c could also be either 2 or 3. Because 3 is not an answer choice, the answer must be 2. **(C)** is correct.

If you find it faster, you could graph the two functions to determine the points of intersection.

30. C

Difficulty: Hard

Category: Advanced Math

Strategic Advice: When you need to find the points of intersection of two equations, set the equations equal to each other.

Getting to the Answer: The question indicates that points P and Q are the points of intersection of the two equations, so set the two equations equal to each other and consolidate terms to get a single quadratic equation equal to 0:

$$3x^2 + \frac{14}{3}x - \frac{73}{3} = -\frac{4}{3}x - \frac{1}{3}$$

$$3x^2 + \frac{18}{3}x - \frac{72}{3} = 0$$

$$3x^2 + 6x - 24 = 0$$

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

Factor the equation to find the values of x:

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

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

$$x = -4 \text{ or } 2$$

You can plug each value of x into either of the original equations to find the corresponding values of y, but the linear equation is easier to work with. For $x = -4$:

$$y = -\frac{4}{3}(-4) - \frac{1}{3}$$

$$y = \frac{16}{3} - \frac{1}{3}$$

$$y = \frac{15}{3} = 5$$

Therefore, one of the points of intersection is $(-4, 5)$. Find the other point of intersection by plugging $x = 2$ into the linear equation:

$$y = -\frac{4}{3}(2) - \frac{1}{3}$$

$$y = -\frac{8}{3} - \frac{1}{3}$$

$$y = -\frac{9}{3} = -3$$

Thus, the other point of intersection is $(2, -3)$.

Note that you could have also found the points of intersection by graphing the two equations.

The question asks for the distance between these two points. The formula for the distance, d, between the points (x_1, y_1) and (x_2, y_2) is $d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$. Find the distance between points P and Q:

$$d = \sqrt{(-4-2)^2 + (5-(-3))^2}$$

$$= \sqrt{(-6)^2 + 8^2}$$

$$= \sqrt{36 + 64}$$

$$= \sqrt{100}$$

$$= 10$$

Therefore, the distance between points P and Q is 10. **(C)** is correct.