Module 1: Quadratic Functions

Answer Key

Quadratic Functions 1.1

Ready

1. $6x + 21$
2. $-60x + 48$
3. $-15a^2 + 65a$
4. $54x^2 - 18x$
5. $8x^2 + 12x$
6. $8a^2 - 20ab$
7. $-44x^2 - 8x$

Set

Note: Explicit equations for exponential functions listed below are possible answers. It is possible students have simplified or used a different point to get their solution. However, linear equations should be simplified to slope-intercept form.

8a. Exponential Function
Explicit Equation:

$$f(x) = 64 \cdot 2^{x-6}$$

Recursive Equation:

$$f(6) = 64$$
$$f(x) = f(x-1) \times 2$$

b. New kind of function
Explicit Equation:

$$f(x) = x^2$$

Recursive Equation:

$$f(7) = 49$$
$$f(x) = f(x-1) + 2x - 1$$

c. Linear Function
Explicit Equation:

$$f(x) = 2x - 1$$

Recursive Equation:

$$f(6) = 11$$
$$f(x) = f(x-1) + 2$$

9d. Linear Function
Explicit Equation:

$$f(x) = 5x - 7$$

Recursive Equation:

$$f(0) = -7$$
$$f(x) = f(x-1) + 5$$

e. Exponential Function
Explicit Equation:

$$f(x) = 5^x$$

Recursive Equation:

$$f(0) = 1$$
$$f(x) = f(x-1) \times 5$$

f. New kind of function
Explicit Equation:

$$f(x) = x^2 + 5$$

Recursive Equation:

$$f(0) = 5$$
$$f(x) = f(x-1) + 2x - 1$$

10. Possible Graphs

a.

b.

c.

d.

e.

f.

Go

11. 4
12. -3
13. 3
14. 5
15. $\frac{3}{2}$
16. $\frac{3}{2}$
17. 50
18. 0.5
19. -6

Quadratic Functions 1.2

Ready

1a. $7x + 10$
1b. $10x^2 + 41x + 21$

2a. $7x - 11$
2b. $6x^2 - 61x + 10$

3a. $11x - 1$
3b. $24x^2 - 15x - 12$

4a. $2x - 11$
4b. $-35x^2 + 79x - 26$

5a. $8x + 6$
5b. $-48x^2 + 24x + 9$

6. $x^2 - 25$

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7. The answers in part a have an \( x \) as well as a number. The answers in part b have an \( x^2 \), an \( x \), and a number.

8. The answer in number 6 only has an \( x^2 \) and a number, it doesn't have an "x" part. This happened because the 5\( x \) and -5\( x \) added together to make 0\( x \). Examples will vary, but should look like \( (x + a)(x - a) \).

9. 2\( x \). This answer is missing the whole number that followed the other part a answers.

10a. 4\( x \) cm
b. \( x^2 \) cm^2

11a. 4\( x \) + 4 in
b. \( x^2 + 2x + 1 \) in^2

12a. 2\( a \) + 2\( b \) + 16 ft
b. \( ab + 3a + 5b + 15 \) ft^2

13a. 2\( a \) + 2\( b \) m
b. \( ab \) m^2

14a. 4\( x \) + 2 m
b. \( x^2 + x - 6 \) m^2

15a. 4\( x \) + 10 in
b. \( x^2 + 5x + 4 \) in^2

16a. Answers will vary but should include that both the perimeter and areas have numbers, variables as well as units.

b. Answers will vary but should include that the area includes variables and units that include squares.

Go
17. 5abc
18. 4\( x^2 \)y
19. \( pqr \)
20. 7\( x \)
21. 6
22. \( x \)

23. \( xy \)
24. 8b
25. \( st^2 \)

Quadratic Functions 1.3

Ready
1. 1,200
2. 99,225
3. 39,325
4. \( x^2 - 2x - 35 \)
5. \( x^2 + 11x + 24 \)
6. \( 2x^2 - 26x + 72 \)
7. \( 3x^2 - 9x - 12 \)
8. \( 6x^2 - 16x + 10 \)
9. \( 30x^2 - 32x - 14 \)

10a. Linear
b. \( f(0) = -5 \)
\( f(x) = f(x - 1) + 6 \)

11a. Quadratic
b. \( f(0) = -2 \)
\( f(x) = f(x - 1) + 2x \)

12a. Linear
b. \( f(0) = 0 \)
\( f(x) = f(x - 1) + 5 \)

13a. Linear
b. \( f(0) = 18 \)
\( f(x) = f(x - 1) - 2 \)

14a. Quadratic
b. \( f(0) = 0 \)
\( f(x) = f(x - 1) + 10x - 6 \)

15a. Linear
b. \( f(0) = 1 \)
\( f(x) = f(x - 1) + 2x + 1 \)

16a.

Quadratic Functions 1.4

Ready
1. -5 (Steepest)
2. \( -\frac{37}{4} \)
3. 2
4. \( -\frac{1}{2} \)

Set
5a. 2 units, 6 units, 20 ft, 60 ft, 160 ft, 1200 ft^2
b. 3 units, 5 units, 30 ft, 50 ft, 160 ft, 1500 ft^2
c. 4 units, 4 units, 40 ft, 40 ft, 160 ft, 1600 ft^2
d. 5 units, 3 units, 50 ft, 30 ft, 160 ft, 1500 ft^2
e. 6 units, 2 units, 60 ft, 20 ft, 160 ft, 1200 ft^2
f. 7 units, 1 units, 70 ft, 10 ft, 160 ft, 700 ft^2

6. Adam's fence should be made into a square to optimize the amount of area that the enclosure will provide.

7. 8. Parabola
9. This graph is curved like a quadratic function. Also, the changes of the changes is constant (each change is 200 less than the change before it.)
Module 1: Quadratic Functions

Go

10. \( f(x) \)
11. \( d(x) \)
12. \( m(x) \)
13. \( r(x) \)
14. \( f(x) \)
15. \( p(x) \)
16a. \( s(x) \)
b. \( r(x) \)

Quadratic Functions 1.5

Ready

1. \( f(-2) = -\frac{3}{2} \)
   \( f(-1) = \frac{2}{3} \)
   \( f(0) = 1 \)
   \( f(1) = 3 \)
   \( f(2) = 9 \)
   \( f(3) = 27 \)

2. \( f(-2) = -\frac{1}{15} \)
   \( f(-1) = -\frac{1}{10} \)
   \( f(0) = 1 \)
   \( f(1) = 5 \)
   \( f(2) = 25 \)
   \( f(3) = 125 \)

3. \( f(-2) = \frac{1}{100} \)
   \( f(-1) = \frac{1}{10} \)
   \( f(0) = 1 \)
   \( f(1) = 10 \)
   \( f(2) = 100 \)
   \( f(3) = 1,000 \)

4. \( f(-2) = 4 \)
   \( f(-1) = 2 \)
   \( f(0) = 1 \)
   \( f(1) = \frac{3}{4} \)
   \( f(2) = \frac{1}{4} \)
   \( f(3) = \frac{1}{16} \)

5. \( f(-2) = 9 \)
   \( f(-1) = 3 \)
   \( f(0) = 1 \)
   \( f(1) = \frac{3}{4} \)
   \( f(2) = \frac{1}{2} \)
   \( f(3) = \frac{1}{27} \)

Go

13a. \([-1, 1]\)
b. \([-1, 3]\)
14a. \((\infty, \infty)\)
b. \([-1, \infty)\)
15a. \((\infty, 2]\)
b. \((\infty, \infty)\)
16a. \([-4, 2]\)
b. \([-2, 2]\)
17a. \([-6, \infty)\)
b. \([-2]\)
18a. \([2]\)
b. \([\frac{1}{2}, 6]\)
19a. \((\infty, \infty)\)
b. \((\infty, \infty)\)

The graph for #20 is discrete set builder notation will work 20a. \( \{x | x \in \mathbb{Z}, -1 \leq x \leq 3 \} \) or \( \{ -1, 0, 1, 2, 3 \} \)
b. \( \{y | y \in \mathbb{Z}, -5 \leq y \leq 7 \} \) or \( \{ -5, -2, 1, 4, 7 \} \)

21. No. The domain of #19 is all of the real numbers. The domain of #20 is integers

Quadratic Functions 1.6

Ready

1. Yes
2. Yes
3. Yes
4. Yes
5. No
6. Yes

Set

7. Car A
8. Car B, because its speed is changing and you can see that in its increasing slope.
9. About \([1, 7]\)
10. About \([7, \infty)\)
11. The slope of the line
12. Car C because it is the highest point of the three cars at \( f(x) = 12 \).

6a. 1,714 ft
   b. 1,666 ft
c. 1,586 ft
d. 1,474 ft
e. 1,330 ft
f. 1,154 ft
g. 946 ft
h. 706 ft
i. 434 ft
j. 130 ft

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