

Unit 3: Modeling and Analyzing Quadratic Functions

3.1 Interpret the Structure of Expressions

1. Which expression is equivalent to $121x^2 - 64y^2$?
 - A. $(11x - 16y)(11x + 16y)$
 - B. $(11x - 16y)(11x - 16y)$
 - C. $(11x + 8y)(11x + 8y)$
 - D. $(11x + 8y)(11x - 8y)$
2. Which expression is a factor of $24x^2 + 16x + 144$?
 - A. 16
 - B. $8x$
 - C. $3x^2 + 2x + 18$
 - D. $8(x - 2)(3x^2 + 9)$
3. Which of these shows the complete factorization of $6x^2y^2 - 9xy - 42$?
 - A. $3(2xy^2 - 7)(xy^2 + 2)$
 - B. $(3xy + 6)(2xy - 7)$
 - C. $3(2xy - 7)(xy + 2)$
 - D. $(3xy^2 + 6)(2xy^2 - 7)$

Answers to Unit 3.1 Sample Items

1. D 2. C 3. C

3.2 Write Expressions in Equivalent Forms to Solve Problems

1. What are the zeros of the function represented by the quadratic expression $2x^2 + x - 3$?
 - A. $x = -\frac{3}{2}$ and $x = 1$
 - B. $x = -\frac{2}{3}$ and $x = 1$
 - C. $x = -1$ and $x = \frac{2}{3}$
 - D. $x = -1$ and $x = -\frac{3}{2}$
2. What is the vertex of the graph of $f(x) = x^2 + 10x - 9$?
 - A. (5, 66)
 - B. (5, -9)
 - C. (-5, -9)
 - D. (-5, -34)

3. Which of these is the result of completing the square for the expression $x^2 + 8x - 30$?
- A. $(x + 4)^2 - 30$
 - B. $(x + 4)^2 - 46$
 - C. $(x + 8)^2 - 30$
 - D. $(x + 8)^2 - 94$
4. The expression $-x^2 + 70x - 600$ represents a company's profit for selling x items. For which number(s) of items sold is the company's profit equal to \$0?
- A. 0 items
 - B. 35 items
 - C. 10 items and 60 items
 - D. 20 items and 30 items

Answers to Unit 3.2 Sample Items

1. A 2. D 3. B 4. C

3.3 Create Equations That Describe Numbers or Relationships

1. The formula for the area of a circle is $A = \pi r^2$. Which equation shows the formula in terms of r ?
- A. $r = \frac{2A}{\pi}$
 - B. $r = \frac{\sqrt{A}}{\pi}$
 - C. $r = \sqrt{\frac{A}{\pi}}$
 - D. $r = \frac{A}{2\pi}$

Answer to Unit 3.3 Sample Item

1. C

3.4 Solve Equations and Inequalities in One Variable

1. What are the solutions to the equation $2x^2 - 2x - 12 = 0$?
- A. $x = -4, x = 3$
 - B. $x = -3, x = 4$
 - C. $x = -2, x = 3$
 - D. $x = -6, x = 2$

2. What are the solutions to the equation $6x^2 - x - 40 = 0$?

A. $x = -\frac{8}{3}, x = -\frac{5}{2}$

B. $x = -\frac{8}{3}, x = \frac{5}{2}$

C. $x = \frac{5}{2}, x = \frac{8}{3}$

D. $x = -\frac{5}{2}, x = \frac{8}{3}$

3. What are the solutions to the equation $x^2 - 5x = 14$?

A. $x = -7, x = -2$

B. $x = -14, x = -1$

C. $x = -2, x = 7$

D. $x = -1, x = 14$

4. An object is thrown into the air with an initial velocity of 5 m/s from a height of 9 m. The equation $h(t) = -4.9t^2 + 5t + 9$ models the height of the object in meters after t seconds.

About how many seconds does it take for the object to hit the ground? Round your answer to the nearest tenth of a second.

A. 0.9

B. 1.5

C. 2.0

D. 9.0

Answers to Unit 3.4 Sample Items

1. C 2. D 3. C 4. C

3.5 Build a Function That Models a Relationship between Two Quantities

1. What explicit expression can be used to find the next term in this sequence?

2, 8, 18, 32, 50, . . .

A. $2n$

B. $2n + 6$

C. $2n^2$

D. $2n^2 + 1$

2. The function $s(t) = vt + h - 0.5at^2$ represents the height of an object, s , in feet, above the ground in relation to the time, t , in seconds, since the object was thrown into the air with an initial velocity of v feet per second at an initial height of h feet and where a is the acceleration due to gravity (32 feet per second squared).

A baseball player hits a baseball 4 feet above the ground with an initial velocity of 80 feet per second. About how long will it take the baseball to hit the ground?

- A. 2 seconds
B. 3 seconds
C. 4 seconds
D. 5 seconds
3. A café's annual income depends on x , the number of customers. The function $I(x) = 4x^2 - 20x$ describes the café's total annual income. The function $C(x) = 2x^2 + 5$ describes the total amount the café spends in a year. The café's annual profit, $P(x)$, is the difference between the annual income and the amount spent in a year.

Which function describes $P(x)$?

- A. $P(x) = 2x^2 - 20x - 5$
B. $P(x) = 4x^3 - 20x^2$
C. $P(x) = 6x^2 - 20x + 5$
D. $P(x) = 8x^4 - 40x^3 - 20x^2 - 100x$

Answers to Unit 3.5 Sample Items

1. C 2. D 3. A

3.6 Build New Functions from Existing Functions

1. Which statement BEST describes the graph of $f(x + 6)$?

- A. The graph of $f(x)$ is shifted up 6 units.
B. The graph of $f(x)$ is shifted left 6 units.
C. The graph of $f(x)$ is shifted right 6 units.
D. The graph of $f(x)$ is shifted down 6 units.

2. Which of these is an even function?

- A. $f(x) = 5x^2 - x$
B. $f(x) = 3x^3 + x$
C. $f(x) = 6x^2 - 8$
D. $f(x) = 4x^3 + 2x^2$

3. Which statement BEST describes how the graph of $g(x) = -3x^2$ compares to the graph of $f(x) = x^2$?
- A. The graph of $g(x)$ is a vertical stretch of $f(x)$ by a factor of 3.
 - B. The graph of $g(x)$ is a reflection of $f(x)$ across the x -axis.
 - C. The graph of $g(x)$ is a vertical shrink of $f(x)$ by a factor of $\frac{1}{3}$ and a reflection across the x -axis.
 - D. The graph of $g(x)$ is a vertical stretch of $f(x)$ by a factor of 3 and a reflection across the x -axis.

Answers to Unit 3.6 Sample Items

1. B 2. C 3. D

3.7 Interpret Functions That Arise in Applications in Terms of the Context

1. A flying disk is thrown into the air from a height of 25 feet at time $t = 0$. The function that models this situation is $h(t) = -16t^2 + 75t + 25$, where t is measured in seconds and h is the height in feet. What values of t best describe the time when the disk is flying in the air?
- A. $0 < t < 5$
 - B. $0 < t < 25$
 - C. all real numbers
 - D. all positive integers

2. Use this table to answer the question.

x	$f(x)$
-2	15
-1	9
0	5
1	3
2	3

What is the average rate of change of x over the interval $-2 \leq x \leq 0$?

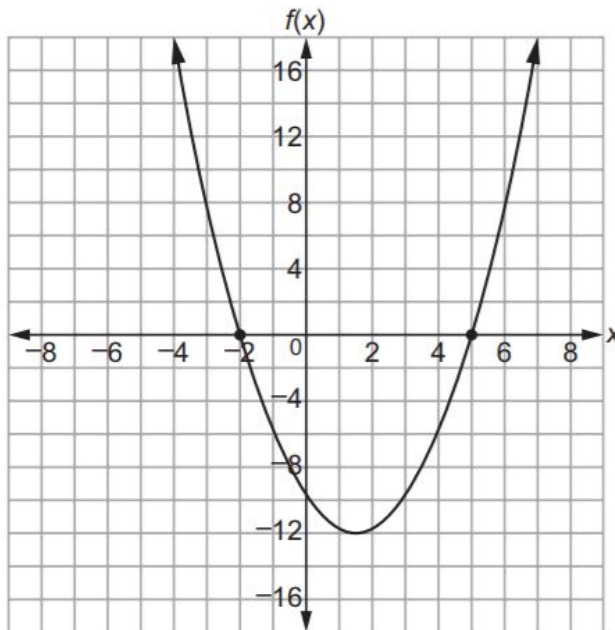
- A. -10
 - B. -5
 - C. 5
 - D. 10
3. What is the end behavior of the graph of $f(x) = -0.25x^2 - 2x + 1$?
- A. As x increases, $f(x)$ increases. As x decreases, $f(x)$ decreases.
 - B. As x increases, $f(x)$ decreases. As x decreases, $f(x)$ decreases.
 - C. As x increases, $f(x)$ increases. As x decreases, $f(x)$ increases.
 - D. As x increases, $f(x)$ decreases. As x decreases, $f(x)$ increases.

Answers to Unit 3.7 Sample Items

1. A 2. B 3. B

3.8 Analyze Functions Using Different Representations

1. Use this graph to answer the question.



Which function is shown in the graph?

- A. $f(x) = x^2 - 3x - 10$
- B. $f(x) = x^2 + 3x - 10$
- C. $f(x) = x^2 + x - 12$
- D. $f(x) = x^2 - 5x - 8$

2. The function $f(t) = -16t^2 + 64t + 5$ models the height of a ball that was hit into the air, where t is measured in seconds and h is the height in feet.

This table represents the height, $g(t)$, of a second ball that was thrown into the air.

Time, t (seconds)	Height, $g(t)$ (feet)
0	4
1	36
2	36
3	4

Which statement **BEST** compares the length of time each ball is in the air?

- A. The ball represented by $f(t)$ is in the air for about 5 seconds, and the ball represented by $g(t)$ is in the air for about 3 seconds.
- B. The ball represented by $f(t)$ is in the air for about 3 seconds, and the ball represented by $g(t)$ is in the air for about 5 seconds.
- C. The ball represented by $f(t)$ is in the air for about 3 seconds, and the ball represented by $g(t)$ is in the air for about 4 seconds.
- D. The ball represented by $f(t)$ is in the air for about 4 seconds, and the ball represented by $g(t)$ is in the air for about 3 seconds.

Answers to Unit 3.8 Sample Items

1. A 2. D