Worksheet: Transformations of Quadratic Functions
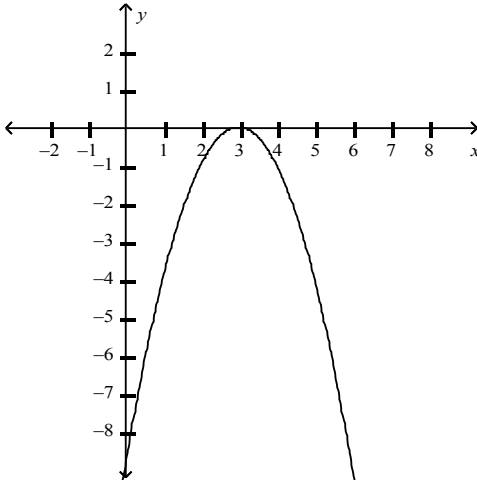
Multiple Choice
Identify the choice that best completes the statement or answers the question.

_____ 1. Which correctly identifies the values of the parameters a, h, and k for the function $f(x) = -2(x+3)^2 + 1$

     a. $a = -2, h = 3, k = 1$ c. $a = -2, h = -3, k = 1$

     b. $a = 2, h = -3, k = -1$ d. $a = -2, h = -3, k = -1$

_____ 2. What is the equation of this graph?

     a. $y = -x^2 + 3$ c. $y = -(x+3)^2$

     b. $y = -3x^2$ d. $y = -(x-3)^2$

_____ 3. Which function includes a translation of 3 units to the left?

     a. $f(x) = (x+3)^2 + 1$ c. $f(x) = (x-3)^2 + 1$

     b. $f(x) = 3x^2 + 1$ d. $f(x) = (x+1)^2 - 3$

_____ 4. Which equation shows a translation of 3 left and vertical compression by a factor of 2 to the graph of $y = x^2$?

     a. $y = 2(x-3)^2$ c. $y = \frac{1}{2}(x-3)^2$

     b. $y = 2(x+3)^2$ d. $y = \frac{1}{2}(x+3)^2$

_____ 5. Joanne hit a ball straight up into the air. The height of the ball in metres, is given by the function $h(t) = -5(t-3)^2 + 45$ t seconds after the ball is hit. In how many seconds will the ball hit the ground?

     a. 3   c. 9

     b. 6   d. 45

_____ 6. Kevin threw a ball straight up with an initial speed of 20 metres per second. The function $y = -5(x-2)^2 + 20$ describes the ball's height, in metres, t seconds after Kevin threw it. What are the coordinates of the vertex?

     a. $(-5, 2)$ c. $(20, 2)$

     b. $(2, 20)$ d. $(-5, 20)$

_____ 7. Which equation describes a parabola that opens downward, is congruent to $y = x^2$, and has its vertex at (0, 3)?

a. $y = (x+3)^2 - 1$ c. $y = -(x-3)^2$

b. $y = -x^2 + 3$ d. $y = x^2 + 3$

_____ 8. List the sequence of steps required to graph the function $f(x) = -(x+4)^2 - 6$
- a. horizontal translation 4 units to the right, vertical compression by a factor of 1, vertical translation 6 units down
- b. horizontal translation 4 units to the right, reflection in x-axis, vertical translation 6 units down
- c. horizontal translation 4 units to the left, vertical translation 6 units up, reflection in x-axis
- d. horizontal translation 4 units to the left, reflection in x-axis, vertical translation 6 units down

_____ 9. Which function matches the graph?
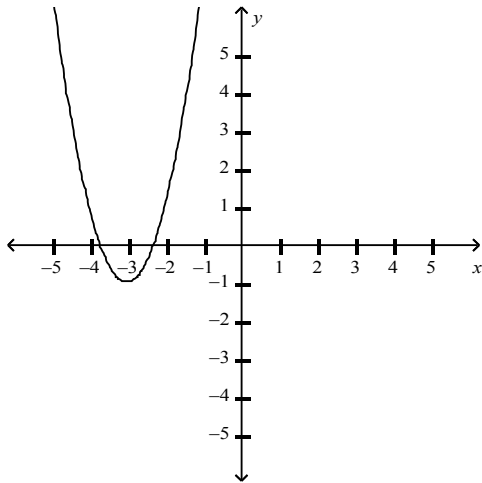
a. $f(x) = -2(x-3)^2 + 1$ c. $f(x) = (x+3)^2 + 2$

b. $f(x) = 2(x+3)^2 - 1$ d. $f(x) = \frac{1}{2}(x-3)^2 - 1$

_____ 10. Consider a parabola P that is congruent to $y = x^2$, opens upward, and has vertex $(-1, 3)$. Now find the equation of a new parabola that results if P is reflected in the x-axis and translated 3 units down.

a. $y = -(x+4)^2 + 3$ c. $-(x+1)^2$

b. $y = (x-1)^2 + 6$ d. $-(x-2)^2 + 3$

_____ 11. The graphs of $y = x^2$ and another parabola are shown below. What is a possible equation for the second parabola?
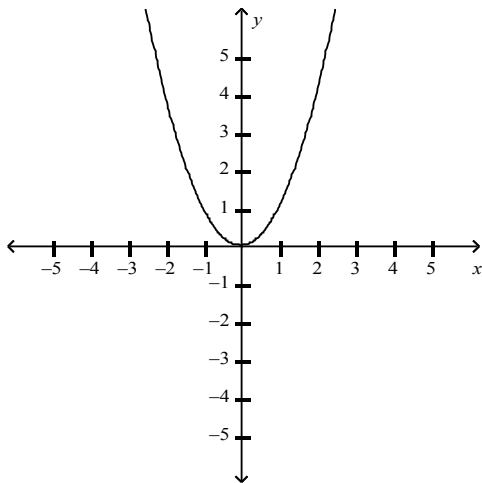
$y=?$

$y=x^2$
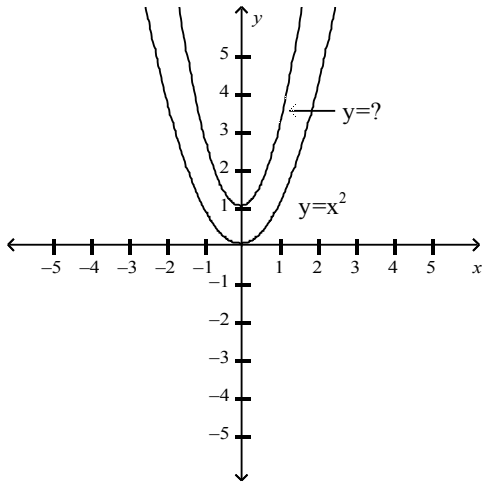
a. $y = 2x^2 + 1$

b. $y = \dfrac{1}{2}x^2 + 1$

c. $y = 2(x + 1)^2$
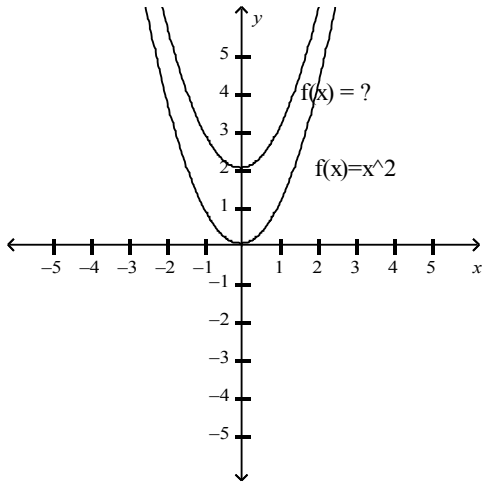
d. $y = -2x^2 - 1$

Short Answer

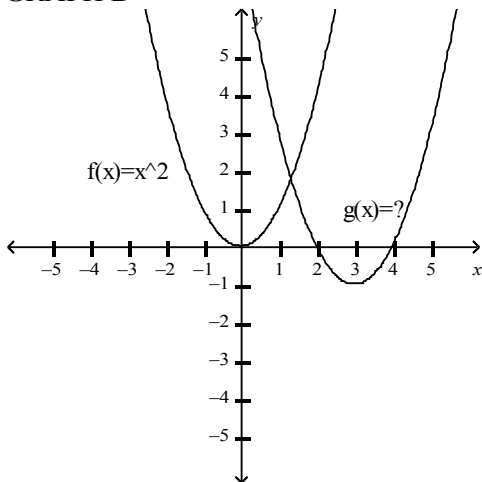12. The graph of $f(x)$ is shown below. Graph the transformed functions in the same set of axes.

13. Name a function to describe each graph.

GRAPH A

GRAPH B

14. How does the shape of the graph of $f(x) = -\frac{1}{3}x^2$ compare with the graph of $g(x) = x^2$? Explain.

15. The net annual income of an engineer in Barry's company can be modelled by $I(x) = -290(x-48)^2 + 148\,000$, where x is the age of the engineer and $27 \le x \le 70$. What is the axis of symmetry?

16. Sketch the final graph of the function $g(x) = -3(x+2) - 3$.

Problem

17. A parabola that opens downward has its vertex at (3, 0) and a y-intercept at (0, −9) The parabola is congruent to the parabola described by the function $f(x) = x^2$
a) What is the equation of the function?
b) Draw a graph of the function using key points.
c) What is the axis of symmetry?

d) What are the values of the parameters a, h, and k?

Worksheet: Transformations of Quadratic Functions
Answer Section

MULTIPLE CHOICE

1. ANS: C   PTS: 1   REF: Knowledge and Understanding
    OBJ: 1.5 - Graphing Quadratic Functions by Using Transformations
2. ANS: D   PTS: 1   REF: Knowledge and Understanding
    OBJ: 1.5 - Graphing Quadratic Functions by Using Transformations
3. ANS: A   PTS: 1   REF: Knowledge and Understanding
    OBJ: 1.5 - Graphing Quadratic Functions by Using Transformations
4. ANS: D   PTS: 1   REF: Knowledge and Understanding
    OBJ: 1.5 - Graphing Quadratic Functions by Using Transformations
5. ANS: B   PTS: 1   REF: Application
    OBJ: 1.5 - Graphing Quadratic Functions by Using Transformations
6. ANS: B   PTS: 1   REF: Application
    OBJ: 1.5 - Graphing Quadratic Functions by Using Transformations
7. ANS: B   PTS: 1   REF: Knowledge and Understanding
    OBJ: 1.5 - Graphing Quadratic Functions by Using Transformations
8. ANS: D   PTS: 1   REF: Communication
    OBJ: 1.6 - Using Multiple Transformations to Graph Quadratic Functions
9. ANS: B   PTS: 1   REF: Knowledge and Understanding
    OBJ: 1.6 - Using Multiple Transformations to Graph Quadratic Functions
10. ANS: C   PTS: 1   REF: Knowledge and Understanding
    OBJ: 1.6 - Using Multiple Transformations to Graph Quadratic Functions
11. ANS: A   PTS: 1   REF: Application
    OBJ: 1.6 - Using Multiple Transformations to Graph Quadratic Functions

SHORT ANSWER

12. ANS:
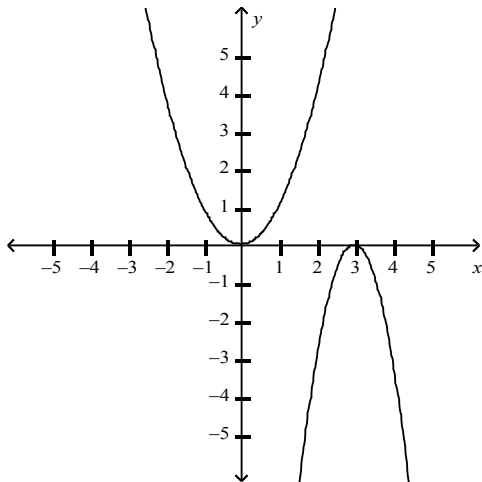
PTS: 1   REF: Knowledge and Understanding

OBJ: 1.5 - Graphing Quadratic Functions by Using Transformations

13. ANS:

Answers may vary. For example:

Graph A: $f(x) = -x^2 + 2$

Graph B: $g(x) = (x-3)^2 - 1$

PTS: 1   REF: Thinking
OBJ: 1.5 - Graphing Quadratic Functions by Using Transformations

14. ANS:

The shape of the graph is the same as the graph of $f(x) = x^2$ compressed vertically by a factor of 3 and reflected vertically.

PTS: 1   REF: Communication
OBJ: 1.5 - Graphing Quadratic Functions by Using Transformations
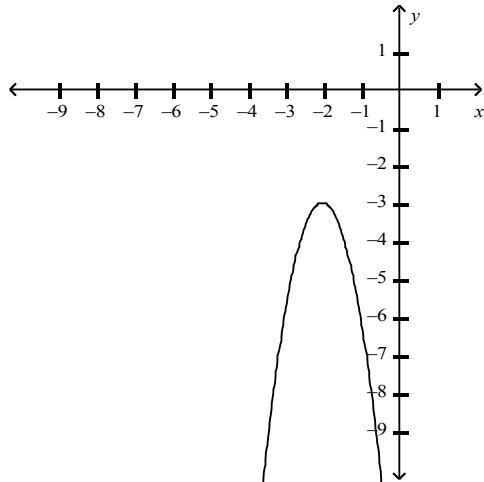
15. ANS:
$x = 48$

PTS: 1   REF: Application
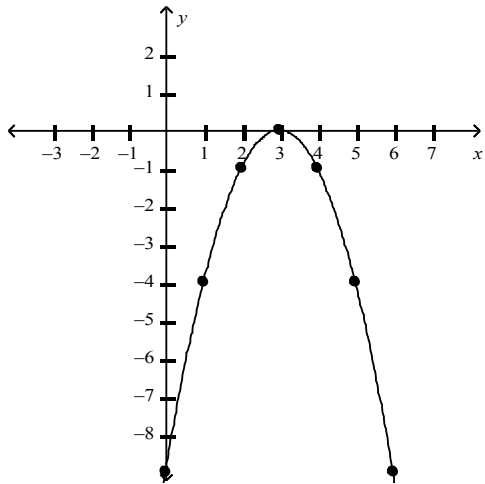OBJ: 1.5 - Graphing Quadratic Functions by Using Transformations

16. ANS:

PTS: 1   REF: Knowledge and Understanding
OBJ: 1.6 - Using Multiple Transformations to Graph Quadratic Functions

PROBLEM

17. ANS:
a) $-(x-3)^2$

b)

c) $x = 3$

d) $a = -1$, $h = 3$, $k = 0$

PTS: 1   REF: Communication

OBJ: 1.5 - Graphing Quadratic Functions by Using Transformations