

## Chapter 2: Quadratic Functions

### Lesson 1: Graphing Quadratics Introduction

#### Question #1

Reference Q.45515

Graph  $y = x^2$  and state the key features.

#### Question #2: Question 11012

Reference Q.11012

Graph the following quadratic function and state the key features:

$$y = -12x^2$$

#### Question #3: Question 11013

Reference Q.11013

Graph the following quadratic function and state the key features:

$$y = x^2 - 3.$$

#### Question #4: Question 11014

Reference Q.11014

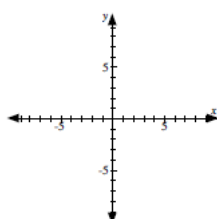
Graph the following quadratic function and state the key features:

$$y = -2x^2 + 6.$$

#### Question #5: Graphing

Reference Q.13704

Consider the graph of the function  $f(x) = (x - 2)^2 + 3$



- Sketch the graph on the grid.
- State the coordinate of the vertex.
- State the maximum or minimum value of the function.
- State the domain and range of the function.

#### Question #6: Question 11015

Reference Q.11015

Graph the following quadratic function and state the key features:

$$y = (x - 2)^2 + 2.$$

#### Question #7: Describe the graphs.

Reference Q.13703

Describe how the graphs of the following functions relate to the graph of  $y = x^2$ .

- $y = (x + 5)^2$
- $y = x^2 - 7$
- $y - 8 = x^2$
- $y = 5 + (x - 2)^2$
- $y + 7 = (x + 1)^2 - 10$
- $y = (x - a)^2 - b$

#### Question #8: Transformations

Reference Q.13705

The following transformations are applied to the graph of  $y = x^2$ . Write the equations of the image function for each.

- a horizontal translation of 7 units right
- a vertical translation of 2 units down
- a translation 3 units left and 8 units up
- a translation **c** units down and **d** units right

#### Question #9: Quadratic Functions

Reference Q.13733

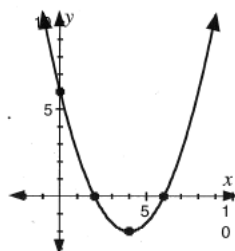
Which of the following transformations shifts the graph of  $y = x^2$  to the graph of  $y + a = (x - b)^2$ ?

- a** units right and **b** units down
- b** units right and **a** units down
- b** units up and **a** units right
- a** units down and **b** units left

#### Question #10: Quadratic Functions

Reference Q.13731

The domain and range, respectively, of the function are



- $x \in \mathbb{R}$  and  $y \in \mathbb{R}$
- $x \geq -2$  and  $y \in \mathbb{R}$
- $x \in \mathbb{R}$  and  $y \geq -2$
- $2 \leq x \leq 6$  and  $y \geq -2$

Reminder:  $x \in \mathbb{R}$  means: "x is in the set of all real numbers".

#### Question #11: Quadratic Functions

Reference Q.13729

Write the **i**) coordinates of vertex, **ii**) max/min value, **iii**) equation of axis of symmetry, **iv**) the domain and **v**) the range for each quadratic function below.

- $y = x^2 + 5$
- $y = (x + 3)^2 - 4$
- $y + 9 = (x - 6)^2 + 1$
- $y - w = (x + r)^2$

#### Question #12: Quadratic functions

Reference Q.13730

After a combination of a horizontal and a vertical translation, the graph of  $y = x^2$  has an image graph with a vertex at **(2, -6)**. Describe the translations

⑨ **Question #13: Transformations**

Reference Q.13706

Write the coordinates of the image of the point  $(-2, 4)$  on the graph  $y = x^2$  when each of the following transformations is applied:

- a horizontal translation of 2 units to the left
- a translation of 3 units up and 11 units right

⑨ **Question #14: Quadratic Functions**

Reference Q.13734

The function defined by the equation  $y = x^2$  is transformed to  $y = (x + 2)^2 + 4$ . If the point  $(2, 4)$  lies on the graph of  $y = x^2$ , which of the following points must lie on the graph of  $y = (x + 2)^2 + 4$ ?

- $(0, 0)$
- $(4, 0)$
- $(4, 8)$
- $(0, 8)$

⑨ **Question #15: Fill in the table**

Reference Q.13709

Complete the following table.

| Function                  | Vertex | Max/Min Value | Equation of Axis of Symmetry | Domain | Range |
|---------------------------|--------|---------------|------------------------------|--------|-------|
| $y = 3x^2$                |        |               |                              |        |       |
| $y = 2x^2 + 1$            |        |               |                              |        |       |
| $y = -(x + 7)^2$          |        |               |                              |        |       |
| $y - 10 = (x + 5)^2$      |        |               |                              |        |       |
| $y + 3 = -3(x - 1)^2 + 2$ |        |               |                              |        |       |

Reminder:  $x \in \mathbb{R}$  means: "x is in the set of all real numbers".

⑨ **Question #16: Question 11016**

Reference Q.11016

Graph the following quadratic function and state the key features:

$$y = 3(x - 2)^2 - 5.$$

⑨ **Question #17: Multi-Parts Transformation Problem**

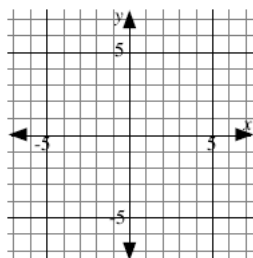
Reference Q.13711

The graph of  $f(x) = x^2$  undergoes a series of transformations.

- State the transformations applied to the graph of  $f(x) = x^2$  which would result in the graph of  $f(x) = -\frac{1}{2}(x - 2)^2 + 1$ .

- Without using a graphing calculator, sketch the graph of

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



- Verify using a graphing calculator.

⑨ **Question #18: Equation of a quadratic function**

Reference Q.13713

Write the equation of a quadratic function which is the image of  $y = x^2$  after a vertical stretch about the  $x$ -axis by the given factor of  $a$ , and after a translation which results in the given vertex.

- $a = 3$ , vertex  $(4, -1)$
- $a = \frac{1}{2}$ , vertex  $(-3, 2)$
- $a = -4$ , vertex  $(0, 5)$
- $a = -\frac{1}{3}$ , vertex  $(-6, -3)$

⑨ **Question #19: Multi-step Transformation Problems**

Reference Q.13710

The following transformation are applied, **in order**, to the graph of  $y = x^2$ .

- a reflection in the  $x$ -axis
- a vertical stretch of factor 3 about the  $x$ -axis
- a translation of 5 units right and 2 units down

- Find the equation of the image function after each transformation.

- At the end of all transformations, the point  $(4, y)$  is on the final graph of the parabola. Find the  $y$ -coordinate for the final graph when  $x = 4$ .

⑨ **Question #20: Transformations in specific order**

Reference Q.13716

The following transformations are applied, in order, to the graph of  $y = x^2$ .

- a vertical stretch of factor 2 about the  $x$ -axis
- a reflection in the  $x$ -axis
- a vertical translation of 12 units up

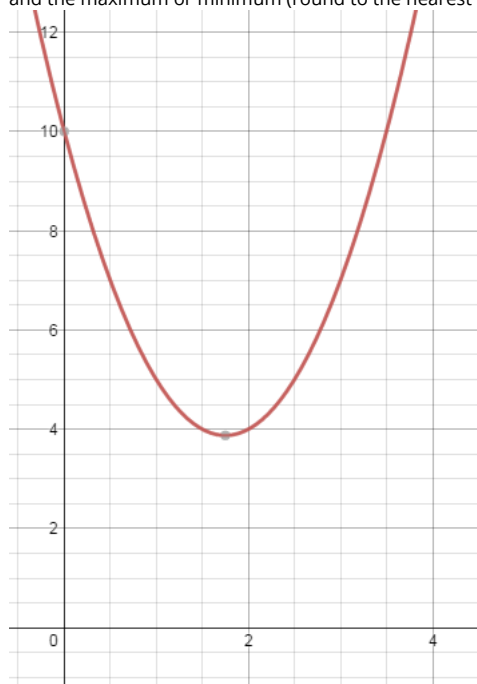
At the end of all the transformations, the point  $(2, y)$  is on the final graph of the parabola.

The value of  $y$ , to the nearest tenth, is \_\_\_\_.

Ⓢ **Question #21: Question 11023**

Reference Q.11023

Below is the graph of  $2x^2 - 7x + 10$ . Find the x-intercept(s), the y-intercept, and the maximum or minimum (round to the nearest tenth).



- a. x-intercept(s)
- b. y-intercept
- c. minimum

Ⓢ **Question #22: Describe the graphs**

Reference Q.13707

Describe how the graphs of the following functions relate to the graph of  $y = x^2$ .

- a.  $y = -3x^2$
- b.  $y = x^2 - 15$
- c.  $y = -\frac{2}{3}(x + 4)^2 - 1$
- d.  $2y = (x - 8)^2 + 12$

Ⓢ **Question #23: Applying a Transformation to a Function**

Reference Q.13708

The following transformations are applied to the graph of  $y = x^2$  in the order given.

Write the equation of the image function for each.

- a. A reflection in the  $x$ -axis and a vertical stretch by a factor of 4 about the  $x$ -axis.
- b. A vertical stretch by a factor of  $\frac{3}{5}$  about the  $x$ -axis, and a translation of 5 units down.
- c. A vertical stretch by a factor of 8 about the  $x$ -axis, a reflection in the  $x$ -axis, a vertical translation of 3 units up, and a horizontal translation 9 units left.
- d. A vertical stretch by a factor of  $c$  about the  $x$ -axis, a reflection in the  $x$ -axis, and a translation of  $e$  units right and  $f$  units down.

Ⓢ **Question #24: Transforming a point from a parabola**

Reference Q.13712

Write the coordinates of the image of the point  $(-3, 9)$  on the graph  $y = x^2$  when each of the following transformations are applied:

- a. a reflection in the  $x$ -axis, followed by a vertical translation of 4 units up
- b. a vertical stretch by a factor of  $\frac{1}{3}$  about the  $x$ -axis

Ⓢ **Question #25: Transforming a point from a graph**

Reference Q.13714

The quadratic function  $f(x) = x^2$  is transformed to

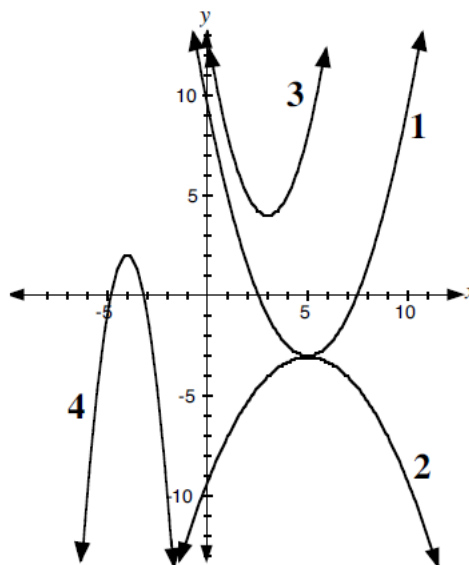
$$f(x) = -\frac{1}{2}(x + 3)^2 + 1.$$

The point  $(1, 1)$  on the graph of  $y = x^2$  is transformed to which point on the graph of  $y = -\frac{1}{2}(x + 3)^2 + 1$ ?

- A.  $(-2, \frac{1}{2})$
- B.  $(-2, \frac{3}{2})$
- C.  $(-2, -1)$
- D.  $(\frac{5}{2}, 2)$

Ⓢ **Question #26: Matching quadratic functions to parabolas on the graph**

Reference Q.13715



The diagram shows the graphs four quadratic functions.

In the first box, write the number corresponding to the graph of

$$y = \frac{1}{2}(x - 5)^2 - 3.$$

In the second box, write the number corresponding to the graph of

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

In the third box, write the number corresponding to the graph of

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

In the last box, write the number corresponding to the graph of

$$y + 3 = -\frac{1}{4}(x - 5)^2.$$