5 Mid-Chapter Review

FREQUENTLY ASKED Questions

Q: How do you know whether the graph of $y = ax^2$ will have a wider or narrower shape near its vertex, compared with the graph of $y = x^2$?

A: The shape depends on the value of a in the equation. Each y-value is multiplied by a factor of a. When $a > 1$, the y-values increase. The parabola appears to be vertically stretched and becomes narrower near its vertex. When $0 < a < 1$, the y-values decrease. The parabola appears to be vertically compressed and becomes wider near its vertex.

Study Aid

- See Lesson 5.1, Examples 1 and 2.
- Try Mid-Chapter Review Questions 1 and 2.

Q: Why is the vertex form, $y = a(x - h)^2 + k$, useful for graphing quadratic relations?

A1: You can use the constants a, h, and k to determine how the graph of $y = x^2$ has been transformed.

- When $a > 1$, the parabola is vertically stretched and when $0 < a < 1$, the parabola is vertically compressed.
- When $a < 0$, the parabola is reflected in the x-axis.
- The parabola is translated to the right when $h > 0$ and to the left when $h < 0$. The parabola is translated up when $k > 0$ and down when $k < 0$.
- The coordinates of the vertex are (h, k).

A2: You can use the constants a, h, and k to determine key features of the parabola.

- When $a > 0$, the parabola opens upward. When $a < 0$, the parabola opens downward.
- The coordinates of the vertex are (h, k).
- The equation of the axis of symmetry is $x = h$.

You can use these properties, as well as the coordinates of a few other points, to draw an accurate sketch of any parabola.

Study Aid

- See Lesson 5.3, Examples 1 to 3.
- Try Mid-Chapter Review Questions 3, 4, and 6 to 8.

Q: When you use transformations to sketch a graph, why is the order in which you apply the transformations important?

A: When a graph is transformed, operations are performed on the coordinates of each point. Apply transformations in the same order you would apply calculations. Apply vertical stretches/compressions and reflections (multiplication) before translations (addition or subtraction).

Stretch → **Reflect** → **Translate**

Study Aid

- See Lesson 5.3, Examples 1 to 3.
- Try Mid-Chapter Review Question 5.

PRACTICE Questions

Lesson 5.1

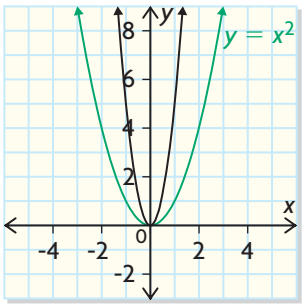
1. Sketch the graph of each equation by correctly applying the required transformation(s) to points on the graph of $y = x^2$. Use a separate grid for each graph.

a) $y = 2x^2$ **c)** $y = -3x^2$

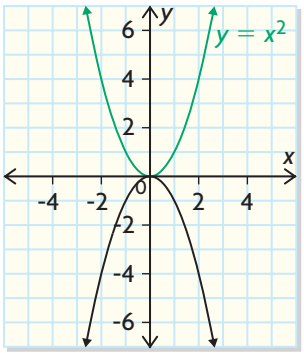
b) $y = -0.25x^2$ **d)** $y = \frac{2}{3}x^2$

2. Describe the transformation(s) that were applied to the graph of $y = x^2$ to obtain each **black** graph. Write the equation of the **black** graph.

a)



b)



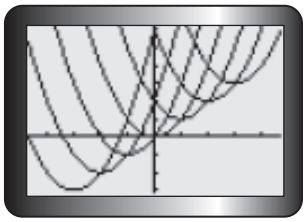
Lesson 5.2

3. Determine the values of h and k for each of the following transformations. Write the equation in the form $y = (x - h)^2 + k$. Sketch the graph.

a) The parabola moves 3 units down and 2 units right.

b) The parabola moves 4 units left and 6 units up.

4. These parabolas were entered as equations of the form $y = (x - h)^2 + k$. For each tick mark, the scale on both axes is 1. Determine as many of the equations as you can.



Lesson 5.3

5. Describe the sequence of transformations that you would apply to the graph of $y = x^2$ to sketch each quadratic relation.

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

b) $y = \frac{1}{2}(x + 3)^2 - 8$

c) $y = 4(x - 2)^2 - 5$

d) $y = \frac{2}{3}x^2 - 1$

6. Sketch a graph of each quadratic relation in question 5 on a separate grid. Use the properties of the parabola and some additional points.

7. For each quadratic relation,

i) state the stretch/compression factor and the horizontal/vertical translations

ii) determine whether the graph is reflected in the x-axis

iii) state the vertex and the equation of the axis of symmetry

iv) sketch the graph by applying transformations to the graph of $y = x^2$

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

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

c) $y = 2(x + 1)^2 - 8$

d) $y = -0.25x^2 + 5$

8. A parabola lies in only two quadrants. What does this tell you about the values of a, h, and k? Explain your thinking, and provide the equation of a parabola as an example.