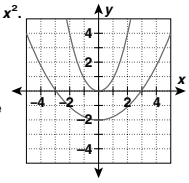
SECTION 9A

Ready To Go On? Skills Intervention

9-4 Transforming Quadratic Functions

Compare Graphs of Quadratic Functions

Compare the graphs of each function with the graph of $f(x) = x^2$.



A. $g(x) = \frac{1}{4}x^2 - 2$

Method 1: Compare the graphs.
Graph both functions on the same graph.

Width: The graph of $g(x) = \frac{1}{4}x^2 - 2$ is wider than the graph of $f(x)$.

Axis of symmetry: The axis of symmetry is the same.

The vertex of $f(x)$ is (0, 0).

The vertex of $g(x) = \frac{1}{4}x^2 - 2$ is translated 2 units down to $(0, -2)$.

B. $g(x) = -3x^2 + 2$

Method 2: Use the functions.
Width: Find $|a|$ for each function.

$g(x) = |-3| =$ 3 $\quad f(x) = |1| =$ 1

The function with the narrowest graph has the greatest absolute value.

The graph of $g(x) = -3x^2 + 2$ is narrower than the graph of $f(x)$.
Determine the axis of symmetry for both graphs:

$g(x) = -\frac{b}{2a} = -\frac{0}{2(-3)} =$ 0 $\quad f(x) = -\frac{b}{2a} = -\frac{0}{2(1)} =$ 0

The axis of symmetry is the same.

The vertex of $f(x)$ is (0, 0). The vertex of $g(x) = -3x^2 + 2$ is translated 2 units up to (0, 2). The graph of $g(x) = -3x^2 + 2$ opens downward, and the graph of $f(x)$ opens upward.

C. $g(x) = x^2 - 3$
Width: Find $|a|$ for each function.

$g(x) = |1| =$ 1 $\quad f(x) = |1| =$ 1

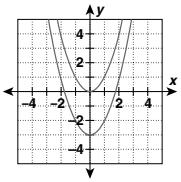
The width of the graphs of $g(x)$ and $f(x)$ are the same.
Determine the axis of symmetry for both graphs:

$g(x) = -\frac{b}{2a} = -\frac{0}{2(1)} =$ 0 $\quad f(x) = -\frac{b}{2a} = -\frac{0}{2(1)} =$ 0

The axis of symmetry is the same.
The vertex of $f(x)$ is (0, 0).

The vertex of $g(x) = x^2 - 3$ is translated 3 units down to $(0, -3)$.

Check Graph both equations to verify all comparisons.



Copyright © by Holt, Rinehart and Winston.
All rights reserved.

SECTION 9A

Ready To Go On? Problem Solving Intervention

9-4 Transforming Quadratic Functions

When comparing graphs, it helps to draw or view them on the same coordinate plane.

The students in a physics class are dropping eggs from a tall building onto a target from different heights. One egg is dropped from a height of 64 feet and another egg is dropped from a height of 96 feet.

a. Write the two height functions and compare their graphs. Use $h(t) = -16t^2 + c$, where c is the height of the egg.

b. Use the graphs to tell when each egg will reach the ground.

Understand the Problem

1. What are you being asked to determine? When the eggs will reach the ground.

2. What function are you given to write the equations? $h(t) = -16t^2 + c$

Make a Plan

3. Write the function for each egg being dropped.

a. 64 foot drop: $h_1(t) = -16t^2 +$ 64 **b.** 96 foot drop: $h_2(t) = -16t^2 +$ 96

Solve

4. Graph each equation on a graphing calculator. Since time and height cannot be negative, set the viewing window for nonnegative values.

The graph of $h_2(t) = -16t^2 + 96$ is a vertical translation of the graph of $h_1(t) = -16t^2 + 64$.

Since the egg in h_2 is dropped from 32 feet higher than h_1, the y-intercept of h_2 is 32 feet higher.

5. Use the graphs to tell when each egg reaches the ground.

The zeros of each function are when the eggs reach the ground.

The egg dropped from 64 feet reaches the ground in 2 seconds.

The egg dropped from 96 feet reaches the ground in approximately 2.5 seconds.

Look Back

6. Use the Calc feature on your calculator and determine the zeros of each function.

7. Do your results in Exercise 5 match your results in Exercise 6? Yes

8. Do your answers seem reasonable? The egg dropped from 96 feet should take longer to reach the ground than the egg dropped from 64 feet.

Copyright © by Holt, Rinehart and Winston.
All rights reserved.

SECTION 9A

Ready To Go On? Quiz

9-1 Identifying Quadratic Functions

Tell whether each function is quadratic.

1. $y + 4x^2 = -5$ Yes

2. $2x^2 + y = 6 + 2x^2$ No

3. $(-1, -4); (0, -3); (1, -2); (2, -1)$ No

Tell whether the graph of each quadratic function opens upward or downward and whether the parabola has a maximum or a minimum.

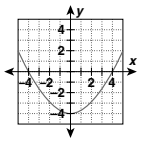
4. $y = -2x^2 - 3x + 7$ Downward; Maximum

5. $y - 3x^2 = 2x + 5$ Upward; Minimum

6. $f(x) = 4x - 0.25x^2$ Downward; Maximum

7. Graph the function $y = \frac{1}{4}x^2 - 4$ and give the domain and range.

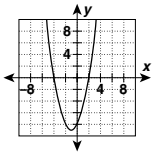
D: all real numbers; R: $y \geq -4$



9-2 Characteristics of Quadratic Functions

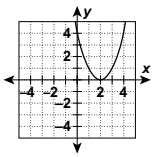
Find the zeros of each function from its graph. Then find its axis of symmetry.

8.



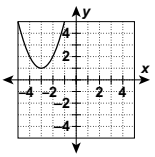
2 and −4; $x = -1$

9.



2; $x = 2$

10.



No zeros; $x = -3$

Find the vertex of each parabola.

11. $y = x^2 - 4x + 2$ (2, −2)

12. $y = 4 - 6x - 3x^2$ (−1, 7)

13. $y = 2x^2 + 8x - 13$ (−2, −21)

14. The height in feet of an arched bridge can be modeled by $y = -0.05x^2 + 2x$, where x is the distance in feet from the bottom of the arch to the ground. How tall is the bridge? 20 feet

Copyright © by Holt, Rinehart and Winston.
All rights reserved.

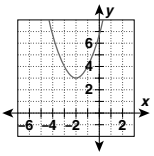
SECTION 9A

Ready To Go On? Quiz continued

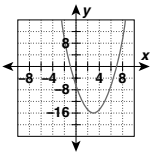
9-3 Graphing Quadratic Functions

Graph each quadratic function.

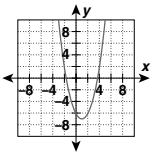
15. $y = x^2 + 4x + 7$



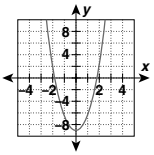
16. $y = x^2 - 6x - 7$



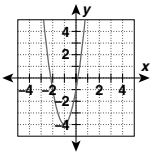
17. $y = x^2 - 2x - 6$



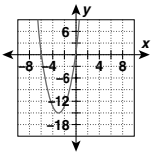
18. $y = 3x^2 - 9$



19. $y = 3x^2 + 6x - 1$



20. $y = 2x^2 + 12x + 3$



9-4 Transforming Quadratic Functions

Compare the graph of each function with the graph of $f(x) = x^2$.

21. $g(x) = 7x^2 + 1$
The graph of $g(x)$ is narrower than $f(x)$, has the same axis of symmetry, opens upward, and its vertex is translated 1 unit up to (0, 1).

22. $g(x) = -x^2 + 5$
The graph of $g(x)$ has the same axis of symmetry, opens downward and the vertex has been translated 5 units up to (0, 5).

23. The pilot of a hot-air balloon drops a sandbag onto a target from a height of 324 feet. Later, he drops another identical sandbag from a height of 961 feet.

a. Write the two height functions and compare their graphs. Use $h(t) = -16t^2 + c$, where c is the height of the balloon and t is the time in seconds.

$h_1(t) = -16t^2 + 324$, $h_2(t) = -16t^2 + 961$

b. Use the graphs to tell when each sandbag will reach the ground. 4.5 s and 7.75 s

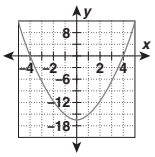
Copyright © by Holt, Rinehart and Winston.
All rights reserved.

Copyright © by Holt, Rinehart and Winston.
All rights reserved.

SECTION 9B Ready To Go On? Quiz

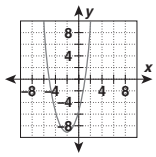
9-5 Solving Quadratic Equations by Graphing
Solve each equation by graphing the related function.

1. $x^2 - 16 = 0$



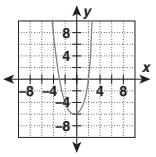
−4 and 4

2. $x^2 + 4x - 5 = 0$



−5 and 1

3. $3x^2 + 3x = 18$



−3 and 2

4. The height of a rocket fired from a platform 80 feet above the ground can be approximated by $h = -16t^2 + 64t + 80$, where h is the height in feet and t is the time in seconds. Find the time it takes the rocket to reach the ground after it is launched.

5 seconds

9-6 Solving Quadratic Equations by Factoring
Use the Zero Product Property to solve each equation.

5. $(x + 2)(x + 7) = 0$ — $x = -2$ and -7

6. $(x - 4)(x - 5) = 0$ — $x = 4$ and 5

7. $x(x + 3) = 28$ — $x = -7$ and 4

8. $(x + 6)(x - 7) = 30$ — $x = -8$ and 9

Solve each quadratic equation by factoring.

9. $x^2 - 4x - 45 = 0$ — $x = -5$ and 9

10. $x^2 - 12x + 32 = 0$ — $x = 4$ and 8

11. $x^2 + x = 12$ — $x = -4$ and 3

12. $-8x - 48 = -x^2$ — $x = -4$ and 12

13. The height of a small rocket can be approximated by the function $h(t) = -16t^2 + 96t$, where h is the height of the rocket in feet and t is the time in seconds. Find the time it takes the rocket to return to the ground.

6 seconds

Copyright © by Holt, Rinehart and Winston. All rights reserved.

SECTION 9B Ready To Go On? Quiz continued

9-7 Solving Quadratic Equations by Using Square Roots
Solve using square roots.

14. $4x^2 = 64$ — $x = -4$ and 4

15. $64x^2 - 81 = 0$ — $x = -\frac{9}{8}$ and $\frac{9}{8}$

16. $-22 = x^2 - 58$ — $x = -6$ and 6

17. Solve $5x^2 + 9 = 18$. Round to the nearest hundredth. $x = -1.34$ and 1.34

9-8 Completing the Square
Complete the square for each expression.

18. $x^2 - 14x + \square$ — 49

19. $x^2 + 6x + \square$ — 9

20. $x^2 + 3x + \square$ — $\frac{9}{4}$

Solve by completing the square.

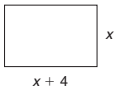
21. $x^2 + 12x = 13$ — $x = -13$ and 1

22. $x^2 + 13 = 8x$ — $x = 4 \pm \sqrt{3}$

23. $x^2 - 4x = 2$ — $x = 2 \pm \sqrt{6}$

24. The length of a rectangle is 4 feet more than the width. The area of the rectangle is 32 square feet. Find the length and width. Round your answer to the nearest tenth of a foot.

length: 8.0 ft; width 4.0 ft



9-9 The Quadratic Formula and the Discriminant
Solve using the Quadratic Formula. Round your answer to the nearest hundredth.

25. $3x^2 + 4x - 4 = 0$ — $x = -2$ and $\frac{2}{3}$

26. $2x^2 + 6 = -x$ — No real solutions

27. $4x^2 + 8x = 3$ — $x = \frac{-2 \pm \sqrt{7}}{2}$ or 0.32, −2.32

Find the number of solutions of each equation using the discriminant.

28. $3x^2 + 12x = -13$ — −12; no real solutions

29. $x^2 + 16 = 8x$ — 0; 1 real solution

30. $x^2 - 4x = 2$ — 24; 2 real solutions

Copyright © by Holt, Rinehart and Winston. All rights reserved.

SECTION 9B Ready To Go On? Enrichment

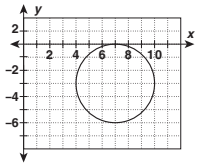
Graphing Circles by Completing the Square

Completing the square can be used to graph circles. The general equation for a circle with its center at the origin is $x^2 + y^2 = r^2$, where r is the radius of the circle. The general equation of a circle with its center translated from the origin is $(x - h)^2 + (y - k)^2 = r^2$. An equation representing a circle can be transformed into the sum of two squares.

Example: $x^2 - 14x + y^2 + 6y + 49 = 0$
$(x^2 - 14x + ___) + (y^2 + 6y + ___) = -49$
$(x^2 - 14x + \mathbf{49}) + (y^2 + 6y + \mathbf{9}) = -49 + \mathbf{49} + \mathbf{9}$
$(x - 7)^2 + (y + 3)^2 = 9$
$(x - 7)^2 + (y + 3)^2 = 3^2$

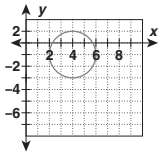
The center of the circle is $(7, -3)$ and the radius is 3.

The circle is shown at the right.



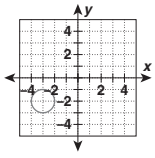
Complete the square on the following equations. Identify the center and radius of the circle and then graph.

1. $x^2 - 8x + y^2 + 2y + 13 = 0$



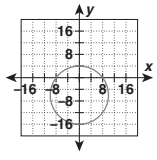
Center: (4, −1)
Radius: 2

2. $x^2 + 6x + y^2 + 4y + 12 = 0$



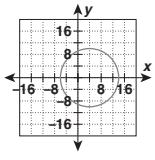
Center: (−3, −2)
Radius: 1

3. $x^2 + y^2 + 10y - 75 = 0$



Center: (0, −5)
Radius: 10

4. $x^2 - 8x + y^2 - 84 = 0$



Center: (4, 0)
Radius: 10

Copyright © by Holt, Rinehart and Winston. All rights reserved.

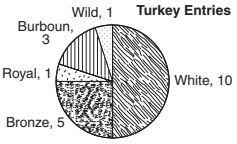
SECTION 10A Ready To Go On? Skills Intervention

10-1 Organizing and Describing Data

Find these vocabulary words in Lesson 10-1 and the Multilingual Glossary.

Vocabulary		
bar graph	line graph	circle graph

Reading and Interpreting Circle Graphs
Use the circle graph to answer each question.



A. Which two turkey entries make up 75% of those entries entered in the fair?

75% of the circle is represented by how much of the circle, if the circle is divided into four sections? 3 of the 4 sections

Which two turkey entries account for 3 of the four sections? white and bronze

B. How many turkey's were entered in the fair? Add: 10 + 5 + 1 + 3 + 1 = 20

There were 20 turkeys entered in the fair.

C. What percent of the turkey entries are white?

What part of the circle is shaded for white turkey entries? 50%

As a check, how many turkey entries are white turkeys? 10

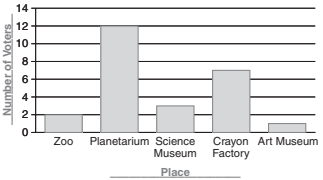
Since the total number of entries is 20, is 10 50% of 20? Yes

Choosing and Creating an Appropriate Display
Use the given data to make a graph. Explain why you chose that type of graph.

Survey of Favorite Field Trips	
Zoo	2
Planetarium	12
Science Museum	3
Crayon Factory	7
Art Museum	1

A bar graph is appropriate for this data because it is a good way to compare categories.

Title: Field Trip Survey Results



Step 1 Determine an appropriate scale and interval. What is the highest data value? 12

Lowest data value? 1

The scale could go from 0 to 14.

Step 2 Use the data to determine each bar height. Draw bars of equal width. Should the bars touch? No

Step 3 Title the graph and label the horizontal and vertical axis.

Copyright © by Holt, Rinehart and Winston. All rights reserved.

Copyright © by Holt, Rinehart and Winston. All rights reserved.