Name _____ Date _____ Class _____

LESSON 5-2

Practice A

Properties of Quadratic Functions in Standard Form

Identify the axis of symmetry for the graph of each function.

1. $f(x) = -(x - 4)^2 - 6$ _____
2. $g(x) = 5(x - 2)^2 + 4$ _____
3. $g(x) = 12(x + 6)^2 - 5$ _____
4. $f(x) = -3(x + 1)^2 - 7$ _____

Tell whether each statement is true or false.

5. The graph of a quadratic function is always a parabola. _____
6. The graphs of all quadratic functions open upward. _____
7. The graph of $f(x) = x^2$ has a maximum value at $(0, 0)$. _____

For the following functions, (a) determine whether the graph opens upward or downward. Then find (b) the axis of symmetry, (c) the vertex, and (d) the *y*-intercept. Graph each function. Then (e) determine if the function has a minimum or a maximum and (f) find the value of the minimum or maximum.

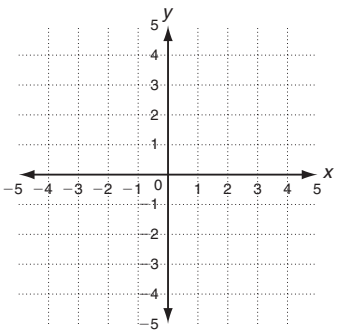
8. $g(x) = 3x^2 + 2x + 1$

a. _____

b. _____

c. _____

d. _____



e. _____

f. _____

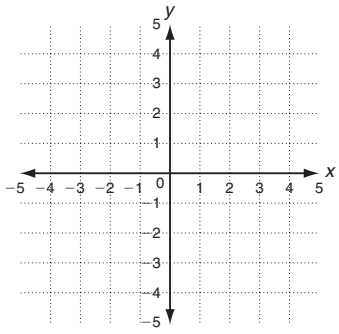
9. $f(x) = -2x^2 - 4x - 2$

a. _____

b. _____

c. _____

d. _____



e. _____

f. _____

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LESSON 5-2

Practice A

Properties of Quadratic Functions in Standard Form

Identify the axis of symmetry for the graph of each function.

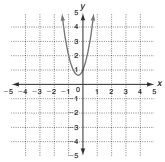
1. $f(x) = -(x - 4)^2 - 6$ — $x = 4$
2. $g(x) = 5(x - 2)^2 + 4$ — $x = 2$
3. $g(x) = 12(x + 6)^2 - 5$ — $x = -6$
4. $f(x) = -3(x + 1)^2 - 7$ — $x = -1$

Tell whether each statement is true or false.

5. The graph of a quadratic function is always a parabola. — True
6. The graphs of all quadratic functions open upward. — False
7. The graph of $f(x) = x^2$ has a maximum value at $(0, 0)$. — False

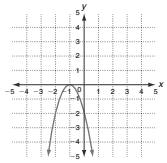
For the following functions, (a) determine whether the graph opens upward or downward. Then find (b) the axis of symmetry, (c) the vertex, and (d) the *y*-intercept. Graph each function. Then (e) determine if the function has a minimum or a maximum and (f) find the value of the minimum or maximum.

8. $g(x) = 3x^2 + 2x + 1$
   a. Upward
   b. $x = -\frac{1}{3}$
   c. $\left(-\frac{1}{3}, \frac{2}{3}\right)$
   d. 1



   e. Minimum
   f. $\frac{2}{3}$

9. $f(x) = -2x^2 - 4x - 2$
   a. Downward
   b. $x = -1$
   c. $(-1, 0)$
   d. -2



   e. Maximum
   f. 0

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LESSON 5-2

Practice B

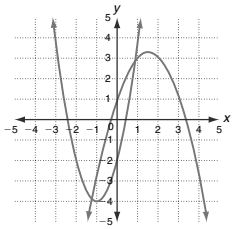
Properties of Quadratic Functions in Standard Form

Identify the axis of symmetry for the graph of each function.

1. $g(x) = x^2 - 4x + 2$ — $x = 2$
2. $h(x) = -8x^2 + 12x - 11$ — $x = \frac{3}{4}$
3. $k(x) = -4(x + 3)^2 + 9$ — $x = -3$

For each function, (a) determine whether the graph opens upward or downward, (b) find the axis of symmetry, (c) find the vertex, and (d) find the *y*-intercept. Then graph the function.

4. $f(x) = -x^2 + 3x + 1$
   a. Upward or downward — Downward
   b. Axis of symmetry — $x = 1.5$
   c. Vertex — $(1.5, 3.25)$
   d. *y*-intercept — 1



5. $g(x) = 2x^2 + 4x - 2$
   a. Upward or downward — Upward
   b. Axis of symmetry — $x = -1$
   c. Vertex — $(-1, -4)$
   d. *y*-intercept — -2

Find the minimum or maximum value of each function. Then state the domain and range of the function.

6. $g(x) = x^2 - 2x + 1$ — Minimum: 0; domain: all real numbers; range: $\{y \mid y \geq 0\}$
7. $h(x) = -5x^2 + 15x - 3$ — Maximum: 8.25; domain: all real numbers; range: $\{y \mid y \leq 8.25\}$

Solve.

8. A record label uses the following function to model the sales of a new release.

$$a(t) = -90t^2 + 8100t$$

The number of albums sold is a function of time, *t*, in days. On which day were the most albums sold? What is the maximum number of albums sold on that day?

Day 45; 182,250 records

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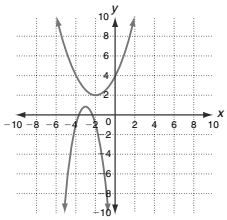
LESSON 5-2

Practice C

Properties of Quadratic Functions in Standard Form

For each function, determine whether the graph opens upward or downward, find the axis of symmetry, the vertex, and the *y*-intercept. Then graph the function.

1. $f(x) = \frac{1}{2}x^2 + 2x + 4$
   a. Upward or downward — Upward
   b. Axis of symmetry — $x = -2$
   c. Vertex — $(-2, 2)$
   d. *y*-intercept — 4
2. $g(x) = -2(x + 3)^2 + 1$
   a. Upward or downward — Downward
   b. Axis of symmetry — $x = -3$
   c. Vertex — $(-3, 1)$
   d. *y*-intercept — -17



Solve.

3. Write the vertex form of a quadratic function that opens upward and has a *y*-intercept of 3. — Possible answer: $f(x) = (x - 2)^2 - 1$
4. The vertex of the function $g(x) = 4x^2 + bx + 16$ is at $(2, 0)$. Find the value of *b* for the function. — $b = -16$
5. The *y*-intercept of $g(x) = 2(x - 3)^2 + k$ is -2. Find the value of *k*. — $k = -20$
6. An airline sells a 3-day vacation package. Sales from this vacation package can be modeled by the quadratic function $s(p) = -40p^2 + 32000p$. Sales are dependent on the price, *p*, of the package. If the price is set too high, the package won't sell, but if the price is too low, prospective buyers will think it is a scam.
   a. At what price, *p*, does the company have the greatest revenue? — \$400
   b. What are the maximum sales possible based on this model? — \$6,400,000
   c. What is the revenue from the vacation package if the price is set at \$800? — The revenue is 0, because no packages would be sold at \$800.

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LESSON 5-2

Review for Mastery

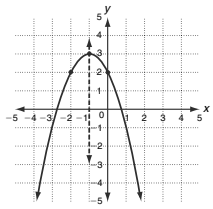
Properties of Quadratic Functions in Standard Form

You can use the properties of a parabola to graph a quadratic function in standard form: $f(x) = ax^2 + bx + c$, $a \neq 0$.

Property	Example: $f(x) = -x^2 - 2x + 2$
$a > 0$: opens upward $a < 0$: opens downward	$a = -1$, $b = -2$, $c = 2$ $a < 0$, so parabola opens downward.
Axis of symmetry: $x = -\frac{b}{2a}$	Axis of symmetry: $x = -\frac{b}{2a} = -\frac{(-2)}{2(-1)} = -1$
Vertex: $\left(-\frac{b}{2a}, f\left(-\frac{b}{2a}\right)\right)$	$f\left(-\frac{b}{2a}\right) = f(-1) = -1(-1)^2 - 2(-1) + 2 = 3$ Vertex: $(-1, 3)$
y-intercept: *c*	*y*-intercept is 2, so $(0, 2)$ is a point on the graph.

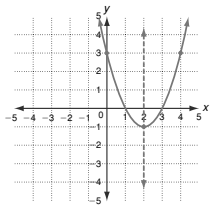
To graph $f(x) = -x^2 - 2x + 2$:

1. Plot vertex.
2. Sketch axis of symmetry through vertex.
3. Plot *y*-intercept.
4. Use symmetry to plot $(-2, 2)$.
5. Sketch graph.



Use the properties of a parabola to graph $f(x) = x^2 - 4x + 3$.

1. $a =$ 1, $b =$ -4, $c =$ 3
2. The graph opens Upward.
3. Axis of symmetry: $x = -\frac{b}{2a} =$ $x = 2$
4. $f\left(-\frac{b}{2a}\right) =$ $f(2) = -1$
5. Vertex: $(2, -1)$
6. *y*-intercept: 3



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