

LESSON **Practice B**
5-2 **Properties of Quadratic Functions in Standard Form**

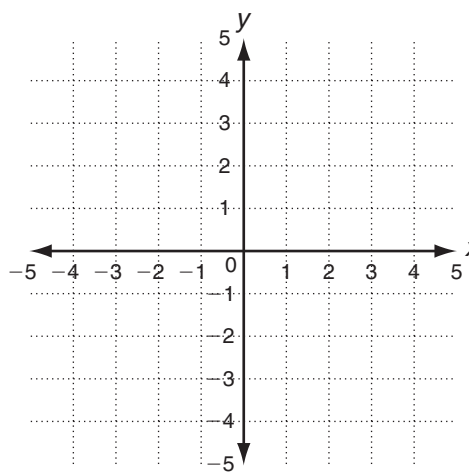
Identify the axis of symmetry for the graph of each function.

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

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 _____
 - b. Axis of symmetry _____
 - c. Vertex _____
 - d. y-intercept _____

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



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

6. $g(x) = x^2 - 2x + 1$ 7. $h(x) = -5x^2 + 15x - 3$

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?

LESSON **Practice A**

5-2 **Properties of Quadratic Functions in Standard Form**

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

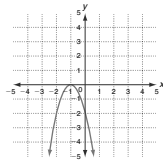
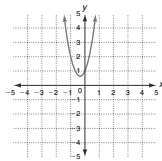
- $f(x) = -(x - 4)^2 - 6$
 $x = 4$
- $g(x) = 5(x - 2)^2 + 4$
 $x = 2$
- $g(x) = 12(x + 6)^2 - 5$
 $x = -6$
- $f(x) = -3(x + 1)^2 - 7$
 $x = -1$

Tell whether each statement is true or false.

- The graph of a quadratic function is always a parabola.
True
- The graphs of all quadratic functions open upward.
False
- 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.

- | | |
|---|---|
| <ol style="list-style-type: none"> $g(x) = 3x^2 + 2x + 1$ <ol style="list-style-type: none"> <u> </u>
Upward <u> </u>
$x = -\frac{1}{3}$ <u> </u>
$(-\frac{1}{3}, \frac{2}{3})$ <u> </u>
1 | <ol style="list-style-type: none"> $f(x) = -2x^2 - 4x - 2$ <ol style="list-style-type: none"> <u> </u>
Downward <u> </u>
$x = -1$ <u> </u>
$(-1, 0)$ <u> </u>
-2 |
|---|---|



- | | |
|--|--|
| <ol style="list-style-type: none"> <u> </u>
Minimum <u> </u>
$\frac{2}{3}$ | <ol style="list-style-type: none"> <u> </u>
Maximum <u> </u>
0 |
|--|--|

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LESSON **Practice B**

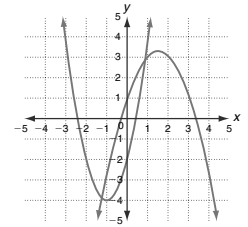
5-2 **Properties of Quadratic Functions in Standard Form**

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

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

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.

- $f(x) = -x^2 + 3x + 1$
 - Downward**
 - $x = 1.5$
 - $(1.5, 3.25)$
 - 1**
- $g(x) = 2x^2 + 4x - 2$
 - Upward**
 - $x = -1$
 - $(-1, -4)$
 - 2**



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

- | | |
|--|---|
| <ol style="list-style-type: none"> $g(x) = x^2 - 2x + 1$
Minimum: 0; domain: all real numbers; range: $y \geq 0$ | <ol style="list-style-type: none"> $h(x) = -5x^2 + 15x - 3$
Maximum: 8.25; domain: all real numbers; range: $y \leq 8.25$ |
|--|---|

Solve.

- 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

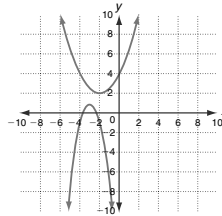
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LESSON **Practice C**

5-2 **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.

- $f(x) = \frac{1}{2}x^2 + 2x + 4$
 - Upward**
 - $x = -2$
 - $(-2, 2)$
 - 4**
- $g(x) = -2(x + 3)^2 + 1$
 - Downward**
 - $x = -3$
 - $(-3, 1)$
 - 17**



Solve.

- Write the vertex form of a quadratic function that opens upward and has a y -intercept of 3.
- The vertex of the function $g(x) = 4x^2 + bx + 16$ is at $(2, 0)$. Find the value of b for the function.
- The y -intercept of $g(x) = 2(x - 3)^2 + k$ is -2 . Find the value of k .

Possible answer:
 $f(x) = (x - 2)^2 - 1$

 $b = -16$

 $k = -20$

- 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.
 - At what price, p , does the company have the greatest revenue?

\$400
 - What are the maximum sales possible based on this model?

\$6,400,000
 - 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 **Review for Mastery**

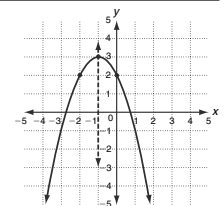
5-2 **Properties of Quadratic Functions in Standard Form**

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

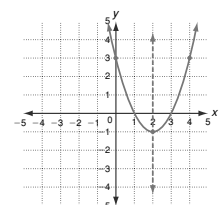
To graph $f(x) = -x^2 - 2x + 2$:

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



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

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



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