

## 4-6 Study Guide and Intervention

### The Quadratic Formula and the Discriminant

**Quadratic Formula** The **Quadratic Formula** can be used to solve *any* quadratic equation once it is written in the form  $ax^2 + bx + c = 0$ .

<b>Quadratic Formula</b>	The solutions of $ax^2 + bx + c = 0$ , with $a \neq 0$ , are given by $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ .
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**Example** Solve  $x^2 - 5x = 14$  by using the Quadratic Formula.

Rewrite the equation as  $x^2 - 5x - 14 = 0$ .

$$\begin{aligned}
 x &= \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} && \text{Quadratic Formula} \\
 &= \frac{-(-5) \pm \sqrt{(-5)^2 - 4(1)(-14)}}{2(1)} && \text{Replace } a \text{ with } 1, b \text{ with } -5, \text{ and } c \text{ with } -14. \\
 &= \frac{5 \pm \sqrt{81}}{2} && \text{Simplify.} \\
 &= \frac{5 \pm 9}{2} \\
 &= 7 \text{ or } -2
 \end{aligned}$$

The solutions are  $-2$  and  $7$ .

### Exercises

Solve each equation by using the Quadratic Formula.

1.  $x^2 + 2x - 35 = 0$

2.  $x^2 + 10x + 24 = 0$

3.  $x^2 - 11x + 24 = 0$

4.  $4x^2 + 19x - 5 = 0$

5.  $14x^2 + 9x + 1 = 0$

6.  $2x^2 - x - 15 = 0$

7.  $3x^2 + 5x = 2$

8.  $2y^2 + y - 15 = 0$

9.  $3x^2 - 16x + 16 = 0$

10.  $8x^2 + 6x - 9 = 0$

11.  $r^2 - \frac{3r}{5} + \frac{2}{25} = 0$

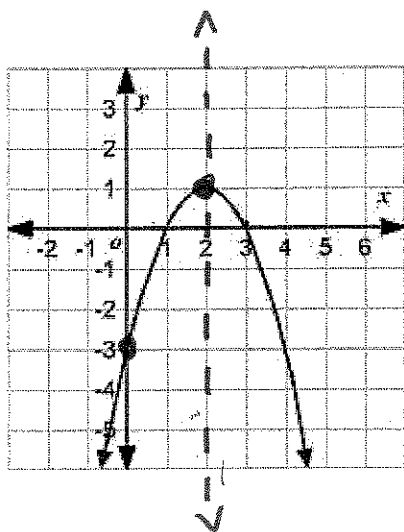
12.  $x^2 - 10x - 50 = 0$

13.  $x^2 + 6x - 23 = 0$

14.  $4x^2 - 12x - 63 = 0$

15.  $x^2 - 6x + 21 = 0$

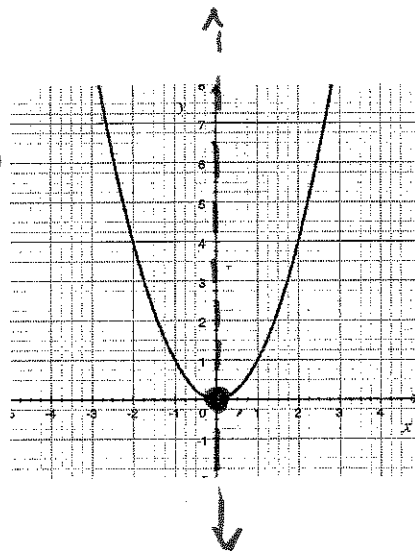
## Guided Notes: Graphing Quadratic Functions



$$ax^2 + bx + c$$

opening up  $a > 0$  →

← opening down  $a < 0$



### Vocabulary

Parabola: the graph of a quadratic function

Vertex: the highest or the lowest point on your parabola

Axis of Symmetry: a line that divides a figure into two symmetrical parts

Y-intercept: where your graph crosses the y-axis

X-intercepts/Zeros/Roots/Solutions: where your graph crosses the x-axis

Minimum: the lowest point of your parabola

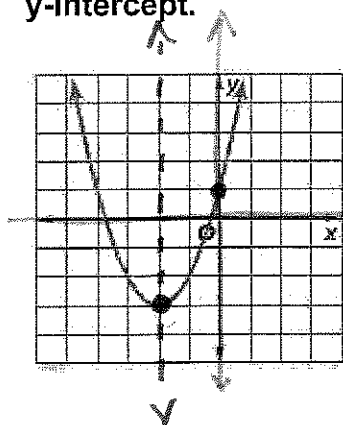
Maximum: the highest point of your parabola

$$x = \frac{-b}{2a}$$

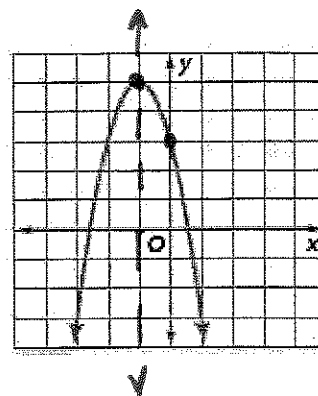
$a > 0$

$a < 0$

**EXAMPLE:** Find the vertex, the equation for the axis of symmetry, and the y-intercept.



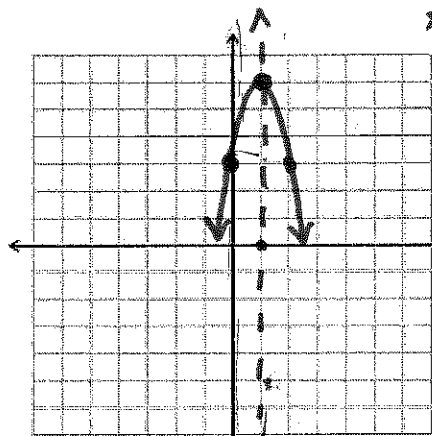
vertex:  
(-2, -3)  
equation:  
 $x = -2$   
y-intercept:  
(0, 1)



vertex:  
(-1, 5)  
equation:  
 $x = -1$   
y-int: (0, 3)

Graph each function.

1)  $f(x) = -3x^2 + 6x + 3$



★ Step 1: Find/  
Graph axis of  
symmetry.

★ Step 2: Find +  
graph vertex.

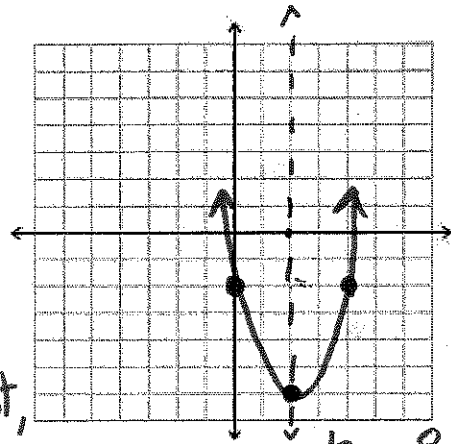
★ Step 3: Find +  
graph y-intercept,  
then, graph its  
mirrored image.

Step 1:  $x = \frac{-b}{2a} = \frac{-6}{2(-3)} = \frac{-6}{-6}$

Step 2:  $-3(1)^2 + 6(1) + 3$   $x = 1$   
 $-3 + 6 + 3$   $(1, 6)$

Step 3:  $-3(0)^2 + 6(0) + 3$   $(0, 3)$

2)  $f(x) = 2x^2 - 8x - 4$



Step 1:  $x = \frac{-b}{2a} = \frac{8}{4}$   $x = 2$

Step 2:  $2(2)^2 - 8(2) - 4$   
 $8 - 16 - 4 = -12$   
 $(2, -12)$

Step 3:  $2(0)^2 - 8(0) - 4$   
 $(0, -4)$

A juggler is tossing a ball into the air. The height of the ball in feet can be modeled by the equation  $y = -16x^2 + 16x + 5$ , where  $y$  represents the height of the ball at  $x$  seconds.

a) Graph this equation.

b) At what height is the ball thrown?

c) What is the maximum height of the ball?

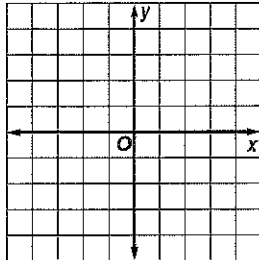
d) When does the ball hit the ground?

# 9-1 Skills Practice

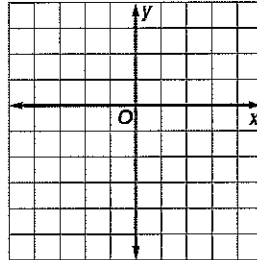
## Graphing Quadratic Functions

Use a table of values to graph each function. State the domain and the range.

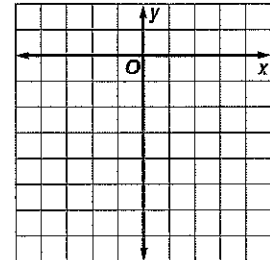
1.  $y = x^2 - 4$



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



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



Find the vertex, the equation of the axis of symmetry, and the y-intercept of the graph of each function.

4.  $y = 2x^2 - 8x + 6$

5.  $y = x^2 + 4x + 6$

6.  $y = -3x^2 - 12x + 3$

Consider each equation.

a. Determine whether the function has a *maximum* or a *minimum* value.

b. State the maximum or minimum value.



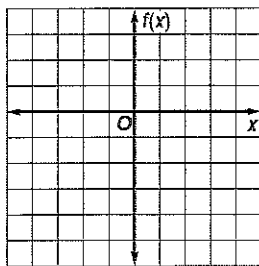
7.  $y = 2x^2$

8.  $y = x^2 - 2x - 5$

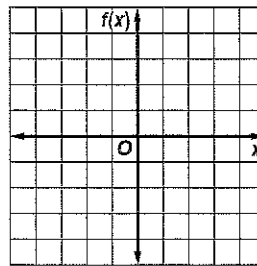
9.  $y = -x^2 + 4x - 1$

Graph each function.

10.  $f(x) = -x^2 - 2x + 2$



11.  $f(x) = 2x^2 + 4x - 2$



12.  $f(x) = -2x^2 - 4x + 6$

