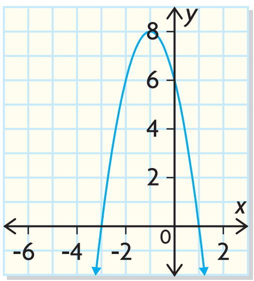
6

Getting Started



WORDS YOU NEED to Know

1. State the vertex, equation of the axis of symmetry, and zeros of the parabola at the left.

2. Match each form with the correct equation.

a)	standard form	**i)**	$y = -2(x + 3)(x - 1)$
b)	factored form	**ii)**	$y = -2(x + 1)^2 + 8$
c)	vertex form	**iii)**	$y = -2x^2 - 4x + 6$

SKILLS AND CONCEPTS You Need

Graphing Quadratic Relations

Study *Aid*

- For more help and practice, see Lessons 5.6, 3.3, and 5.3.

Different strategies can be used to graph a quadratic relation. The strategy you use might depend on the form of the relation.

EXAMPLE

Describe a strategy you could use to graph each quadratic relation.

a) $y = x^2 + 4x - 1$ **b)** $y = -2(x + 3)(x - 5)$ **c)** $y = 2(x - 3)^2 - 4$

Solution

a) The equation is in standard form.
- Partially factor the equation to locate two ordered pairs with the same y-coordinate.
- Determine the x-coordinate of the vertex by calculating the mean of the x-coordinates of the points you determined above.
- Substitute the x-coordinate of the vertex into the equation to determine the y-coordinate of the vertex.
- Substitute two other values of x into the equation to determine two more points on the parabola.
- Use symmetry to determine the points on the parabola that are directly across from the two additional points you determined.
- Plot the vertex and points, then sketch the parabola.

b) The equation is in factored form.
- Locate the zeros by setting each factor to zero and solving each equation.
- Determine the x-coordinate of the vertex by calculating the mean of the x-coordinates of the zeros that you determined above.
- Substitute the x-coordinate of the vertex into the equation to determine the y-coordinate of the vertex.
- Plot the vertex and zeros, then sketch the parabola.

c) The equation is in vertex form.

- Locate the vertex and the axis of symmetry.
- Determine the y-intercept by letting x equal 0.
- Use symmetry to determine the point on the parabola that is directly across from the y-intercept.
- Plot the vertex and points, then sketch the parabola.

3. Graph each quadratic relation.

a) $y = (x + 4)^2 - 3$ **c)** $y = (x + 5)(x - 7)$ **e)** $y = 2x^2 + x - 1$

b) $y = -3(x - 3)^2 - 1$ **d)** $y = \frac{1}{2}(x - 4)(x - 7)$ **f)** $y = -3x^2 - 5x$

Factoring Quadratic Expressions

You can use a variety of strategies to factor a quadratic expression.

Study Aid

- For more help and practice, see Lessons 4.2 to 4.6.

EXAMPLE

Factor. Use an area diagram for part a). Use decomposition for part b).

a) $x^2 - 7x - 18$ **b)** $4x^2 + 8x - 5$

Solution

a) $x^2 - 7x - 18$

	x	-9
x	x^2	$-9x$
2	$2x$	-18

This is a trinomial where $a = 1$ and there are no common factors. Look for two binomials that each start with x. To determine the factors, find two numbers whose product is -18 and whose sum is -7. The numbers are -9 and 2.

$x^2 - 7x - 18 = (x - 9)(x + 2)$

b) $4x^2 + 8x - 5$

This is a trinomial where $a \neq 1$ and there are no common factors. Look for two numbers whose sum is 8 and whose product is $(4)(-5) = -20$. The numbers are -2 and 10. Use these to decompose the middle term.

$= 4x^2 - 2x + 10x - 5$

$= \underline{4x^2 - 2x} + \underline{10x - 5}$

$= 2x(2x - 1) + 5(2x - 1)$

Group the terms in pairs, and divide out the common factors.

$= (2x - 1)(2x + 5)$

Divide out the common binomial as a common factor.

4. Factor each expression, if possible.

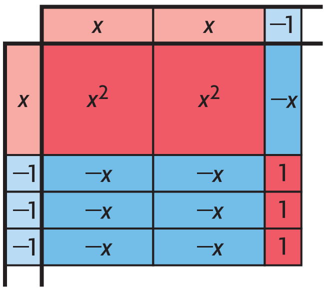
a) $x^2 + 8x + 12$ **c)** $x^2 + 7x - 30$ **e)** $-6x^2 - 7x + 24$

b) $x^2 - 5x + 6$ **d)** $9x^2 - 30x + 25$ **f)** $2x^2 - x - 5$

Study Aid

- For help, see the Review of Essential Skills and Knowledge Appendix.

Question	Appendix
5	A-9



PRACTICE

5. Solve each equation.

a) $4x + 8 = 0$ **c)** $-2x + 12 = 0$

b) $5x - 3 = 0$ **d)** $12x + 7 = 0$

6. Expand and simplify.

a) $(3x - 5)(x - 4)$ **c)** $(2x + 3)(4x - 5)$ **e)** $(3a + 7)(3a + 7)$

b) $(n + 1)(n - 1)$ **d)** $(7 - 3p)(2p + 5)$ **f)** $(6x - 5)^2$

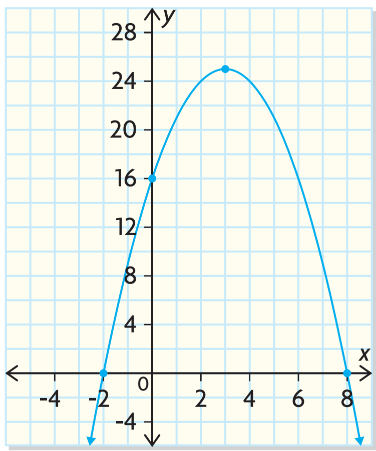
7. The algebra tiles at the left show $2x^2 - 7x + 3$ and its factors. Determine the factors for each expression. Use algebra tiles or area diagrams, if you wish.

a) $x^2 + 4x + 3$ **c)** $3x^2 - 5x - 2$ **e)** $2x^2 + 12x$

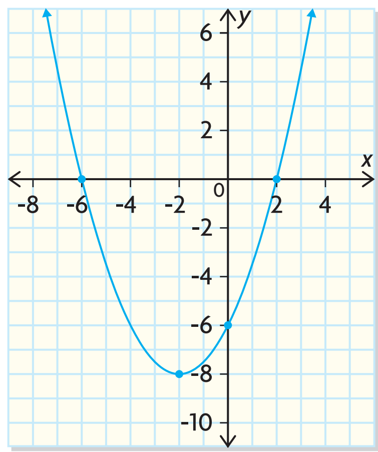
b) $x^2 - 8x + 16$ **d)** $4x^2 - 9$ **f)** $9x^2 - 6x + 1$

8. For each quadratic relation, determine the zeros, the y-intercept, the equation of the axis of symmetry, the vertex, and the equation in standard form.

a)



b)



9. For each quadratic relation, determine the y-intercept, the equation of the axis of symmetry, and the vertex.

a) $y = (x - 4)(x + 6)$ **b)** $y = -4(x - 3)^2 - 5$

10. Do you agree or disagree with each statement? Provide examples to support your answers.

a) Every quadratic expression can be written as the product of two linear factors.

b) Every quadratic relation has a maximum value or a minimum value.

c) The graph of a quadratic relation always has two x-intercepts.

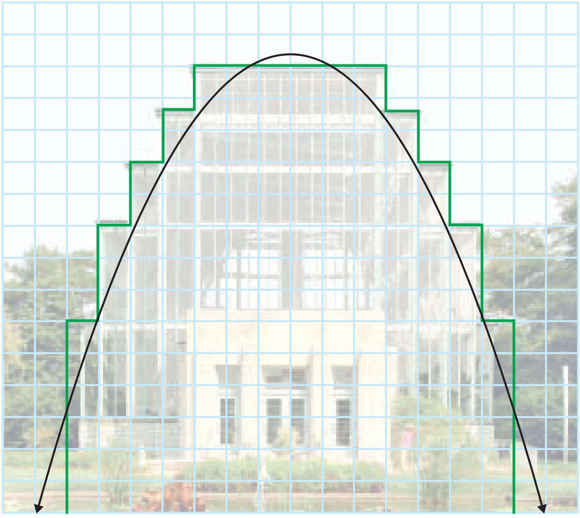
APPLYING What You Know

YOU WILL NEED

- grid paper
- ruler

The Jewel Box

This building is called the Jewel Box. It is a large greenhouse in St. Louis, Missouri. Its design is based on a parabola that passes through the corners of the roof line.



What quadratic relations can be used to model this parabola?

A. Trace the parabola from the photo at the right onto grid paper. Decide where to draw the x- and y-axes.

B. Create an algebraic model for the parabola in vertex form.

C. Create an algebraic model for the parabola in factored form.

D. How are the two models you created for parts B and C the same? How are they different?

E. Write both of your models in standard form. Do all three models represent the same parabola? Explain.

F. Which form of the quadratic relation do you prefer to model the shape of the roof line of the Jewel Box? Justify your answer.