

Warm Up

Find each product.

1. $(x + 2)(x + 7)$

2. $(x - 11)(x + 5)$

3. $(x - 10)^2$

Factor each polynomial.

4. $x^2 + 12x + 35$

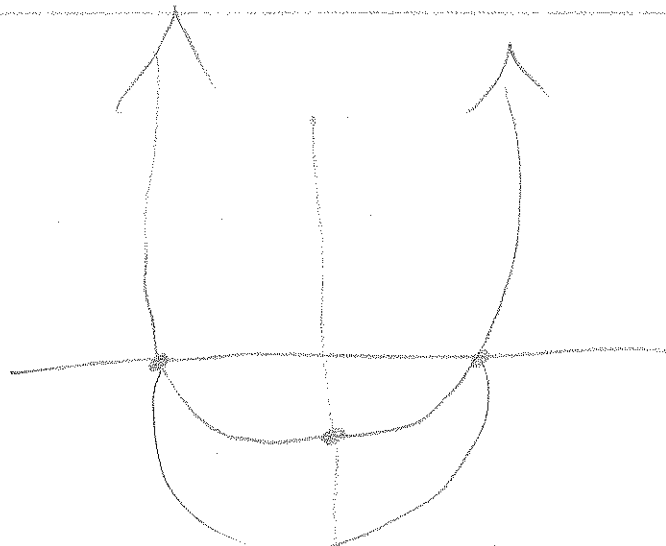
5. $x^2 + 2x - 63$

6. $x^2 - 10x + 16$

7. $2x^2 - 16x + 32$

Objective

* Solve quadratic equations by factoring.

x-intercepts, zeros, roots
solutions

You have solved quadratic equations by graphing. Another method used to solve quadratic equations is to factor and use the Zero Product Property.

If $a \cdot b = 0$
then $a = 0$ or $b = 0$

Zero Product Property

For all real numbers a and b ,

WORDS	NUMBERS	ALGEBRA
If the product of two quantities equals zero, at least one of the quantities equals zero.	$3(0) = 0$ $0(4) = 0$	If $ab = 0$, then $a = 0$ or $b = 0$.

$$(x+7)(4x-3)$$

$$x = -7$$

or

$$x = \frac{3}{4}$$

$$4x - 3 = 0$$

$$\begin{array}{r} +3 \quad +3 \\ \hline 4x = 3 \\ \frac{4x}{4} = \frac{3}{4} \\ x = \frac{3}{4} \end{array}$$

$$(x-3)(5x+2) = 0$$

$$x = 3$$

or

$$x = -\frac{2}{5}$$

$$5x + 2 = 0$$

$$\begin{array}{r} -2 \quad -2 \\ \hline 5x = -2 \\ \frac{5x}{5} = \frac{-2}{5} \end{array}$$

Example 1A: Use the Zero Product Property

Use the Zero Product Property to solve the equation. Check your answer.

$$(x - 7)(x + 2) = 0$$

$$(x - 2)(x) = 0$$

$$x = 0$$

$$0(0-2)$$

$$2(2-2)$$

$$x = 2$$

$$0(-2) = 0$$

$$2(0) = 0$$

Check It Out! Example 1a

Use the Zero Product Property to solve each equation. Check your answer.

$$(x)(x + 4) = 0$$

$$(x + 4)(x - 3) = 0$$

If a quadratic equation is written in standard form, $ax^2 + bx + c = 0$, then to solve the equation, you may need to factor before using the Zero Product Property.

$$x_{1,2} = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \quad 3x^2 + 1 = 4x \quad = \text{get into standard form}$$

$$\frac{8}{2(3)} \pm \frac{8}{6}$$

$$3x^2 - 4x + 1 = 0$$

$$a=3 \quad b=-4 \quad c=1$$

$$(3x^2 - 1x)(-3x + 1)$$

$$x(3x-1) - 1(3x-1)$$

$$(x-1)(3x-1) = 0$$

$$x=1$$

$$x = \frac{1}{3}$$

$$3x - 1 = 0$$

$$+1 \quad +1$$

$$\frac{3x}{3} = \frac{1}{3}$$

Example 2A: Solving Quadratic Equations by Factoring

Solve the quadratic equation by factoring. Check your answer.

$$x^2 - 6x + 8 = 0$$

$$x^2 + 4x = 21$$

Example 2C: Solving Quadratic Equations by Factoring

Solve the quadratic equation by factoring. Check your answer.

$$x^2 - 12x + 36 = 0$$

$$-2x^2 = 20x + 50$$

Helpful Hint

$(x - 3)(x - 3)$ is a perfect square. Since both factors are the same, you solve only one of them.

Check It Out! Example 2a

Solve the quadratic equation by factoring.

Check your answer.

$$x^2 - 6x + 9 = 0$$

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

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

$$a=1 \quad b=4 \quad c=-5 =$$

~~$$x^2 + 4x = 5$$~~

$$(x+5)(x-1) = 0$$

$$x = 1$$

$$x = -5$$

$$30x = -9x^2 - 25$$

$$3x^2 - 4x + 1 = 0$$

Example 3: Application

The height in feet of a diver above the water can be modeled by $h(t) = -16t^2 + 8t + 8$, where t is time in seconds after the diver jumps off a platform. Find the time it takes for the diver to reach the water.

$$\begin{aligned}
 h(t) &= -16t^2 + 8t + 8 \\
 &= -8(2t^2 - t - 1) \\
 A &= 2 \quad b = -1 \quad c = -1 \\
 &= -8(2t^2 - t - 1) = (2t + 1)(t - 1) \\
 &= t(2t + 1) - 1(2t + 1) \\
 &= (t - 1)(2t + 1) = 0 \\
 t &= 1 \\
 t &= -\frac{1}{2}
 \end{aligned}$$

Check It Out! Example 3

What if...? The equation for the height above the water for another diver can be modeled by $h = -16t^2 + 8t + 24$. Find the time it takes this diver to reach the water.