

Warm-Up

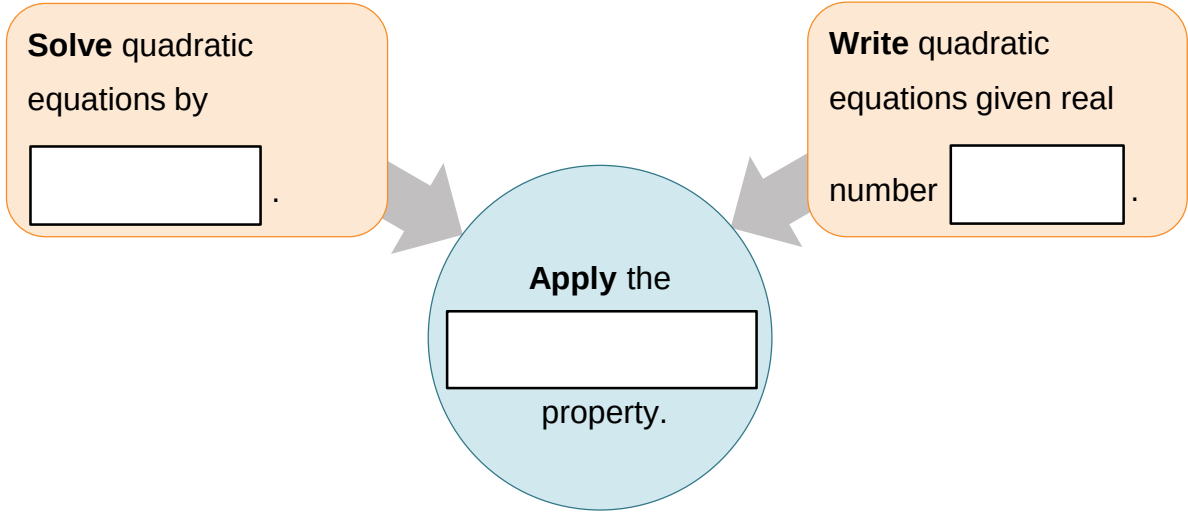
Solving Quadratic Equations: Zero Product Property



Lesson Question



Lesson Goals



Words to Know

Fill in this table as you work through the lesson. You may also use the glossary to help you.

	a value of the independent variable in a function that results in a value of zero for the dependent variable
	an x -value where the polynomial function intersects the x -axis; the x -values where $f(x) = 0$
	to break up a polynomial into a product of polynomials that can be multiplied to get the original polynomial
	the property stating that if a product is equal to zero, then at least one of the factors must be zero

Warm-Up

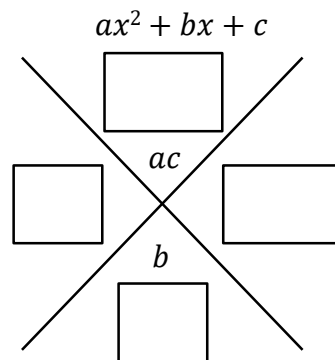
Solving Quadratic Equations: Zero Product Property



Factoring by the X Method

- Write the product ac at the top of the X.
- Write b at the bottom of the X.
- Write two numbers that have the product of ac and the sum of b on the sides of the X.
- Replace the x -term in the trinomial with two x -terms. Use the numbers on the sides of the X as their coefficients.
- Use double grouping to factor the four terms.

Factor $x^2 + 4x - 5$.



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

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

$$(x - 1) \boxed{}$$

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The Zero Product Property

The **zero product property** says that if a product equals zero, then at least one of the must be zero.

- $2(0) = 0$

- $2(a) = 0$

- $a(b) = 0$

$$\boxed{} = 0$$

If $a = 0$: $0(b) = \boxed{}$

If $b = 0$: $a(0) = \boxed{}$

If both are zero: $0(0) = 0$

Using the Zero Product Property

Solve $(x + 3)(x - 8) = 0$.

$$\boxed{} = 0$$

-3 -3

$$x = \boxed{}$$

$$x - 8 = \boxed{}$$

+8 +8

$$x = \boxed{}$$

Check:

$$(-3 + 3)(-3 - 8) = 0$$

$$0(-11) = 0 \checkmark$$

$$(8 + 3)(8 - 8) = 0$$

$$11(0) = 0 \checkmark$$

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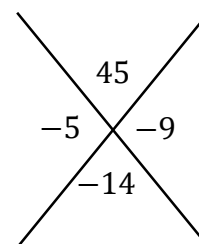
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How to Solve a Quadratic Equation by Factoring

1. Write the equation in standard form, setting one side equal to zero.
2. Factor the polynomial.
3. Apply the zero product property.
4. Solve the resulting equations.
5. Check the solutions for reasonableness.

Solve $x^2 - 14x + 45 = 0$.



$$x^2 + (-5x) + (-9x) + 45 = 0$$

$$x(x - 5) - 9(x - 5) = 0$$

$$(x - 5)(x - 9) = 0$$

$$(x - 5) = 0$$

$$(x - 9) = 0$$

$$x = \boxed{}$$

$$x = \boxed{}$$

Check:

$$\boxed{} - 14(5) + 45 = 0$$

$$9^2 - 14(\boxed{}) + 45 = 0$$

$$25 - 70 + 45 = \boxed{} \checkmark$$

$$81 - 126 + 45 = \boxed{} \checkmark$$

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Finding the Roots of a Function by Factoring

Find the **roots** of the function $y = 6x^2 - 2x - 20$.

$$6x^2 - 2x - 20 = \boxed{}$$

$$\boxed{}(3x^2 - x - 10) = 0$$

$$2(3x^2 + (-6x) + 5x - 10) = 0$$

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

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

$$\boxed{} = 0 \qquad 3x + 5 = \boxed{}$$

$$x = \boxed{}$$

$$3x = -5$$

$$x = \boxed{}$$

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Checking the Solution by Graphing

- Enter $y = 6x^2 - 2x - 20$ into the graphing calculator.
- Locate the x -intercepts at $(-1.667, 0)$ and $(2, 0)$.
- $\frac{-5}{3}$ is about -1.667 . So, the solutions check.

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Solving a Real-World Problem

Shawn shoots a marble into the air from ground level. The function that models this scenario is $h(t) = -16t^2 + 48t$, where h is the height of the marble in feet and t is the time in seconds. How long until the marble hits the ground?

$$h(t) = \boxed{}$$

$$-16t^2 + 48t = 0$$

$$\boxed{} = 0$$

$$-16t = 0 \qquad t - 3 = 0$$

$$t = \boxed{} \qquad t = \boxed{}$$

One possible solution is $t = 0$. That's when the marble is being $\boxed{}$.

When $t = 3$ at 3 $\boxed{}$, that's when the marble is going to hit the ground.

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Writing a Quadratic Function

The **zeros of a function** are -4 and 2 . Write a possible quadratic function with these zeros.

$$\begin{array}{ll} x = -4 & x = 2 \\ x + 4 = 0 & x - 2 = 0 \end{array}$$

$$(\boxed{})(\boxed{}) = 0$$

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

One possible function is $f(x) = x^2 + 2x - 8$.

We can multiply through by a $\boxed{}$ and get the same zeros.

$$g(x) = 2(x^2 + 2x - 8)$$

$$g(x) = \boxed{}$$

This function still has zeroes of $x = -4$ $x = 2$.

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Writing a Quadratic Function

Write a quadratic function that has a double root of -6 .

$$\begin{array}{ll} x = \boxed{} & x = \boxed{} \\ (x + 6) = 0 & (x + 6) = 0 \end{array}$$

$$(x + 6)(x + 6) = 0$$

$$\boxed{} = 0$$

One possible function is $y = x^2 + 12x + 36$

Summary

Solving Quadratic Equations: Zero Product Property

**Lesson Question**

How is the property of multiplying by zero used to solve a quadratic equation?

**Answer**

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Review: Key Concepts

- If a product equals 0, then at least one of the must be .
- To solve a quadratic equation by factoring:
 1. Write the equation in standard form, setting one side equal to zero.
 2. Factor the polynomial.
 3. Apply the property.
 4. the resulting equations.
 5. the solutions for reasonableness.

Summary

Solving Quadratic Equations: Zero Product Property

Use this space to write any questions or thoughts about this lesson.