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Factoring to Solve Quadratic Equations

Unit 9 Lesson 4

FACTORING TO SOLVE QUADRATIC EQUATIONS

Students will be able to:

Understand how to solve quadratic equations by factoring the quadratic equations.

Key Vocabulary:

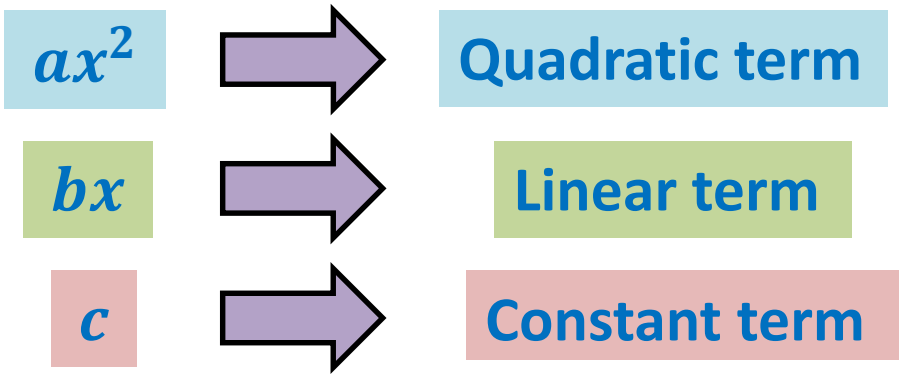
- Quadratic Equation
- Zero-Product Property
- Solution By Factorization

FACTORING TO SOLVE QUADRATIC EQUATIONS

A **quadratic equation** is of the form:

$$f(x) = ax^2 + bx + c = 0$$

Where, $a \neq 0$.



Zero-Product Property

This property is important when solving the quadratic equations.

If the product of two or more numbers is zero, one of them must be equal to zero.

$$ab = 0 \quad \Rightarrow \quad a = 0 \text{ or } b = 0$$

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Problem 1: What are the solutions of the quadratic equation $y = (x + 2)(x - 3)$?

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Apply the zero-product property:

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

$$(x + 2) = 0 \quad \text{or} \quad (x - 3) = 0$$

$$x = -2 \qquad x = 3$$

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Solution by Factorization

In this method, the middle term of the quadratic equation $ax^2 + bx + c = 0$ i.e. bx is re-written as a sum of two terms mx and nx such that:

$$(\pm mx) + (\pm nx) = (\pm bx)$$

$$(\pm mx) \times (\pm nx) = (\pm acx^2)$$

- The algebraic **sum** of two terms is equal to the middle term.
- The algebraic **product** of two terms is equal to the product of the quadratic term and the constant term.

After this, the equation can be simplified and written as $(x \pm m)(x \pm n) = 0$ and zero product property can be applied to find the values of x.

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Problem 2: Find the solution of the quadratic equation $x^2 - x - 6$.

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Break the middle term i.e. $-x$ into two terms such that their sum is $-x$ and product is $\mathbf{1x^2.(-6) = -6x^2.}$

Take $-3x$ and $2x$:

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

$(-3x) \times (2x) = (-6x^2)$

$x^2 - x - 6 = 0$ $\Rightarrow$ $x^2 + 2x - 3x - 6 = 0$ $\Rightarrow$ $x(x+2) - 3(x+2) = 0$

$\Rightarrow$ $(x-3)(x+2) = 0$ $\Rightarrow$ $(x-3) = 0$ or $(x+2) = 0$

$\Rightarrow$ $x = 3, -2$