Lesson 2: 4.2 Factoring Quadratic Equation

Any quadratic equation can be written in the **standard form** \( ax^2 + bx + c = 0 \); we already learned that we can solve the equations by graphing the corresponding functions.

We can also sometimes solve a quadratic equation by factoring.

Recall that, when a number is multiplied by zero, the result is always zero.

The **zero product property** states that, if the product of two real numbers is zero, then *one or both* of the numbers must be zero.

- Thus, if \( ab = 0 \),
- then \( a = 0 \), or \( b = 0 \),
- or both \( a \) and \( b \) are equal to zero.

You will be able to solve some quadratic equations by writing them in standard from, and then factoring and setting each factor equal to zero. For the equation \( x^2 + 2x - 3 = 0 \):

\[
x^2 + 2x - 3 = 0 \\
(x+3)(x-1) = 0 \\
(x+3) = 0 \quad (x-1) = 0 \\
x = -3 \quad x = 1 \\
\]

*apply the zero product property*

*solve for \( x \) in each product*

*state the solutions*

*test solutions to ensure they are correct*

\[
x^2 + 2x - 3 = 0 \\
x = -3 \quad x = 1
\]
Example 1: Solving by Factoring

Solve each of the following equations by factoring:

a) \(x^2 + 5x + 6 = 0\)

b) \(x^2 - 3x - 4 = 0\)

c) \(x^2 + 2 = 3x\)
Example 2: Solving by Factoring

a) Solve and check \(2x^2 + 14x + 24 = 0\).

i) Check to remove a common factor.

ii) Factor the left side of the equation.

iii) Use the zero product property.

iv) Check your work against the original equation.

b) Solve and check \(-6x^2 + 3x + 18 = 0\).

i) Check to remove a common factor.

ii) Factor the left side of the equation.

iii) Use the zero product property.

iv) Check your work against the original equation.

Hint: make sure that when you remove a common factor, \(ax^2\) is positive.
c) Solve and check $\frac{3}{10}x^2 + \frac{11}{10}x + 2 = 0$

i) Check to remove a common factor.

ii) Factor the left side of the equation.

iii) Use the zero product property.

iv) Check your work against the original equation.

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d) Solve and check $-\frac{1}{6}b^2 - \frac{1}{6}b + 2 = 0$

i) Multiply the equation by the lowest common denominator.

ii) Now remove the common factor.

iii) Factor the left side of the equation.

iv) Use the zero product property.

v) Check your work against the original equation.
Example 3: Solving by Factoring

Solve $2x^2 + 3 = 5x + 1$. Check your solution by substitution AND by graphing.
Example 4: Factoring When c=0

Solve $3x^2 + 5x = 0$. Check your solution by substitution AND by graphing.

i) remove the common factor

ii) Use the zero product property.
Example 5: Dimensions of a Soccer Pitch

The length of a soccer pitch is 20m less than twice its width. The area of the pitch is 6000 m². Find its dimensions.

Step 1: Create your equation

Let...

Step 2: Solve the equation

Step 3: Check your solutions.
Example 6: Writing an Equation

a) Write an equation whose roots are -5 and 3.

b) A quadratic function has x-intercepts of -1/2 and 4/3. Determine the equation for the function.

c) The solutions for a quadratic equation are -1/3 and 2. What is the equation?