

Lesson 29 (6.2 and 6.5): Solving Quadratics by Factoring

By the end of the lesson, we will be able to:

x^2

- ~Solve Quadratic Equations by Factoring
(Find Roots)
- ~Take the Roots and get the original
Quadratic Equation

Lesson 29 (6.2 and 6.5): Solving Quadratics by Factoring

If the product of two numbers is *zero*,
what do you know about the numbers?

Why?

Zero Product Property: If $a \cdot b = 0$,
then either $a = 0$ or $b = 0$, or both.

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Zero Product Property: If $a \cdot b = 0$,
★ then either $a = 0$ or $b = 0$, or both.

This property can be used to solve quadratic equations. Quadratic means the variable is squared (x^2). Quadratic equations can have up to 2 solutions. Sometimes the solutions are called roots or zeros.

Lesson 29 (6.2 and 6.5): Solving Quadratics by Factoring

Steps for solving quadratic equations by factoring:

1. Move all terms to one side of the equation so the equation is set to zero.
2. Factor the polynomial.
3. Set each factor equal to zero.
4. Solve each new equation.

Example 1:

$$\begin{array}{r} -7 \cdot 4 = -28 \\ -7 + 4 = -3 \end{array}$$

a.) $x^2 - 3x - 28 = 0$

$$(x-7)(x+4)=0$$

$$\begin{array}{r} x-7=0 \\ +7 \quad +7 \\ \hline \end{array}$$

$$x=7$$

$$\begin{array}{r} x+4=0 \\ -4 \quad -4 \\ \hline \end{array}$$

$$x=-4$$

$$\begin{array}{l} x=7 \quad x=-4 \\ \text{or} \\ x=7, -4 \end{array}$$

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Steps for solving quadratic equations by factoring:

1. Move all terms to one side of the equation so the equation is set to zero.
2. Factor the polynomial.
3. Set each factor equal to zero.
4. Solve each new equation.

$$\begin{array}{l} \underline{6} \cdot \underline{-2} = -12 \\ \underline{6} + \underline{-2} = 4 \end{array}$$

Example 1:

$$\text{b.) } x^2 + 4x = 12$$
$$\underline{-12 \quad -12}$$

$$x^2 + 4x - 12 = 0$$

$$(x+6)(x-2) = 0$$

$$\begin{array}{cc} \begin{array}{c} x+6=0 \\ \underline{-6 \quad -6} \\ x=-6 \end{array} & \begin{array}{c} x-2=0 \\ \underline{+2 \quad +2} \\ x=2 \end{array} \\ \hline \boxed{x=-6 \quad x=2} \end{array}$$

or

$$x = -6, 2$$

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Example 1:

$$\text{c.) } 3m^2 - 13m = 10$$

$\begin{array}{cc} -10 & -10 \end{array}$

$$\underline{3m^2 - 13m - 10 = 0}$$

$$\underline{3m^2 - 15m} + \underline{2m - 10} = 0$$

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

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

$$\underline{-15} \cdot \underline{2} = -30$$

$$\underline{-15} + \underline{2} = -13$$

$$\begin{array}{r} m-5=0 \\ +5 \quad +5 \\ \hline \end{array}$$

$$\boxed{m=5}$$

$$\begin{array}{r} 3m+2=0 \\ -2 \quad -2 \\ \hline \end{array}$$

$$\frac{3m}{3} = \frac{-2}{3}$$

$$\boxed{m = -\frac{2}{3}}$$

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Example 1:

d.) $3m^2 - 13m = -10$

Lesson 29 (6.2 and 6.5): Solving Quadratics by Factoring

Example 1:

e.) $3x^2 + 12x = 0$

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

$$\begin{array}{r} 3x=0 \\ \hline 3 \quad 3 \end{array}$$

$$\begin{array}{r} x+4=0 \\ \hline -4 \quad -4 \end{array}$$

$$\boxed{x=0}$$

$$\boxed{x=-4}$$

f.) $x^2 - 9 = 0$

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

$$\begin{array}{r} x+3=0 \\ \hline -3 \quad -3 \end{array}$$

$$\begin{array}{r} x-3=0 \\ \hline +3 \quad +3 \end{array}$$

$$\boxed{x=-3 \quad x=3}$$

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Example 1:

$$\begin{array}{r} g.) 16x^2 = 49 \\ -49 \quad -49 \\ \hline \end{array}$$

$$16x^2 - 49 = 0$$

$$(4x + 7)(4x - 7) = 0$$

$$\begin{array}{r} 4x + 7 = 0 \\ -7 \quad -7 \\ \hline \end{array}$$

$$\begin{array}{r} 4x = -7 \\ \frac{4x}{4} = \frac{-7}{4} \\ \boxed{x = -\frac{7}{4}} \end{array}$$

$$\begin{array}{r} 4x - 7 = 0 \\ +7 \quad +7 \\ \hline \end{array}$$

$$\begin{array}{r} 4x = 7 \\ \frac{4x}{4} = \frac{7}{4} \\ \boxed{x = \frac{7}{4}} \end{array}$$

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Example 1: *Take note of the powers...*

$$\text{h.) } 35x^3 + 16x^2 = 12x$$
$$\quad \quad \quad -12x \quad -12x$$

$$35x^3 + 16x^2 - 12x = 0$$

$$x (35x^2 + 16x - 12) = 0$$

$$x \left(\underbrace{35x^2 + 30x}_{\text{red}} - \underbrace{14x - 12}_{\text{red}} \right) = 0$$

$$x \left(5x(7x+6) - 2(7x+6) \right) = 0$$

$$x (7x+6)(5x-2) = 0$$

$$x=0 \quad 7x+6=0 \quad 5x-2=0$$

$$\underline{30} \cdot \underline{-14} = -420$$

$$\underline{30} + \underline{-14} = 16$$



$$X=0$$

$$\begin{array}{r} 7X+6=0 \\ -6 \quad -6 \\ \hline \end{array}$$

$$\begin{array}{r} 7X=-6 \\ \hline 7 \quad 7 \end{array}$$

$$\begin{array}{r} 5X-2=0 \\ +2 \quad +2 \\ \hline \end{array}$$

$$\begin{array}{r} 5X=2 \\ \hline 5 \quad 5 \end{array}$$

$$X=0$$

$$X = -\frac{6}{7}$$

$$X = \frac{2}{5}$$

Lesson 29 (6.2 and 6.5): Solving Quadratics by Factoring

You can use the reverse process to create quadratic equations when given the **solutions**.

How to write a quadratic equation when given the solutions:

1. Set x equal to each solution.
2. If the solution is a fraction, multiply both sides by the denominator so you have integers.
3. Move the term over so the equation is set to zero.
4. Write the expression in parentheses. Repeat for the other solution(s).
5. Multiply the expressions. (Usually this means you will FOIL).

Lesson 29 (6.2 and 6.5): Solving Quadratics by Factoring

Example 2: Write a quadratic equation that has the given roots.

a.) 7, -3

$$\begin{array}{r} x=7 \\ -2-7 \\ \hline \end{array} \quad \begin{array}{r} x=-3 \\ +3+3 \\ \hline \end{array}$$

$$x-7=0 \quad x+3=0$$

$$(x-7)(x+3)=0$$

$$x^2 + 3x - 7x - 21 = 0$$

$$\boxed{x^2 - 4x - 21 = 0}$$

b.) -5, 5

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Example 2: Write a quadratic equation that has the given roots.

c.) $-\frac{2}{3}, -\frac{4}{5}$

$3 \cdot x = -\frac{2}{3} \cdot 3 \quad x = -\frac{4}{5} \cdot 5$

$$\begin{array}{r} 3x = -2 \\ +2 \quad +2 \\ \hline \end{array}$$

$$3x + 2 = 0$$

$$\begin{array}{r} 5x = -4 \\ +4 \quad +4 \\ \hline \end{array}$$

$$5x + 4 = 0$$

$$(3x + 2)(5x + 4) = 0$$

$$15x^2 + 12x + 10x + 8 = 0$$

$$15x^2 + 22x + 8 = 0$$

d.) 0, 6

$$x = 0$$

$$\downarrow$$

$$x = 0$$

$$x = 6$$

$$\begin{array}{r} -6 \quad -6 \\ \hline \end{array}$$

$$x - 6 = 0$$

$$(x)(x - 6) = 0$$

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

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Example 2: Write a quadratic equation that has the given roots.

e.) $-3i, 3i$ f.) $4, \frac{1}{3}$

$$\begin{array}{r} x = -3i \quad x = 3i \\ +3i \quad +3i \\ \hline \end{array}$$

$$x + 3i = 0 \quad x - 3i = 0$$

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

$$x^2 - \cancel{3xi} + \cancel{3xi} - 9i^2 = 0$$
$$\boxed{x^2 + 9 = 0}$$

$-9(-1)$

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Quadratic Equation

CAN YOU?

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Homework:

Assignment 29 + Test 7 Review

