Lesson 3.3: Solving by Factoring

How To Solve by Factoring

1. **Set the equation equal to 0.**
2. **Factor as much as possible**
3. **Set each factor equal to 0 and solve for x.**

Use the Quadratic Formula when you have a

quadratic (that doesn't factor) in the form of $ax^2 + bx + c$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

How to Know When to Use What Method

1. Grouping Method: 4 terms
2. Diagram/Bottoms Up: 3 terms (highest exponent is twice as big as middle term's exponent)
3. Perfect Squares: 2 terms
4: Perfect cubes: 2 terms
5. Synthetic Division: Every other method fails

9) $x^4 + 5x^3 + 4x^2 = 0$

① Done

② $x^2(x^2 + 5x + 4) = 0$

$x^2(x + 4)(x + 1) = 0$

③

$x^2 = 0$

$x = 0$

$x + 4 = 0$

$x = -4$

$x + 1 = 0$

$x = -1$

7) $2x^3 + 3x^2 - 6x = 9$

$-9 \quad -9$

① $2x^3 + 3x^2 - 6x - 9 = 0$

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

② $(2x+3)(x^2-3) = 0$

③ $2x+3=0$

$-3 \quad -3$

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

$x = -3/2$

$x^2 - 3 = 0$

$+3 \quad +3$

$\sqrt{x^2} = \sqrt{3}$

$x = \pm\sqrt{3}$

$\sqrt{3}$ — 3, 1

Simplify:

$\sqrt{8}$ — 2, 4, (2, 2)

$2\sqrt{2}$

$\sqrt{12}$ — 6, 3, 2, 2

$\boxed{2\sqrt{3}}$

10) $3x^4 - 5x^2 - 2 = 0$

① Done ✓

② $x^4 - 5x^2 - 6$

$(x^2 - \frac{6}{3})(x^2 + \frac{1}{3})$

$(x^2 - 2)(3x^2 + 1) = 0$

③

$x^2 - 2 = 0$

$\sqrt{x^2} = \sqrt{2}$

$x = \pm\sqrt{2}$; 2

$3x^2 + 1 = 0$

$\frac{3x^2}{3} = \frac{-1}{3}$

$\sqrt{x^2} = \sqrt{-\frac{1}{3}}$

$x = \pm\sqrt{-\frac{1}{3}} = \pm i\sqrt{\frac{1}{3}}$

11) $x^3 + 7x^2 + 6 = -14x$

$+14x \quad +14x$

① $x^3 + 7x^2 + 14x + 6 = 0$

② $x^2(x+7) + 2(7x+3)$

-3	1	7	14	6
	↓	-3	-12	-6
	1	4	2	0

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

③ $x+3=0$

$x=-3$

$a=1 \quad b=4 \quad c=2$

$$x = \frac{-4 \pm \sqrt{4^2-4(1)(2)}}{2(1)}$$

$$x = \frac{-4 \pm \sqrt{8}}{2}$$

$8 = 4 \cdot 2$

$\sqrt{4}\sqrt{2} = 2\sqrt{2}$

$$x = \frac{-4 \pm 2\sqrt{2}}{2}$$

$$= -2 \pm \sqrt{2}$$

19) $x^5 = x^6 + x^5 + 8x^3$

$-x^5 \quad -x^5$

$a^3+b^3 = (a+b)(a^2-ab+b^2)$

$x = \dfrac{-b \pm \sqrt{b^2-4ac}}{2a}$

① $0 = x^6 + 8x^3$

② $0 = x^3(x^3+8)$

$a = \sqrt[3]{x^3} = x$

$b = \sqrt[3]{8} = 2$

$x^3(x+2)(x^2-2x+4) = 0$

③

$x^3 = 0$

$x = 0$

$x+2 = 0$

$x = -2$

$a = 1 \quad b = -2, \quad c = 4$

$x = \dfrac{2 \pm \sqrt{(-2)^2 - 4(1)(4)}}{2(1)}$

$= \dfrac{2 \pm \sqrt{-12}}{2}$ $\quad \sqrt{4}\sqrt{3}$

$= \dfrac{2 \pm 2\sqrt{-3}}{2} = 1 \pm i\sqrt{3}$