

Name: Key

Algebra II

Period: _____

Solving Polynomial Equations

Solving Polynomial Equations by factoring	1.) MOVE ALL TERMS to one side and set the equation EQUAL TO 0 . 2.) FACTOR the polynomial completely! 3.) SET EACH FACTOR EQUAL TO 0 and SOLVE for each x-value. -For quadratic equations, solve by square roots or the quadratic formula - SIMPLIFY all irrational and complex solutions!
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Directions: Solve each equation by factoring.

1.) $x^3 - x = 0$

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

$$x(x+1)(x-1) = 0$$

$$\therefore \boxed{x=0} \quad \begin{array}{l} x+1=0 \\ -1 \quad -1 \end{array} \quad \begin{array}{l} x-1=0 \\ +1 \quad +1 \end{array}$$

$$\boxed{x=-1} \quad \boxed{x=1}$$

2.) $4x^3 - 7x = 2x$

$$4x^3 - 9x = 0$$

$$x(4x^2 - 9) = 0$$

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

$$\boxed{x=0} \quad \begin{array}{l} 2x+3=0 \\ x=-3/2 \end{array} \quad \begin{array}{l} 2x-3=0 \\ x=3/2 \end{array}$$

3.) $x^4 - 256 = 0$ *Difference of squares*

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

$$(x^2 + 16)(x+4)(x-4) = 0$$

$$x^2 + 16 = 0 \quad x+4 = 0 \quad x-4 = 0$$

$$\sqrt{x^2} = \sqrt{-16} \quad \boxed{x=-4} \quad \boxed{x=4}$$

$$\boxed{x = \pm 4i}$$

4.) $5x^5 - 80x = 0$

$$5x(x^4 - 16) = 0$$

$$5x(x^2 + 4)(x^2 - 4) = 0$$

$$5x(x^2 + 4)(x+2)(x-2) = 0$$

$$5x = 0, x^2 + 4 = 0, x+2 = 0, x-2 = 0$$

$$\boxed{x=0} \quad \begin{array}{l} x^2 = -4 \\ x = \pm 2i \end{array} \quad \boxed{x=-2} \quad \boxed{x=2}$$

5.) $x^3 + 125 = 0$

$$(x+5)(x^2 - 5x + 25) = 0$$

$$x+5 = 0 \quad x^2 - 5x + 25 = 0$$

$$\boxed{x=-5} \quad \frac{5 \pm \sqrt{(5)^2 - 4(1)(25)}}{2(1)}$$

$$\frac{5 \pm \sqrt{25 - 100}}{2}$$

$$\Rightarrow \boxed{x = \frac{5 \pm 5i\sqrt{3}}{2}}$$

6.) $8x^3 - 5 = -4$

$$8x^3 - 1 = 0$$

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

$$2x-1 = 0 \quad 4x^2 + 2x + 1 = 0$$

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

$$\frac{-2 \pm \sqrt{-12}}{8} \Rightarrow \frac{-2 \pm 2i\sqrt{3}}{8} \therefore \boxed{x = \frac{-1 \pm i\sqrt{3}}{4}}$$

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7.) $x^4 - x^2 - 72 = 0$

$$(x^2 - 9)(x^2 + 8) = 0$$

$$(x+3)(x-3)(x^2+8) = 0$$

$$x+3=0, x-3=0, x^2+8=0$$

$$\boxed{x=-3} \quad \boxed{x=3} \quad \sqrt{x^2} = \sqrt{-8}$$

$$\boxed{x = \pm 2i\sqrt{2}}$$

$$\begin{array}{r} -72 \\ -9 \quad 8 \\ -1 \end{array}$$

8.) $4x^4 + 3 = 5 - 7x^2$

$$+7x^2 - 5 + 5 + 7x^2$$

$$4x^4 + 7x^2 - 2 = 0$$

$$(4x^4 + 8x^2)(x^2 - 2) = 0$$

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

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

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

$$x^2 = -2 \quad \therefore \boxed{x = \pm i\sqrt{2}}$$

$$\begin{array}{r} -8 \\ 8 \quad -1 \\ 7 \end{array}$$

$$2x+1=0$$

$$\therefore \boxed{x = -1/2}$$

$$2x-1=0$$

$$\therefore \boxed{x = 1/2}$$

9.) $(x^3 + 2x^2 - 9x - 18) = 0$

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

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

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

$$x+3=0 \quad x-3=0 \quad x+2=0$$

$$\therefore \boxed{x=-3} \quad \boxed{x=3} \quad \boxed{x=-2}$$

10.) $(2x^3 - 3x^2 - 32x + 48) = 0$

$$x^2(2x-3) - 16(2x-3) = 0$$

$$(x^2 - 16)(2x-3) = 0$$

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

$$x+4=0, x-4=0, 2x-3=0$$

$$\boxed{x=-4} \quad \boxed{x=4} \quad \boxed{x=3/2}$$