More Factoring Strategies
Unit 4 Day 3

10) $x^2 + 81$

$(x + 9)(x + 9)$

$x^2 + 9x + 9x + 81$

$x^2 + 18x + 81$

$x^2 + 81$

$(x + 9i)(x - 9i)$

$x^2 - 9ix + 9ix - 81i^2$

$x^2 + 81$

$-81 \cdot -1 = 81$

9) $x \cdot x \cdot x$ $\overset{\downarrow}{6 \cdot 6 \cdot 6}$

$x^3 + 216$

$(x+6)(x^2 - 6x + 36)$

18) write cubic function
      2, 3, 4

$f(x) = (x-2)(x-3)(x-4)$

crosses @ -8

$\cdots \cdot \cdot \cdot \cdot \cdot \cdot$ -24

23) Quartic degree 4
      5, -5, 0 (mult 2)

$(x-5)(x+5)(x-0)(x-0)$

$(x-5)(x+5)(x)(x)$

$x^2 (x-5)(x+5)$

No matter what you are factoring, look for a **Greatest Common Factor** FIRST!!!

Factor out the GCF

$7x^2 - 28$	$7(x^2 - 4) \qquad 7(x+2)(x-2)$
$2x^3 - 9x^2$	$x^2(2x - 9)$
$5x^2 - 35x$	$5x(x - 7)$
$8x^3 - 40x^2 - 16x$	$8x(x^2 - 5x - 2)$
$3x^3 + 27x^2 - 3x - 27$	$3(x^3 + 9x^2 - x - 9)$
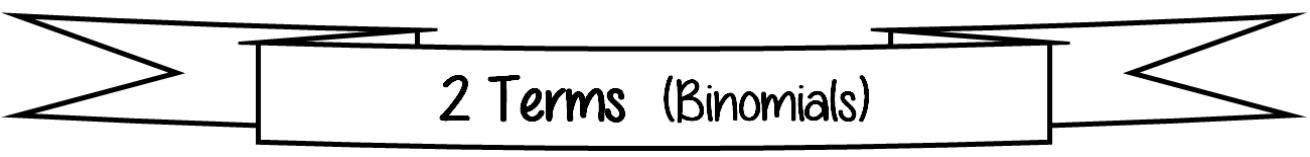
2 Terms (Binomials)

- **Sum or Difference of Squares**

$$98x^2 - 8$$

$2(49x^2 - 4)$
$2(7x+2)(7x-2)$

$$9x^2 + 121 = 0$$

$(3x+11i)(3x-11i)=0$

$3x+11i=0$ or $3x-11i=0$

$x=\dfrac{-11}{3}i$ $\qquad$ $x=\dfrac{11i}{3}$
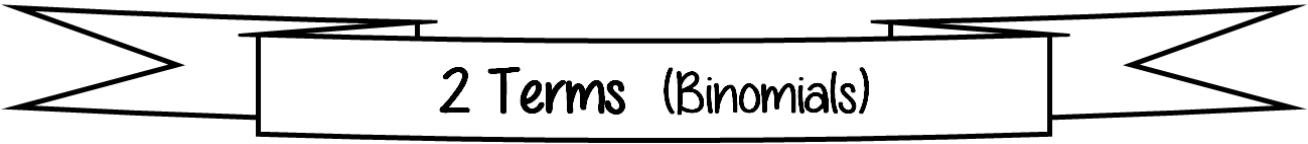
2 Terms (Binomials)

- ## Sum or Difference of Cubes

$x \cdot x \cdot x$ $7 \cdot 7 \cdot 7$

$$x^3 - 343$$

$(x - 7)(x^2 + 7x + 49)$

$$64x^4 + x$$

$4 \cdot 4 \cdot 4 \quad x \cdot xx \quad 1 \cdot 1 \cdot 1$

$x(64x^3 + 1)$

$x\left(4x + 1\right)\left(16x^2 - 4x + 1\right)$
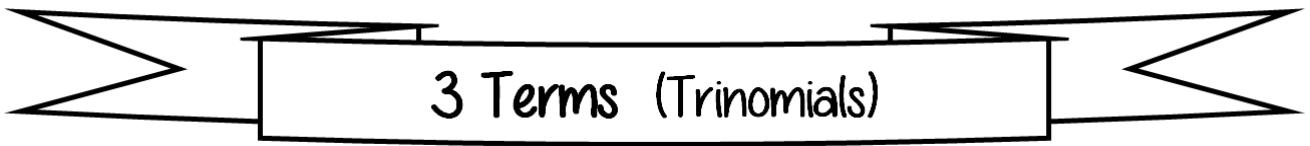
3 Terms (Trinomials)

- # Quadratic (a = 1)

  $$x^2 + 5x - 36$$

- # Quadratic (a ≠ 1)

  $$10x^2 - 11x - 6$$

- # Quadratic Type **New!**

  $x^2 \quad x^2$

  $$x^4 - 4x^2 - 12$$

  $\begin{matrix} 1:12 \\ 2:6 \\ 3:4 \end{matrix}$

  $$\left(x^2 + 2\right)\left(x^2 - 6\right)$$

3 Terms (Trinomials)
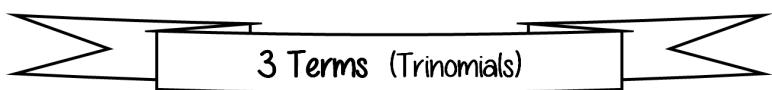
- **Quadratic (a = 1)**

$$x^2 + 5x - 36$$

$$2x^3 + 10x^2 - 28x$$

3 Terms (Trinomials)
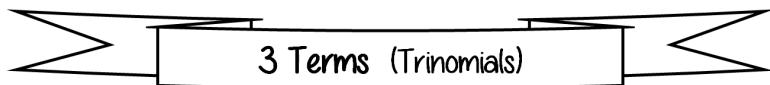
- ## Quadratic (a ≠ 1)

$$10x^2 - 11x - 6$$

$$12x^3 - 25x^2 + 12x$$

3 Terms (Trinomials)

- **Quadratic Type**

New!
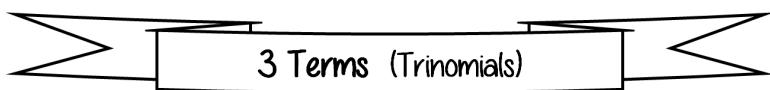
$$x^4 - 4x^2 - 12$$

$$2x^4 + 14x^2 - 60$$

$$2(x^4 + 7x^2 - 30)$$

$$2(x^2 - 3)(x^2 + 10)$$

1·30
2·15
3·10
5·6

Solve for x. $x^4 - 5x^2 + 4 = 0$

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

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

$$x = -1 \quad x = 1 \quad x = -2 \quad x = 2$$

$$x^2 - 1 = 0$$
$$\underline{+1 \quad +1}$$
$$\sqrt{x^2} = \sqrt{1}$$
$$x = \pm 1$$
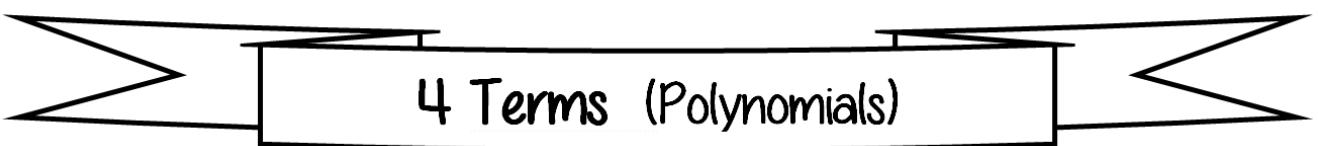
$$x^2 - 4 = 0$$
$$\sqrt{x^2} = \sqrt{4}$$
$$x = \pm 2$$

4 Terms (Polynomials)

- ## Factor by Grouping *New!*

This is not in your notes! Just watch!

$$5x^3 + 10x^2 + 3x + 6$$

$$5x^2(x+2) + 3(x+2)$$

$$(x+2)(5x^2+3)$$

4 Terms (Polynomials)

New!
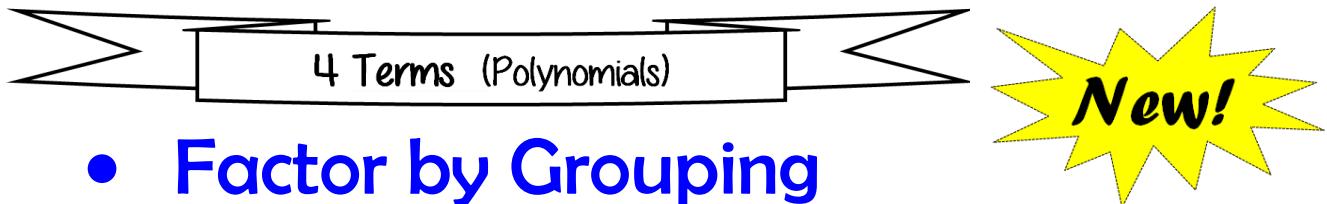
- **Factor by Grouping**

$$3x^4 - 18x^3 + 4x - 24$$

$$3x^3(x - 6) + 4(x - 6)$$

$$(x - 6)(3x^3 + 4)$$

$$x^3 + 5x^2 - 4x - 20 = 0$$

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

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

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

$$x = -5 \quad x = -2 \quad x = 2$$

4 Terms (Polynomials)
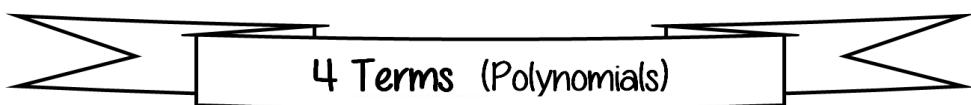
- ## When Grouping Doesn't Work

$$x^3 + 5x^2 + 5x + 15$$

$$x^2(x+5) + 5(x+3)$$

$$x^3 - 4x^2 - 20x + 48$$

$$x^2(x-4) - 4(5x-12)$$

After you have factored, always scan to see if any of the factors can be factored a little more...

Solve for x.

$$4x^3 - 8x^2 = 49x - 98$$
$$-49x + 98 \quad -49x \quad +98$$

$$\underbrace{4x^3 - 8x^2}\ \underbrace{-49x + 98} = 0$$

$$4x^2(x-2) - 49(x-2) = 0$$

$$(x-2)(4x^2 - 49) = 0$$

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

$$x = 2 \qquad x = \frac{-7}{2} \qquad x = \frac{7}{2}$$