# POLYNOMIALS

- many terms (1 or more)
- whole # powers

## Solving by Factoring

$$3x^3 + x^2 = x^4 + 3x$$

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

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

$$0 = x[x^2(x-3) - 1(x-3)]$$

$$0 = x[(x-3)(x^2-1)]$$

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

$$\boxed{x = 0, 3, -1, 1}$$

## 2 terms

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

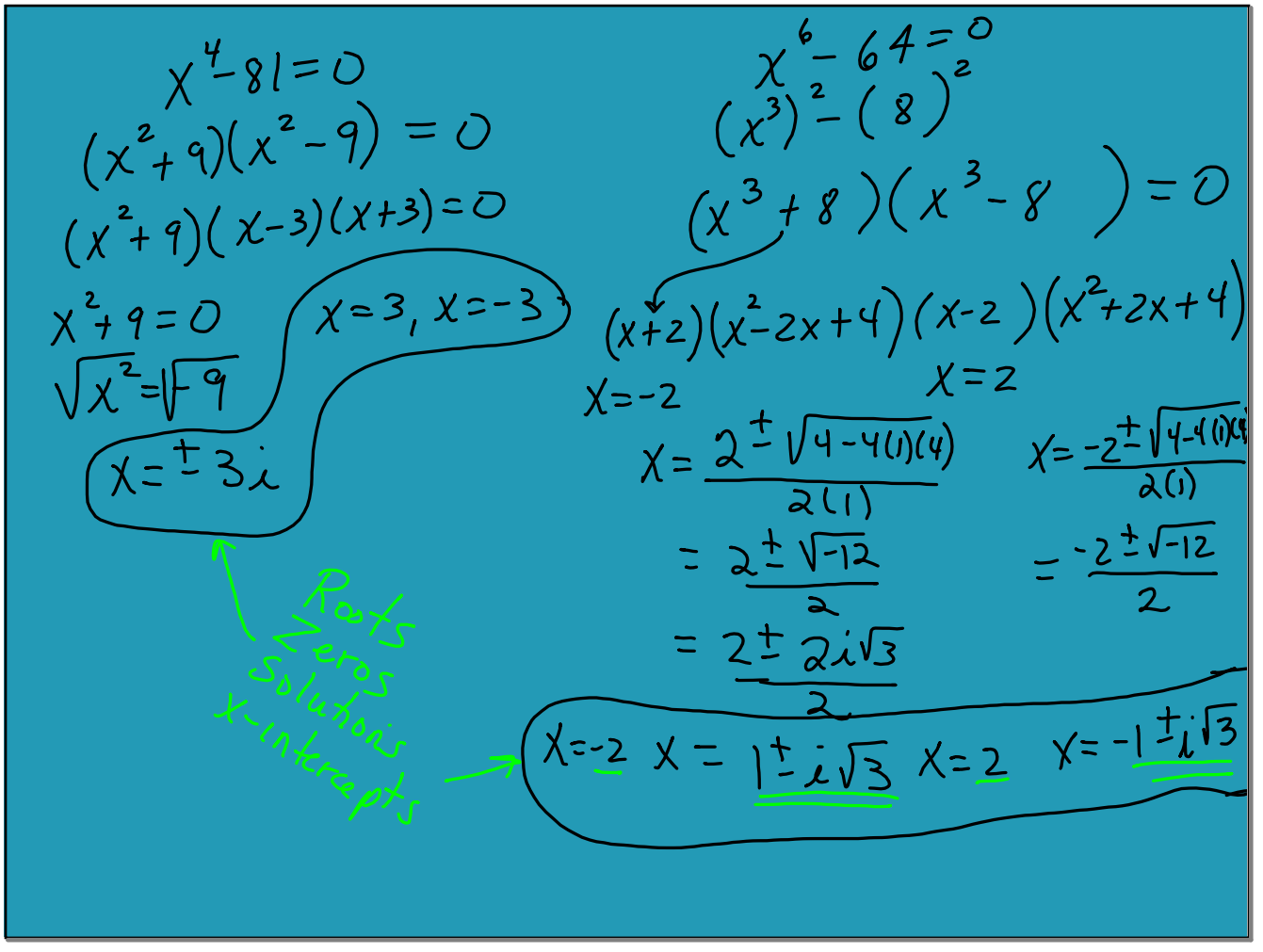
$$a^2 + b^2 = a^2 + b^2$$

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

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

## 3 terms UNFOIL

## 4 terms Grouping


$x^4 - 81 = 0$
$(x^2+9)(x^2-9) = 0$
$(x^2+9)(x-3)(x+3) = 0$
$x^2+9=0$
$\sqrt{x^2} = \sqrt{-9}$
$x = \pm 3i$
$x = 3, x = -3$
Roots
Zeros
Solutions
x-intercepts
$x^6 - 64 = 0$
$(x^3)^2 - (8)^2$
$(x^3+8)(x^3-8) = 0$
$(x+2)(x^2-2x+4)(x-2)(x^2+2x+4)$
$x = -2$
$x = 2$
$x = \frac{2 \pm \sqrt{4-4(1)(4)}}{2(1)}$
$= \frac{2 \pm \sqrt{-12}}{2}$
$= \frac{2 \pm 2i\sqrt{3}}{2}$
$x = \frac{-2 \pm \sqrt{4-4(1)(4}}{2(1)}$
$= \frac{-2 \pm \sqrt{-12}}{2}$
$x = -2$ $x = 1 \pm i\sqrt{3}$ $x = 2$ $x = -1 \pm i\sqrt{3}$

Given the roots, find a possible equation. (Reverse factoring)

Roots: $2, -\frac{3}{5}$

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

$x - 2 = 0$ $\quad 5x = -3$

$5x + 3 = 0$

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

$\boxed{5x^2 - 7x - 6 = 0}$

Roots: $x = 3 + \sqrt{2}$ $\quad x = 3 - \sqrt{2}$

$x - 3 - \sqrt{2} = 0$ $\quad x - 3 + \sqrt{2} = 0$

$(x - 3 - \sqrt{2})(x - 3 + \sqrt{2}) = 0$

$(x-3)^2 - \sqrt{4} = 0$ (Firsts, Outers, Inners, Lasts)

FOIL!

$x^2 - 6x + 9 - 2 = 0$

$\boxed{x^2 - 6x + 7 = 0}$

# Solve polynomial inequalities

(Solutions in interval notation.)

$x^2 + 3x \geq 18$

$x^2 + 3x - 18 \geq 0$

+ Test Points!

1) Set $< 0$ or $> 0$
2) Factor
3) Test Points

$(x+6)(x-3) \geq 0$

$x = -6 \quad x = 3$


$(-\infty, -6] \cup [3, \infty)$

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