

Solving equations by graphing:

Solve this equation: $x^3 + x^2 - 5x + 1 = -2x - 3$

Method 1:
Finding Intersections

Graph the two sides
of the equation as separate
graphs Y_1 and Y_2 .

$$Y_1 = x^3 + x^2 - 5x + 1$$

$$Y_2 = -2x - 3$$

You only get one answer from the graph:

$$x = -2.68$$

Method 2:
Finding Zeros

Move everything to one
side of the equation so
the other side = 0

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

A polynomial of degree n has exactly n solutions.

Some of these solutions may be imaginary!

Only real solutions show up on a graph.

Find all 3 solutions to this polynomial:

$$x^3 + 3x^2 - 4x - 11 = 0$$

From the graph:

$$x = -3.17, -1.78, 1.95$$

Find all 3 solutions to this polynomial:

$$x^3 - 2x^2 + 7x - 14 = 0$$

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

$$x^2 + 7 = 0$$

$$\sqrt{x^2} = \sqrt{-7}$$

$$x = \pm i\sqrt{7}, 2$$

	x	-2
x^2	x^3	$-2x^2$
$+7$	$+7x$	-14

Difference of Perfect Squares:

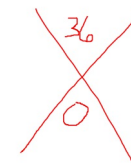
$$49x^2 - 100 = (7x + 10)(7x - 10)$$

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

Sum of Perfect Squares:

$$x^2 + 36 \text{ This doesn't factor!}$$

$$a^2 + b^2 \text{ never factors!}$$



No two numbers multiply to 36 and add to 0.

$$x^3 - 8$$

this isn't the difference of Perfect Squares but it is the Difference of Perfect Cubes.

Difference of Perfect Cubes:

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

$$\begin{array}{l} \downarrow \quad \downarrow \\ x^3 - 8 = (x - 2)(x^2 + 2x + 4) \\ a = x \\ b = 2 \end{array}$$

Perfect Cubes:

$$1^3 = 1$$

$$2^3 = 8$$

$$3^3 = 27$$

$$4^3 = 64$$

$$5^3 = 125$$

Unlike the Sum of Perfect Squares, the Sum of Perfect Cubes **does** factor:

$$x^3 + 27 =$$

Sum of Perfect Cubes:

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

$$\begin{array}{l} x^3 + 27 = (x + 3)(x^2 - 3x + 9) \\ a = x \\ b = 3 \end{array}$$