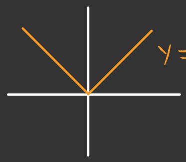
Warm up

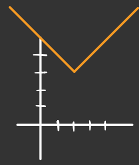
Use the parent graph, $y=|x|$, to graph $y=|x-2|+3$



$y=|x|$

translate right 2 units

translate up 3 units



$y=|x-2|+3$

Absolute Values

- $|-5| = x$ $\quad x=5$
- $|5| = x$ $\quad x=5$
- $|x| = 5$ $\quad x=5$ or $x=-5$

In general, for $a>0$

$$|x| = a \implies x=a \text{ or } x=-a$$

Ex

① $|x-3|-1=4$

$$|x-3|=5$$

$x-3=5$ or $x-3=-5$

$x=8$ or $x=-2$

$|8-3|-1 = |5|-1 = 5-1 = 4$ ✓

$|-2-3|-1 = |-5|-1 = 5-1 = 4$ ✓

② $|7x-4|=8$

$7x-4=8$ or $7x-4=-8$

$7x=12$ $\quad 7x=-4$

$x=\frac{12}{7}$ or $x=-\frac{4}{7}$

Inequalities: For $a>0$

$|x| < a$ (or $\leq$) $\Longrightarrow$ $x<a$ **and** $x>-a$ $\quad -a<x<a$

$(-a, a)$

$|x| > a$ (or $\geq$) $\Longrightarrow$ $x<-a$ **or** $x>a$

$(-\infty, -a) \cup (a, \infty)$

Ex

③ $|5-2x| \geq 1$

$5-2x \leq -1$ or $5-2x \geq 1$

$-2x \leq -6$ $\quad -2x \geq -4$

$x \geq 3$ $\quad x \leq 2$

Dividing/Multiplying by -1 swaps inequality

$(-\infty, 2] \cup [3, \infty)$

④ $|3x+2| < 5$

$-5 < 3x+2 < 5$

$-7 < 3x < 3$

$-\frac{7}{3} < x < 1$

$(-\frac{7}{3}, 1)$

⑤ $|2x-4| < -6$

No solution

Polynomials

A polynomial is a function of the form

$$P(x) = a_n x^n + a_{n-1} x^{n-1} + \cdots + a_1 x + a_0$$

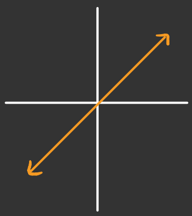
English: Each term is a constant and a variable to an integer power.

Polynomials	Not Polynomials
$f(x) = x^2$	$f(x) = \frac{2}{x} + 5$
$f(x) = x - 1$	$f(x) = 7x^{-1}$
$f(x) = 9x^3 - \frac{1}{12}x^2 + 1$	$f(x) = \sqrt{x} - 6$
$f(x) = -7$	$f(x) = e^x$

The first nonzero term of a polynomial (the x w/ the biggest exponent) is called the <u>leading term</u> and n (exponent) is its <u>degree</u>.

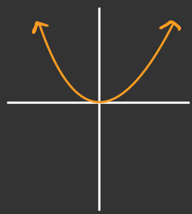
Why do we care? It tells us generally what they look like.

x



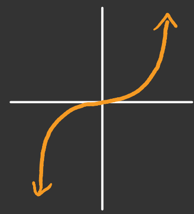
linear

x^2



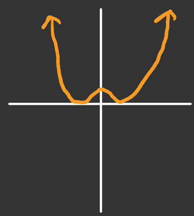
quadratic

x^3

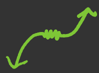
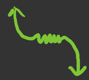


cubic

x^4

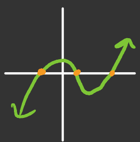


quartic

n	$a_n > 0$	$a_n < 0$
even		
odd		

x^5

X-intercepts



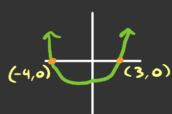
X-intercepts are points where y is 0. X's that satisfy this are called <u>zeros</u>

<u>Ex</u>

① $f(x) = x^2 + x - 12$

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

Zeros are $x = -4, 3$



② $f(x) = x^4 + 4x^2 - 45$

$= (x^2 - 5)(x^2 + 9)$

$x^2 - 5 = 0$

$x^2 = 5$

$x = \pm\sqrt{5}$

$x^2 + 9 = 0$

$x^2 = -9$

$x = \pm\sqrt{-9}$

$= \pm\sqrt{9}\sqrt{-1}$

$= \pm 3i$

Zeros are $x = \sqrt{5}, -\sqrt{5}, 3i, -3i$