Absolute Value

$$|x| = \begin{cases} x, & \text{if } x \geq 0 \\ -x, & \text{if } x < 0 \end{cases}$$

The Absolute Value Operation

$|x| \longrightarrow$ if x is positive, the result is +

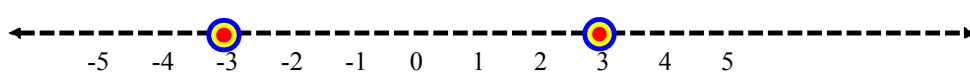$\longrightarrow$ if x is negative, the result is +

Practice:

a) $|2 - 18|$
$= |-16|$
$= -(-16)$
$= 16$

b) $2|3 + (-2)^2 - 7|$
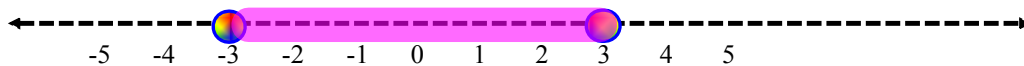$= 2|3 + 4 - 7|$
$= 2|0|$
$= 0$

c) $|8| - |-10|$
$= 8 - 10$
$= -2$

Absolute Value on a Number Line

$|x| = 3 \longrightarrow$ which numbers are 3 away from zero?

$\longrightarrow$ 2 equals

$x = 3$
$x = -3$

$|x| \leq 3 \longrightarrow$ which #s are 3 or less units from zero?

$|x| > 2 \longrightarrow$ which #s are more than 2 units away from zero?

The Absolute Value Function : $f(x) = |x|$

x	y
-5	5
-3	3
-1	1
0	0
1	1
3	3
5	5
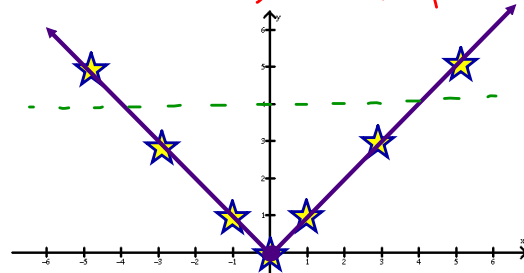
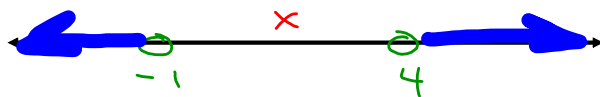$f(x) = |x|$
can be defined
piecewise

$$f(x) = \begin{cases} x, & x \geq 0 \\ -x, & x < 0 \end{cases}$$

Solving an absolute value equation involves ==considering both sides of the piecewise function.==

Ex. $|2x-3| > 5$

case 1: $2x-3 \geq 0$
$2x-3 = 5$
$2x = 8$
$\boxed{x = 4}$

case 2: $2x-3 < 0$
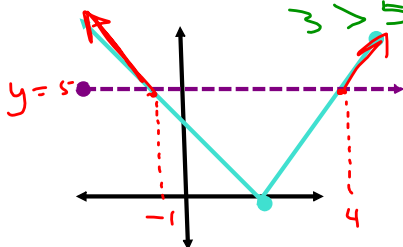$-(2x-3) = 5$
$-2x+3 = 5$
$-2x = 2$
$\boxed{x = -1}$

test $x = 0$ by subing it
into original equ

NEVER Test
with the
sol^ns "

$|2x-3| > 5$
$|2(0)-3| > 5$
$|-3| > 5$
$3 > 5$

since the result is false,
the sol^n to our inequality does
NOT contain x=0.

∴ the sol^n is
$x < -1$ and $x > 4$

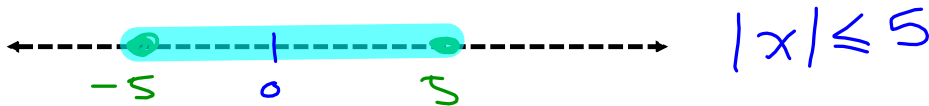$y = 5$

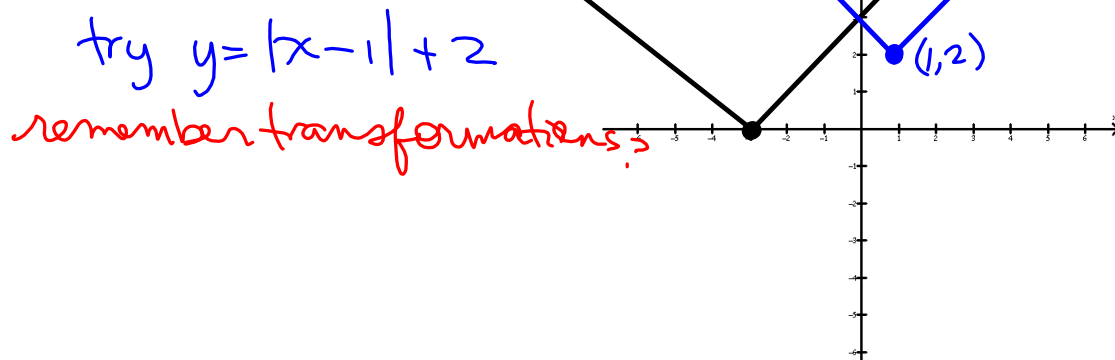# Practice

(a) Draw on a number line $|x| \geq 4$

-4 4

(b) Express using absolute value notation: $-5 \leq x \leq 5$

-5 0 5

$|x| \leq 5$

(c) Express using absolute value notation:

-5   -4   -3   -2   -1   0   1   2   3   4   5

$|x| < 2$
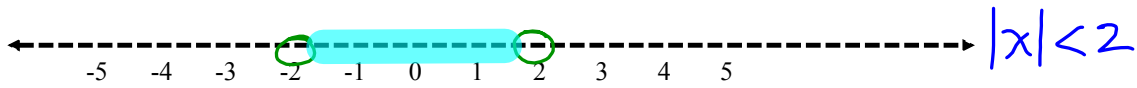
(d) Graph the function $f(x) = |x + 3|$

try $y = |x - 1| + 2$

remember transformations?
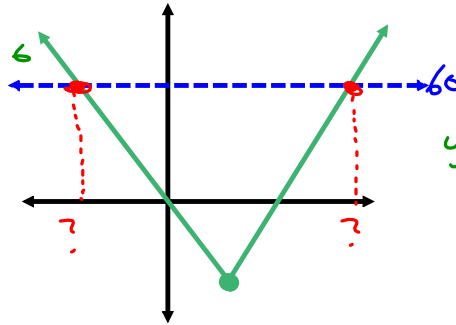
$(1,2)$

Solving Absolute Value Equations

Recall what the three cases mean:

1. $|2x + 4| = 6$

$y = 6$

2 sol'ns

2. $|3(x + 4) - 6| \leq 60$

60

? ≤ x ≤ ?

3. $|x - 4 + 3x + 13| > 9$

$y = 9$

x_2 x

and $\boxed{x > x_1 \\ x < x_2}$
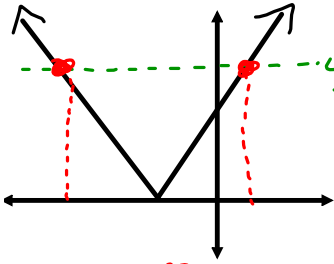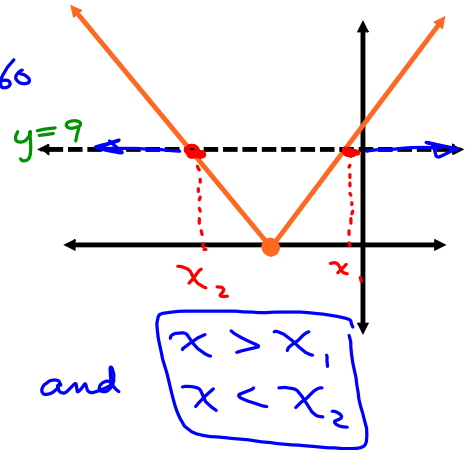
The Reciprocal Function

$$\boxed{f(x) = \frac{1}{x}} = x^{-1}$$

Parent function

x	y
- 0.1	10
- 0.5	2
1	1
2	0.5
5	0.2
10	0.1

the -ve of x yields the -ve of y

hyperbola
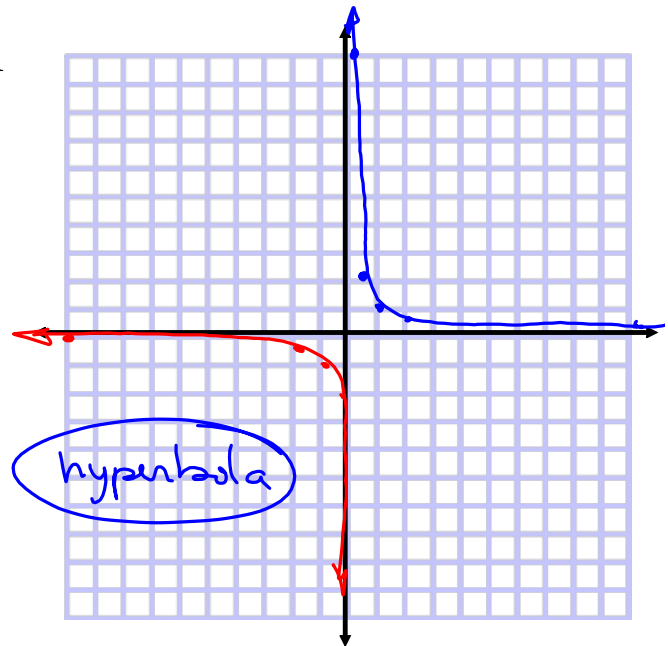
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