7.2 Absolute Value Functions

* The function $y = |f(x)|$ can be defined as the following piecewise function:

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

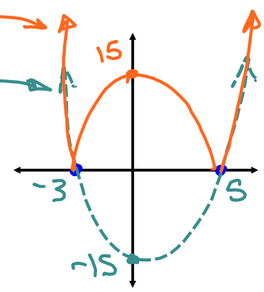
only in one way for any condition

Ex. $y = |3x - 5|$ see graph below

$$y = \begin{cases} 3x-5, & x \geq 5/3 \\ -(3x-5), & x < 5/3 \end{cases}$$
$= -3x+5$

Ex. $y = |x^2 - 2x - 15|$

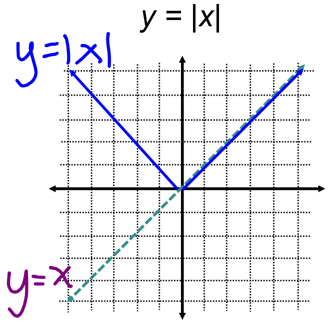
$y = x^2 - 2x - 15$
$= (x-5)(x+3)$
$\boxed{x=5}$ $\boxed{x=-3}$



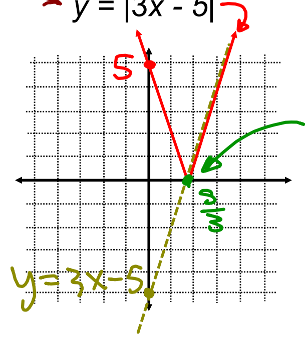
$$y = \begin{cases} x^2-2x-15 & \text{for } x \geq 5 \text{ and } x \leq -3 \\ -(x^2-2x-15) & \text{for } -3 < x < 5 \end{cases}$$

* Graphically, it looks like the graph of an absolute function "bounces" off the x-axis instead of becoming negative.

$y = |x|$



$y = |3x - 5|$



x-int: $y=0$
$0 = |3x-5|$
$0 = 3x-5$
$\frac{5}{3} = \frac{3x}{3}$

* As with any function, we can obtain the **x-intercept by replacing y with 0** and the **y-intercept by replacing x with 0**

ex. $y = |3x - 5|$

x-int: $y=0$
$0 = |3x-5|$
$0 = 3x-5$
$\boxed{\frac{5}{3} = x}$

y-int: $x=0$
$y = |3(0)-5|$
$= |-5|$
$= 5$

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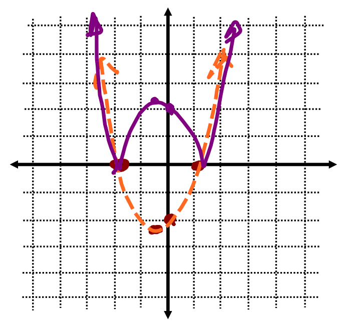
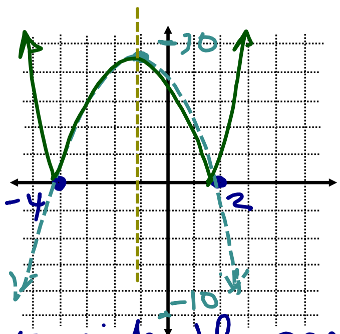
Ex. $y = |x^2 + x - 2|$ → $R: \{y \in \mathbb{R} \mid y \geq -2.25\}$



* $y = x^2 + x - 2$ is a quadratic function with zeroes at -2 and 1, a vertex at (-0.5, -2.25), and a y-intercept of -2. → $R: \{y \in \mathbb{R} \mid y \geq 0\}$

* $y = |x^2 + x - 2|$ is the same with the exception of it's range... and that weird hump thing.

Ex. $y = |-x^2 - 2x + 8|$



consider the parent

$y = -(x^2 + 2x - 8)$

$= -(x+4)(x-2)$

$\boxed{x = -4}$ $\boxed{x = 2}$

AOS is halfway @ $x = -1$

$\therefore y_v = -(-1)^2 - 2(-1) + 8$

$y_v = -1 + 2 + 8$

$y_v = 9$

vertex @ $(-1, 9)$

	y	$\lvert y \rvert$
opens:	down	up
zeroes:	-4 & 2	same
vertex:	$(-1, 9)$	same
Y-int.:	8	"
domain:	$x \in \mathbb{R}$	"
range:	$y \leq 9$	$y \geq 0$

* To graph an absolute value function press MATH, then NUM. If you're creating a table of values to graph, try starting at the axis of symmetry for your x-values.

x	y
-1	9
0	8
1	5
2	0
3	7

then mirror across the AOS

Homefun: pg. 375 #1-5, 6abc, 7, 8abc, 9-13, 16-18, 22-26, 28