Section 1.1 - Domain and range, extracting info from a graph, Vertical line test for functions, miscellaneous algebra tricks (sum/diff of cubes), Difference quotients, "And" vs "Or" with respect to set membership, Piecewise functions, Absolute Value as a piecewise function, Recognizing "Pythagorean forms,"

Domain of *f* is the set of *x*-values that result in a real output.

Only 2 things:

$\frac{\text{STUFF}}{0}$ is bad.

$\sqrt{\text{negative}}$ is bad.

$\frac{\text{STUFF}}{\text{MESS}}$: Need $\text{MESS} \neq 0$.

Solve $\text{MESS} = 0$ & throw out the answer.

$\text{MESS} \neq 0$ works just like $\text{MESS} = 0$.

$\sqrt{\text{STUFF}}$: NEED $\text{STUFF} \geq 0$.

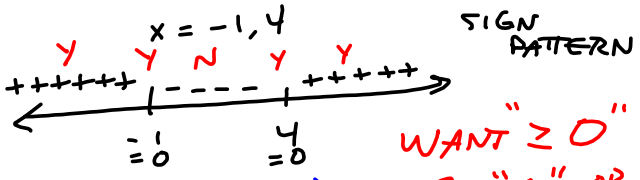
$\sqrt{x^2-3x-4}$

NEED $x^2-3x-4 \geq 0$

$x^2-3x-4 = x^2-4x+x-4 = x(x-4)+1(x-4)$

$= (x-4)(x+1) = 0 \Rightarrow$

$x = -1, 4$



WANT "≥ 0"
SO "$+$" OR "$=0$"

$(x+1)$ $(x-4)$

$(x-4)(x+1)$

So $x \in \boxed{(-\infty, -1] \cup [4, \infty) = \Theta}$

OR
Disjunction.

$x \in (-\infty, -1]$ OR $x \in [4, \infty)$

$\{x \mid x$ is rich OR x is famous$\}$ is bigger set than

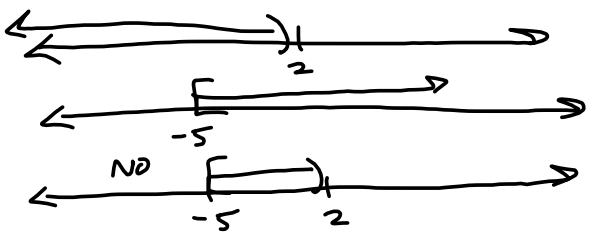
$\{x \mid x$ is rich AND x is famous$\}$

AND

CONJUNCTION.

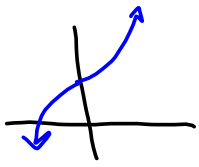
Intersection $\cap$

$(-\infty, 2) \cap [-5, 20) = [-5, 2)$



SUM/DIFFERENCE of cubes

$x^3 + 8 = x^3 + 2^3 = (x+2)(x^2 - 2x + 2^2)$



Just a cubed function moved up (or down) and so it only has one x-intercept.

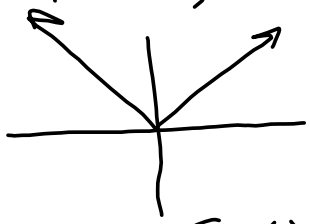
0^0 x^2-2x+4 has NO REAL ZEROS.

$x^3 - 8 = (x-2)(x^2+2x+4)$

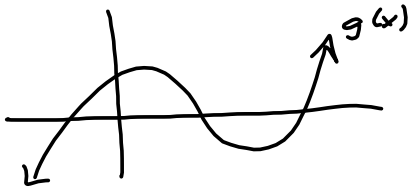
Remember this about absolute value of ANYTHING!

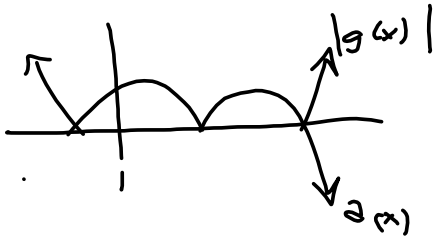
$$f(x) = |x| = \begin{cases} x & \text{if } x \geq 0 \\ -x & \text{if } x < 0 \end{cases}$$

$|4| = 4$, $|-3| = 3$



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





Pythagorean Objects.

$x^2+y^2=r^2$ Equation of a circle of radius r w/ center $(x,y)=(0,0)$.

$\Rightarrow x^2=r^2-y^2$

$\sqrt{x^2}=|x|=\sqrt{r^2-y^2} \Rightarrow x=\pm\sqrt{r^2-y^2}$

$x=\sqrt{r^2-y^2}$ RIGHT $\frac{1}{2}$

$x=-\sqrt{r^2-y^2}$ LEFT HALF

$\sqrt{3^2}=3$

$\sqrt{(-3)^2}=\sqrt{9}=3$

If $y=\sqrt{9-x^2}$ Recognize this as the top half of a circle of radius $r=3$

$y=-\sqrt{9-x^2}$ = BOTTOM HALF!

$\sqrt{x^2+9}$ Looks like a radius!

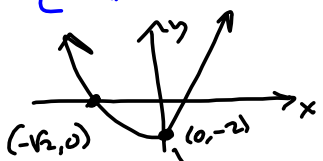
$y=\sqrt{x^2+9}$ Still "Pythagorean," sort of

$y^2=x^2+9$

$x^2+9=y^2$ circle of radius "y" in a sense.

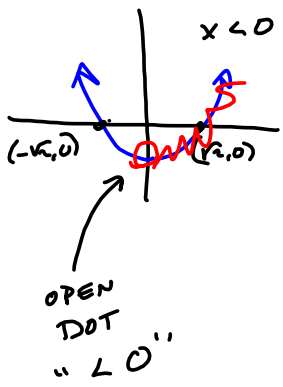
$$f(x) = \begin{cases} x^2 - 2 & \text{if } x < 0 \\ 2x - 2 & \text{if } x \geq 0 \end{cases}$$

(I cooked it to be continuous)



closed dot, courtesy of $x \geq 0$ & they meet.

$$f(x) = \begin{cases} x^2 - 2 & \text{if } x < 0 \\ 3x + 1 & \text{if } x \geq 0 \end{cases}$$



$x^2 - 2 = 0$

$x^2 = 2$

$x = \pm\sqrt{2}$