§ Relations & Functions

Def: a pairing of elements from one set with elements of a second set is called a relation. (a relation is a set of ordered pairs).

Def: * the first element in the ~~ordered~~ ordered pair is called the abscissa.

* the set of abscissas of a relation is called the domain.

Def: * the second element in the ordered pair is called the ordinate.

* the set of ordinates of a relation is called the range.

Def: * a function is a relation in which each element of the domain is pair with exactly one element of the range.

*(i.e. for each x value there can be one and only one y value to be a function)

Def: Vertical line test – test used to determine if a graph represents a function. To be a function, a vertical line is drawn through the graph & may only intersect graph at one point.

§ Relations § Functions continued . . .

* <u>function notation</u> $\Rightarrow$ symboled used is $f(x)$ and is read "f of x", and is interpreted as the value of the function "f" at x.

$\therefore$ $y = f(x)$ represents the value of 'y' is equal to the value of the function 'f' at x.

$\therefore$ ordered pair (x, y) can be $(x, f(x))$

* <u>Domain of functions</u>: the domain of a function is all real numbers for which the corresponding values in the range are also real numbers.
  - meaning that there domain restrictions for certain functions.

<u>examples</u>: fractions $\Rightarrow$ cannot have zero in the denominator

square roots $\Rightarrow$ value under radical must be greater than or equal to zero

STATE THE DOMAIN

Ex: $f(x) = \dfrac{4}{x+5}$

* Fractions cannot have zero in the denominator.

* so how does $x+5=0$

$x=-5$

$\therefore$ (therefore) $x \neq -5$

thus domain in interval notation would be $(-\infty,-5) \cup (-5,\infty)$

Interval notation:
- ( ) means # not included
- [ ] means # is included
- $\cup$ means union (with)

Ex: $f(x) = \dfrac{3}{x^2-4}$

* how does $x^2-4=0$

$x^2=4$

$x = \pm 2$

$\therefore$ $x \neq -2$ or 2

think: works works works

$-\infty$ $\leftarrow$ x x $\rightarrow$ $+\infty$

-2 2

thus $(-\infty,-2) \cup (-2,2) \cup (2,\infty)$

Ex: $g(x) = \dfrac{8x-9}{x^2-49}$

* $x^2-49=0$

$x^2=49$

$x \neq -7$ or 7

✓ x ✓ x ✓

$-\infty$ $\leftarrow$ $\rightarrow$ ∞

-7 7

$\therefore$ $(-\infty,-7) \cup (-7,7) \cup (7,\infty)$

* notice $8x-9$ has no affect on domain (numerator)

STATE THE DOMAIN

Ex: $f(x) = \sqrt{x-8}$

* $\sqrt{\ }$ cannot have a # less than zero

* so how does $x-8 \geq 0$

$x - 8 \geq 0$

$x \geq 8$

$\therefore$ x must be greater than or equal to eight

Domain: $[8, \infty)$ cannot be a # less than 8.

Ex: $h(x) = \sqrt{2x+7}$

$2x+7 \geq 0$

$2x \geq -7$

$x \geq -7/2$ or -3.5

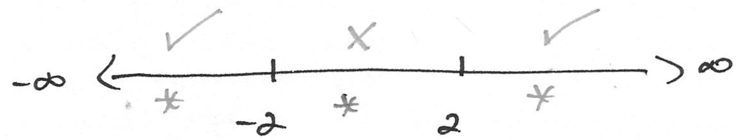
$\therefore [-7/2, \infty)$

Ex: $m(x) = \sqrt{x^2 - 4}$

* with x^2, determine $=0$

$x^2 - 4 = 0$

$x^2 = 4$ thus $x = -2$ or 2



* anything less than -2 gives positive value
* anything greather than 2 gives positive value
* however, anything between -2 & 2 gives a negative value & doesn't work

$\therefore$ Domain is $(-\infty, -2] \cup [2, \infty)$

Ex: $f(x) = \dfrac{5}{\sqrt{x+4}}$

- $x+4 > 0$

  $x > -4$

$\therefore$ D: $(-4, \infty)$

Ex: $g(x) = \dfrac{\sqrt{x+6}}{x-10}$

* $x+6 \geq 0$ $\quad x \geq -6$

* $x-10 \neq 0$ $\quad x \neq 10$

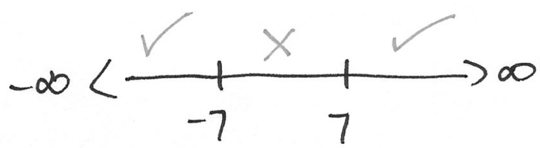
$\therefore [-6, 10) \cup (10, \infty)$

Ex: $f(x) = \dfrac{2x-1}{\sqrt{x^2-49}}$

$x^2 - 49 = 0$

$x^2 = 49$

$x = -7, 7$



$\therefore$ D: $(-\infty, -7) \cup (7, \infty)$