

DOMAIN AND RANGE

The **domain** of a function is the set of x values (along the x-axis) that gives a valid answer (y value) when evaluated through the equation.

With linear equations such as:

$$y = x + 3$$

$$y = x^2 + 2x + 1$$

$$y = x^3 + 3x^2 + 2x + 6$$

The domain is all real numbers, written $\mathfrak{R}, (-\infty, \infty)$ or $-\infty < x < \infty$. You can place any number (x value) in for x and get a valid answer (y value).

In equations with a variable in the denominator:

$$y = 3x + \frac{1}{x^2} + 6$$

$$y = \frac{x + 2}{x - 4}$$

$$y = \frac{x^2 + 2x - 8}{3x^2 - 12x + 9}$$

the domain is all x values that do not make the denominator equal zero.

$\left[\frac{1}{0} \text{ is undefined . If you place this in your calculator , you will get an error message .} \right]$

To find the domain, set the denominator equal to zero. Solve. The answers you get are not part of your domain; all others are.

$$y = 3x + \frac{1}{x^2} + 6$$

$$x^2 = 0$$

$$x = 0$$

$$D = \{ \mathfrak{R} \mid x \neq 0 \} \text{ read - the set of all reals such that } x \text{ does not equal zero or } (-\infty, 0) \cup (0, \infty)$$

$$y = \frac{x+2}{x-4}$$

$$x-4=0$$

$$x=4$$

$$D = \{\mathfrak{R} \mid x \neq 4\} \text{ read like above or } (-\infty, 4) \cup (4, \infty)$$

$$y = \frac{x^2 + 2x - 8}{3x^2 - 12x + 9}$$

$$3x^2 - 12x + 9 = 0$$

$$(x-3)(3x-3) = 0$$

$$x-3=0 \quad 3x-3=0$$

$$x=3 \quad 3x=3$$

$$x=1$$

$$D = \{\mathfrak{R} \mid x \neq 1, 3\} \text{ or } (-\infty, 1) \cup (1, 3) \cup (3, \infty)$$

The domain of a radical equation cannot have an x value that makes the equation under the square root have a negative answer. (Negative numbers do not have square roots.) Therefore, set what is under the square root greater than/equal to zero.

$$y = \sqrt{x-7}$$

$$x-7 \geq 0$$

$$x \geq 7 \text{ or } [7, \infty)$$

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

$$9-x \geq 0$$

$$x \leq 9 \text{ or } (-\infty, 9]$$

$$y = \sqrt{4+x}$$

$$4+x \geq 0$$

$$x \geq -4 \text{ or } [-4, \infty)$$

$$y = \sqrt{3x+4}$$

$$3x+4 \geq 0$$

$$3x \geq -4$$

$$x \geq \frac{-4}{3}$$

When a square root is in the denominator, set what is under the square root greater than zero. (Remember, you cannot have zero in the denominator.)

$$y = \frac{x+5}{\sqrt{x-9}}$$

$$x-9 > 0$$

$$x > 9 \quad \text{or} \quad (9, \infty]$$

The range of a function is all of the y values. Range is along the y -axis. Domain is along the x -axis.