Domain of a Function

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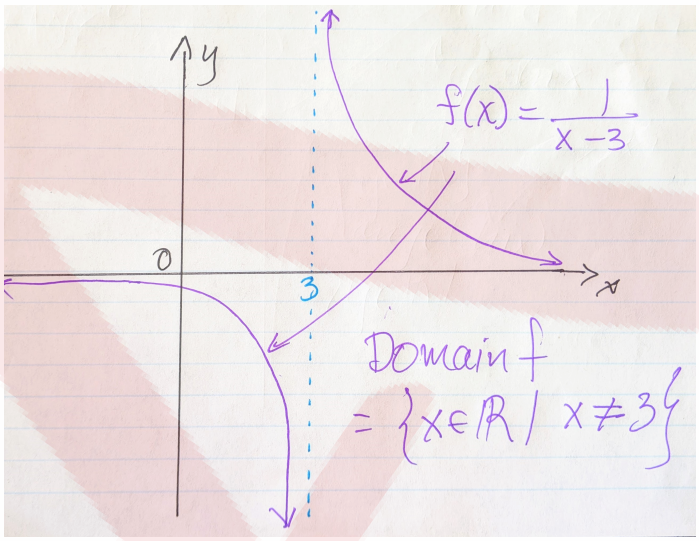
What is the domain of a function?

The domain and range are terms associated any function. Let's first consider what the domain and range are for any function f then we'll look at the special case of a quadratic. The **domain** of a function is the set of all x values that the function may be evaluated at. Below is a graph of a function and it's domain.



Now, let's look at an example.

Example

Suppose we are given the following function,

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

What is it's domain and how do we find it?

Solution Looking at the function we see that for any value of x we can evaluate $f(x)$. For example,

x	f(x)
0	f(0) = -2
1	f(1) = 1
-1	f(-1) = -3
2	f(2) = 18

We can create a table of values and for any real number x and $f(x)$ will exist. So our domain for f is the set of all real numbers. This can be written as,

$$Domain f = \{x | x \in \mathbb{R}\}$$

Example

Let's consider another example. What is the domain of the function given below.

$$f(x) = \frac{1}{x-2}$$

Solution What happens when $x = 2$? When $x = 2$,

$$f(2) = \frac{1}{2-2} = \frac{1}{0}$$

which does not exist. But, for any other value of x, the function $f(x)$ does exists. So the domain for this function is any real number except $x = 2$, or

$$Domain f = \{x \in \mathbb{R} | x \neq 2\}$$

Example

Let's consider another example. Find the domain of the following function,

$$f(x) = \sqrt{6-x}$$

Solution Now we need to consider the square root function. What do we know about the square root function? We know that we cannot take the square root of a negative number. This means that for our example $f(x) = \sqrt{6-x}$, $6-x$ cannot be negative or $6-x$ must be at least zero or,

$$6 - x \geq 0. \tag{1}$$

To determine which x values satisfy (1) we have to "solve" the inequality in (1).

$$\begin{array}{rcl} 6-x & \geq & 0 \\ 6 & geq & x \end{array}$$

This means our domain is any real number x such that $x \leq 6$ or

$$Domain f = \{x \in \mathbb{R} | x \leq\}$$

Exercises

What is the domain of the following functions?

a) x^3

b) $\frac{1}{5x+2}$

c) $\frac{1}{x^2-9}$

d) $\frac{x+2}{x^2-10x+25}$

e) $\sqrt{x-2}$

f) $\sqrt{x^2+4x-5}$