Notes on learning calculus

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What is calculus?

Calculus is the mathematics of **change.** It **relates** two completely different things in the world around us. We do this by many concepts present here. They are : *Functions, limits, derivatives, limits and integrals.*

The first thing we will be studying is *functions.*

Functions? What are Functions?

This is the first question we all ask when studying about functions. What **are** they? It is a lot like asking what a number is. We don't know a number is, but we know it when we see it.

Example : When we see 3 apples, we know that it represents a quantity.

We know more of what a number does than what it is. It is the same with functions. We know what a function *does,* than what it *is.* So here it is :

*A functions assigns each number in its **domain**, another number.* This statement doesn't explain much at beginning. A more familiar statement is ;

*A function is thought of as a set of rules which the numbers **plugged** into it follow.*

The term *plugged* refers to the numbers put in a function.

Example :

```
f(2) = 4 - this function assigns the number 2 to 4.
f(3) = 9 - this function assigns the number 3 to 9.
f(4) = 16 - this function assigns the number 4 to 16
f(5) = 25 - this function assigns the number 5 to 25.
```

follow the rule,

```
f(x) = x * x
```

The *domain* consists of all the numbers for which the rule makes sense.

For example : for the function,

```
f(x) = 1 / x
```

This function does not always make sense. Because we are **dividing** by x, x must follow some rules.

To divide by x, x must *not be equal to 0.* (Dividing by 0 is forbidden.) All the other numbers are suitable for this purpose.

So we can say the **domain** of this function is all real numbers, not equal to zero.

We write domains as *intervals* of numbers, assuming a $<$ b,

(a,b) is the *open* interval between them, *excluding* a and b.

[a,b] is the *closed* interval between them, *including* a and b.

[c, inf) is all the numbers between c and infinity, including c.

(c, inf) is all the numbers between c and infinity, excluding c.

(-inf, d)