Differentiation

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## Definition of the derivative

The derivative measures the rate of change of one quantity with respect to another. Differentiation is then just the process of finding the derivative of a function. If we have a function of x then one of the many notations for specifying the derivative is as follows

So if we took one or the simplest non-linear functions and differentiate it we see that

.

So in the simple case where x is equal to one

It is worth noting that differential calculus is concerned with finding the instantaneous rate of change of f with respect to x.

Why Bother?

Numerous problems in business, economics and finance are concerned with determining how one quantity is changing with respect to another. Differentiation also enables us to find where a function is highest and lowest both locally and across the entire domain. Also we often find where a rate of change is greatest or smallest and again differentiation provides us with this.

Where the derivative does not exist

There are three places where the derivative does not exist

* Discontinuity
* Cusp on a function
* Vertical inflection point

## Calculation of the derivative

### The approach



Algebraic Derivation

If then the derivative is defined as

Simple Example

Let us consider a basic quadratic then the derivative becomes

### Proofs

#### Constant Function

The derivative of a constant function is zero

