

Differential Calculus for Algebra Students

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1 Limits

If we have an undefined number that **approaches** another number, we can use a limit to define it. For example in **The Differential Calculus** ^[1] we use variables like (d,dx,dy,ds,dt) alot, these are all incredibly small numbers that approach 0.

$$\lim_{dt \rightarrow 0}$$

We also use it for numbers that approach **infinity**.

$$\lim_{x \rightarrow \infty}$$

2 Derivatives

Derivatives are a big part of **The Differential Calculus** ^[1] they are essentially the slope at a single point. **Slope** is a rate of **change**. The **derivative** is the slope at the specific point on a function. Change isn't instant though, change is the difference between two points in time. The derivative is really the difference between two points that are **extremely close together**.

$$\lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$$

If we graph the respective derivative of **each point** on a function, you get another function (a function of all the derivatives of the original function).

Original function: $f(x)$.

Derivative function: $f'(x)$.

The process of finding a derivative is called **differentiating**.

We can use shortcuts called **Derivative rules**, For example the derivative of any power, x^n is just nx^{n-1} . We can use these rules to differentiate faster: See the next few sections.

3 L'Hôpital's rule

Sometimes when we evaluate a limit, we get an **Indeterminate Form**, meaning we cant solve it.

Ex: $\frac{0}{0}$, $\frac{\infty}{\infty}$, ... When we get these results, we can apply L'Hôpital's rule:

When a limit resolves in an **Indeterminate Form** Differentiate the limit until it is in a **Determinate Form**

- 4 Derivatives: Constants Rule
- 5 Derivatives: Linearity Rule
- 6 Derivatives: Power Rule
- 7 Derivatives: Sum and Difference Rules
- 8 Derivatives: Product Rule
- 9 Derivatives: Quotient Rule
- 10 Derivatives: Reciprocal Rule
- 11 Derivatives: Chain Rule
- 12 Derivatives: Root Rule
- 13 Derivatives: Logarithmic Rule
- 14 Derivatives: Trigonometric Rules
- 15 Derivatives: Inverse Trigonometric Rule

References

- [1] The study of rates of change.
- [2] The area of Calculus concerned with finding the area under a curve.