

Intuition - What is differentiation

One would say that differentiation is quite difficult to learn, but we as a Math learner should see it as a simple tool that helps Understand many complicated concepts. We shall start with the intuition of differentiation.

Imagine we are having a slide. Place a ball on the top of the slide and let it roll down. We will always want to ask: What is the instantaneous speed of the ball at every moment? This is the origin of differentiation, and in fact we shall refer this question to some general statement: What is the *rate of change* of the distance travel at every moment?

If we further convert the question to a mathematical statement, we will see that the formulation of the question be like:

$$v(t) = \frac{\Delta s(t)}{\Delta t} = \frac{s(t) - s(t_0)}{t - t_0}$$

which comes from Newtonian physics with v denoting the average speed of the ball at some time interval, and s denoting the displacement of the ball at some moment.