Difference Quotient

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1. Introduction

With **linear functions**, we encountered the concept of the **slope of a function** for the first time.

We already know the slope formula:

$$m = \frac{y_1 - y_0}{x_1 - x_0}$$

With its help, we can calculate the slope m of a straight line from any two points

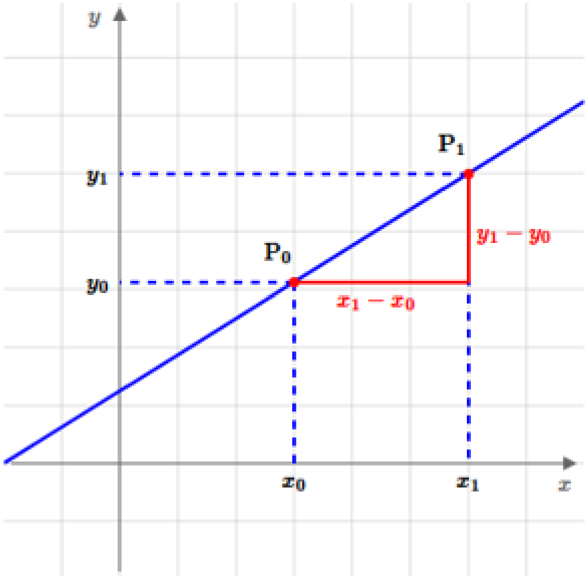
$$P_0(x_0|y_0)$$

and

$$P_1(x_1|y_1).$$

An interesting fact is that a straight line has the **same slope at every point**. Therefore, m is constant.

The diagram on page 1 illustrates this using two points P_0 and P_1. The vertical difference is $y_1 - y_0$, while the horizontal difference is $x_1 - x_0$.



A straight line has a constant slope.

We are already familiar with **quadratic functions**: the graph of a quadratic function is a special type of curve called a **parabola.**

This naturally raises the question of how the **slope of a curve** (= **curved graph)** is defined.

Intuitively, it is clear that a curve has a **different slope at two arbitrary points** P_0 and P_1, except in special cases. Consequently, the slope m does **not have a constant value.**

A curve does not have a constant slope.

With the help of **differential calculus**, we can extend our understanding of the concept of slope from straight lines to curves:

$$\text{Slope of a straight line} \xrightarrow{\text{Differential Calculus}} \text{Slope of a curve}$$

The diagram on page 2 shows a parabola with two points P_0 and P_1, illustrating that the slope changes along the curve.