

## What is Differentiation

### Aim

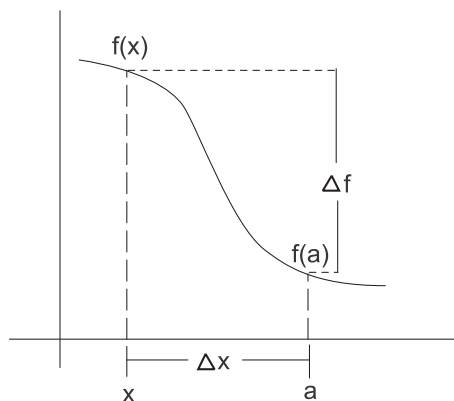
To explain the meaning of differentiation.

### Learning Outcomes

At the end of this section you will be able to:

- Understand what is meant by differentiation,
- Define the derivative as the gradient of a tangent.

Differentiation is the process of calculating a derivative. The derivative of a function represents an infinitesimal change in the function with respect to whatever parameters it may have. For example, if the independent variable  $x$  of a function  $f(x)$  is increased by a small amount  $\Delta x$  (“delta x”) it will cause a corresponding change  $\Delta f$  of  $f(x)$ . The ratio  $\frac{\Delta f}{\Delta x}$  is a measure of the *rate of change* of  $f$  with respect to  $x$ . The limit value,  $\lim_{\Delta x \rightarrow 0} \frac{\Delta f}{\Delta x}$  when  $\Delta x$  tends to zero (if it exists) is the first derivative of  $f(x)$  with respect to  $x$  which describes the instantaneous change of  $f$  at a given point  $x$ .



Another way of thinking of differentiation is in terms of slopes or gradients. For all curves other than linear (straight-line) curves, the gradient of the curve can change at each point along the axis. This means that it is extremely difficult to calculate the gradient of the curve at any given point. Differentiation can be used to find the gradient of any curve by calculating the slope of the tangent to the curve at the point in question. Therefore differentiation can be thought of as calculating the slope of a curve at a given point.

## Related Reading

Booth, D.J. 1998. *Foundation Mathematics*. 3<sup>rd</sup> Edition. Pearson Education Limited.

Croft, A., R. Davison. 2003. *Foundation Mathematics*. 3<sup>rd</sup> Edition. Pearson Education Limited.

Morris, O.D., P. Cooke. 1992. *Text & Tests 4*. The Celtic Press.