### M3.6 – Draw and use the slope of a tangent to a curve as a measure of rate of change

### Tutorials

Learners may be tested on their ability to:

* use this method to measure the gradient of a point on a curve, e.g. quantity of product formed plotted against time when the concentration of enzyme is fixed.

**Using tangents to measure rate of change**

In section M3.5 we explained how to calculate the gradient of a straight line to work out the rate of change. In a straight line graph the gradient is constant throughout. But if we have a curved line then the gradient is different at different points on the curve.

So how do we work out the rate of change at a point on a curved graph?

An easy way is to draw a tangent to the curve. A tangent is a straight line that is drawn so it just touches the curve at a singular point. The slope of this line matches the slope of the curve at just that point. You then simply find the gradient of the line, as described in M3.5, to find the gradient at that point on the curve.

This gives you the rate of change at a particular point on a curve.

There are a few things to remember when drawing tangents: Firstly, always use a ruler and a pencil. You need to make sure the line you draw is dead straight, and using a pencil is essential in case you make a mistake. Choose the point where the tangent is to be taken and line the ruler up to that point. Make sure none of the line of the curve is covered by the ruler; the curve needs to be entirely visible whilst the tangent is drawn.

1. Use a ruler and a pencil
2. Line the ruler up to the point where the tangent is to be taken
3. Make sure none of the curve is covered by the ruler

Once you have drawn the tangent to a curve you can then work out the gradient of the tangent in the same way as we explained in section M3.5. This will give you the rate of change of the curve at that particular point.

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