### M3.5 – Calculate rate of change from a graph showing a linear relationship

### Tutorials

Learners may be tested on their ability to:

* calculate a rate from a graph, e.g. rate of transpiration.

**Calculating rate of change from a graph**

As we explained in section M3.3, a graph with a linear relationship can be represented by the formula *y = mx + c*. The “c” represents the y-intercept, as we demonstrated in section M3.4. In this section we’re going to explain how to work out the gradient of the line, which is represented by the letter “m”.

y = mx + c

“c” 🡪 y-intercept

“m” 🡪 gradient

To calculate the gradient, we can use the formula:

gradient equals the change in y divided by the change in x:

$$Gradient=\frac{'change in y'}{'change in x'} $$

To use this formula you take two points on the line of the graph. Measuring the vertical distance between the points gives the change in y, and measuring the horizontal distance between the points gives the change in x. Dividing the change in y by the change in x gives the gradient of the line.

The gradient of a linear graph tells us the rate of change of one variable with respect to another.In other words you could say that the gradient expresses how quickly *y* changes as *x* changes.

Rate of change

How quickly *y* changes as *x* changes

What does this mean in a biological context?

In many cases our independent variable (x) is time. This fits naturally with describing the gradient simply as ‘rate’.

For example if we are studying transpiration we can take readings of the total volume of water lost (our dependent or ‘y’ variable) as time passes (our independent or ‘x’ variable).

When we plot these results as a line graph the gradient of the line gives us the rate of transpiration.

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