

# Families of straight lines

Thursday, 17 January 2019 5:06 PM

★ By the end of the lesson I would hope that you have an understanding of the concepts below which you can apply to a number of complex questions:

- Know what it means to have a family of straight lines
- Know the three families of straight lines which are used in the textbook series

## RECAP:

---

We are nearing the end of this section of work.

We have been dealing with straight lines which can, generally, belong to a family.

We have looked at parallel and perpendicular lines.

We have looked at how a straight line can be expressed in:

- Gradient intercept form
- Intercept form

We now move onto the next section

## Family 1: $y = mx$

---

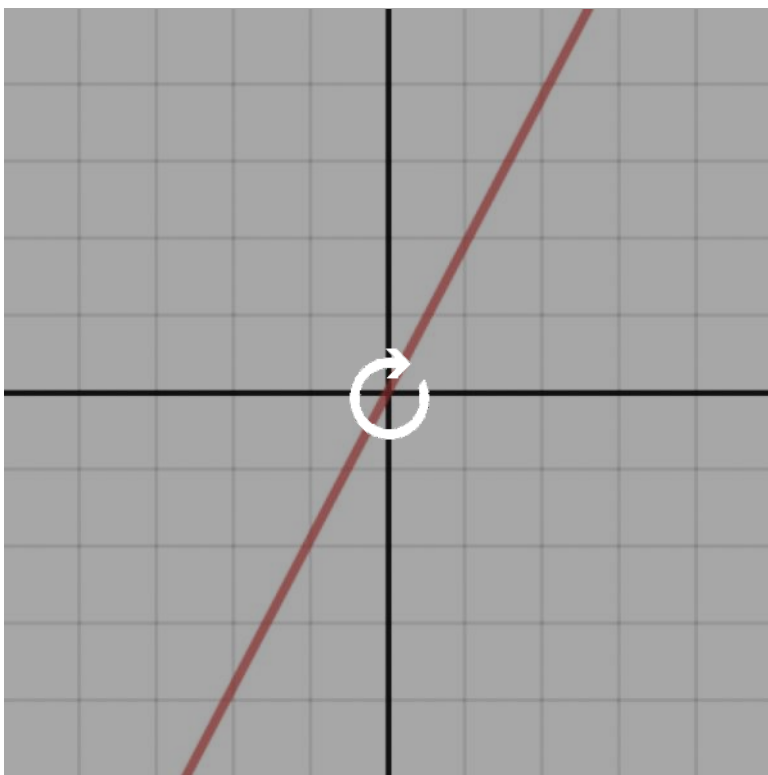
When looking at the above formula, and those which will follow, look at what the variable is.

You might argue that they all are!

But, in this case, let's see what happens when we change only the value of  $m$ .

Using DESMOS.com

[Desmos graph](#)



$$\begin{array}{c} \downarrow \quad \downarrow \\ y = mx + c \\ y = 2x - 3 \end{array}$$

## Family 2: $y = 2x + c$

---

Here we are looking at changing the value of  $c$ .

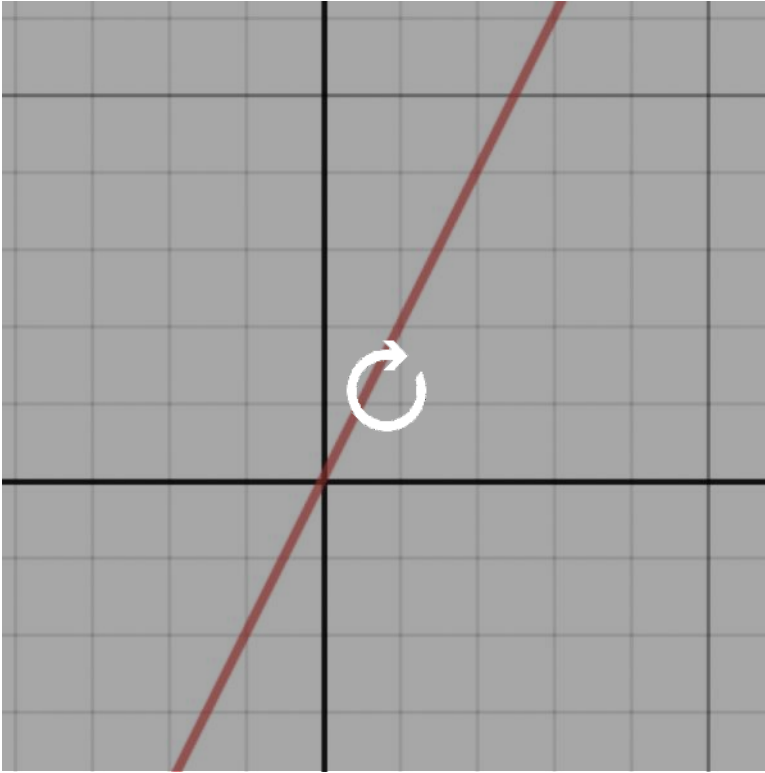
In this case the value changes the  $y$ -axis intercept. The value of the gradient stays the same.

But they are all the same family of straight lines.

Using DESMOS.com

$$\begin{array}{c} \downarrow \\ y = 2x + c \end{array}$$

[Desmos graph](#)



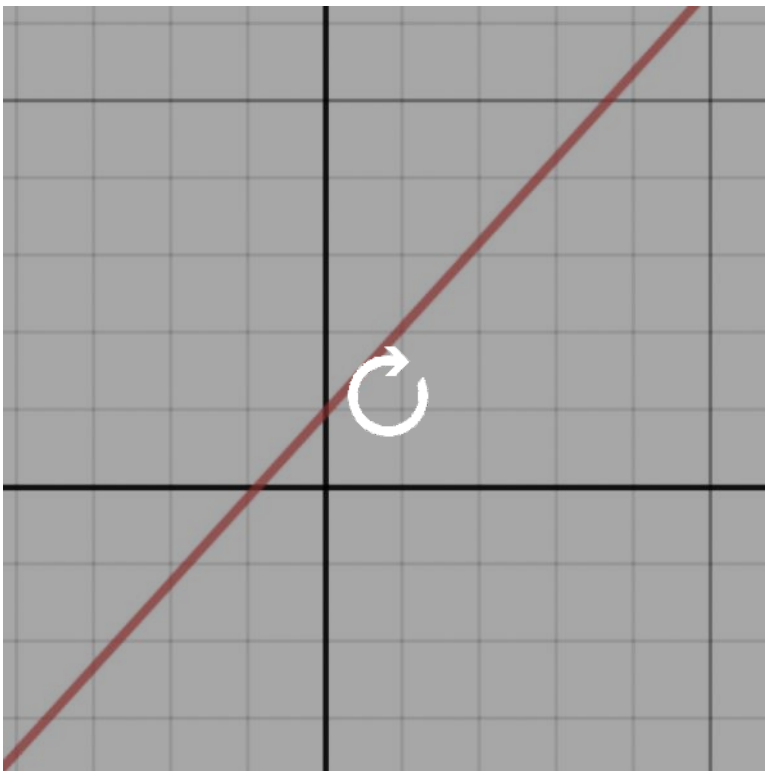
### Family 3: $y = mx + 1$

This is simply combining the above two.  
Here, the intercept stays the same, but the gradient is changing.

We can see this more clearly using an interactive example from DESMOS.com

[Desmos graph](#)

$$y = mx \text{ (1)}$$



## Why is this important?

Isn't it important to belong to a family?

Lots of the graphs you will be looking at belong to families.

As soon as you begin to see the link between graphs and which tribe they belong to, you can start to make greater leaps in Mathematics!

Note: In the above examples  $m$  is known as a **parameter**.

### Example:

Extracted from the Cambridge Essentials Textbook Series

Find the value of  $m$  if the line  $y = mx + 2$  passes through the point (3,11)

$$\begin{aligned}y &= mx + 2 & (3, 11) & (x, y) \\11 &= m(3) + 2 & \uparrow \\9 &= 3m \\m &= 3\end{aligned}$$

### Example:

Extracted from the Cambridge Essentials Textbook Series

A family of lines have equations of the form  $y = mx + 2$ , where  $m$  is a negative number.

- Find the x-axis intercept of a line in this family in terms of  $m$ .
- For which values of  $m$  is the x-axis intercept greater than 3?
- Find the equation of the line perpendicular to the line  $y=mx+2$  at the point (0,2).

$$y = mx + 2$$

Find the x-axis intercept of a line in this family in terms of  $m$ .

$$y = 0$$

$$0 = mx + 2$$

$$mx = -2$$

$$x = -\frac{2}{m}$$

$$\left(-\frac{2}{m}, 0\right)$$

For which values of  $m$  is the x-axis intercept greater than 3?

$$-\frac{2}{m} > 3$$

$x \ m$

$$-\frac{2}{3} < m < 0$$

$$\frac{-1}{3m} > 3 \quad \times m$$

$$-2 < 3m \quad -3$$

$$-\frac{2}{3} < m$$

$$-\frac{2}{3} < m < 0$$

Find the equation of the line **perpendicular** to the line  $y = mx + 2$  at the point  $(0, 2)$ .

$$y - y_1 = m(x - x_1)$$

$$y - 2 = m(x - 0)$$

$$y - 2 = mx$$

$$y - 2 = -\frac{1}{m}x$$

$$y = -\frac{1}{m}x + 2$$

$$m = -\frac{1}{m}$$