Equation of the line & unusual equations of the line

Think of a function as being like a Christian name which is used to distinguish one person from another but we can get a bit of information about the person. For example Ciara would tell us the person is a girl. We can also use a function to distinguish one line (or curve) from another but unlike a Christian name in which often the only information you can get from it is gender a function will actually *give information about the properties and characteristics of the line or curve* it represents.

1) Equation of the line

All lines are represented by the general equation **Y = MX + C.**

$$\text{e.g. } Y = \tfrac{1}{2}X + 5$$

Here the M represents the slope or the steepness of the line (the larger M is the steeper the line. If M is a negative value then it means the line has a 'downhill' slope. If M = 0 then it is horizontal). In our example the line has a slope of ½ which means it has a slight uphill slope.

The C represents the Y coordinate of the point where the line crosses the Y axis (ie it represents the Y intercept). Every point on the y axis always has an X coordinate of 0 so in our example above the point on the y axis that our example crosses is at the point (0, 5).

Although some lines might have the same slope and some lines might have the same value for C no two lines will have exactly the same slope and value for C at the same time – if they did then they are actually the same line

Note that to correctly identify the slope and C there must be <u>nothing</u> beside the Y just like it's written in the equation of the line (you can have 1Y or +Y which is the same as Y but nothing else). For example in the line

$$-Y = 3X - 2$$

the slope is not M = 3 and C is not C = -2 because there is a minus in front of Y.

Rearranging the equation by dividing every term by -1 gives Y = -3X + 2 so our slope is M = -3 and C = 2

Note 2 horizontal lines have a slope M = 0 & vertical lines have a slope M = ∞ or 'undefined'

2) **Unusual equations of the line**

Note that sometimes you get equations of a line that at first don't look like an equation of a line but we can show they are equations of a line by making them look like Y = MX + C.

For example the equation

$$Y = 5X$$

is a line. When we compare this to the general equation of the line we see that the constant C term is missing. We can make this look like the equation of the line without changing the overall value of the right hand side of the equation by including '0' for C the constant term,

i.e. $Y = 5X + 0$

because adding the '0' to it doesn't change anything. When you add (or subtract) '0' to some number or term you get that term i.e. $5X + 0 = 5X$. So $Y = 5X$ is an equation of the line. Not only that but our $Y = 5X + 0$ indicates that the line crosses the y axis at 0, or more precisely (0,0)

Other equations of a line which at first don't look like Y = MX + C are equations like

$X = 2$

or $Y = 3$

ie where one of the letters is equal to a number. What's happening here is some part of these equations is missing and is equal to '0'.

With the Y = 3 example above we can make it look like the equation of a line. Here we see the 'X' term is missing. We can include an X term without changing the overall value of the right hand side by including '0X' to give

$Y = (0)X + 3$

Since any number multiplied by '0' is equal to '0' then $Y = (0)X + 3$ is the same as $Y = 0 + 3$ which is the same as $Y = 3$.

So Y = 3 is another equation of the line. Note that the '0X' does not mean the X is equal to 0. It means *the number in front* of X is 0. If we look closer at the $Y = (0)X + 3$ this is telling us that Y =3 is a line with slope equal to 0 and it crosses Y axis at 3 (or more precisely (0,3)).

We can make X = 2 look like an equation of a line by moving the 'X' around to the same side of the equals sign as the constant '2' which will give

$0 = -X + 2$

Now we can see it is just the ‘Y’ term that is missing. We can include a Y term by putting ‘0Y’ on the left side to give

$$0Y = X - 2$$

(again this means the Y isn’t equal to 0 but *the number in front of Y* is 0)

If we look closer we see this has the same structure as $Y = MX + C$