Graphing straight lines using intercepts



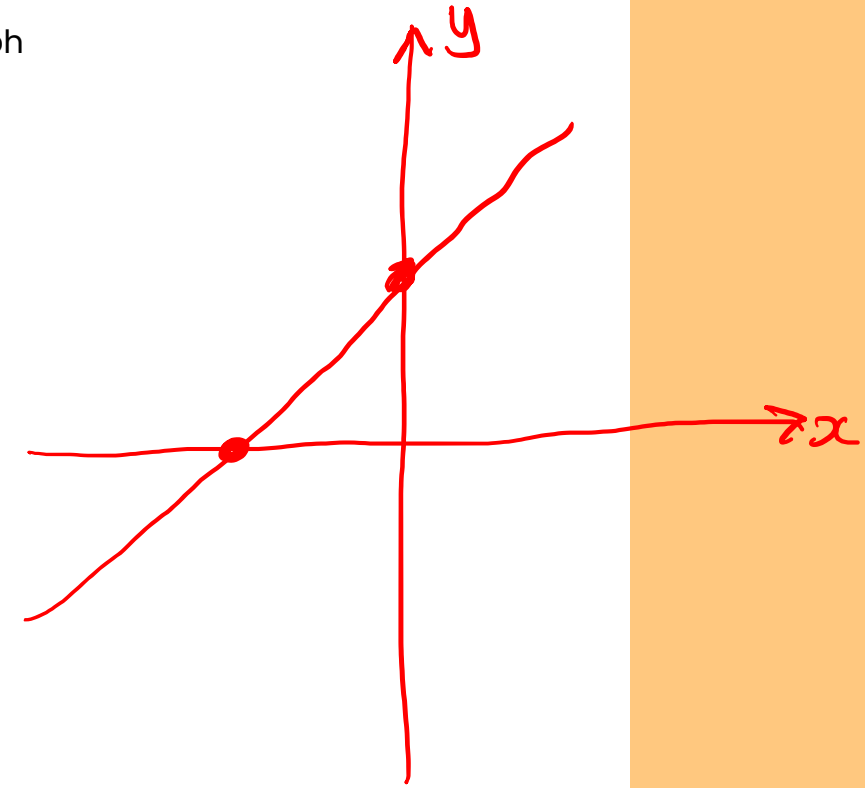
Year 9
Mathematics

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Learning Objectives

By the end of the lesson I hope that you understand and can apply the following to a range of questions from the Year 9 Mathematics course.

- Understand that we need a minimum of two points to sketch a straight line graph
- Know how to find the x- and y-intercepts from the rule of a linear graph.
- Sketch a linear graph by finding the intercepts and joining them



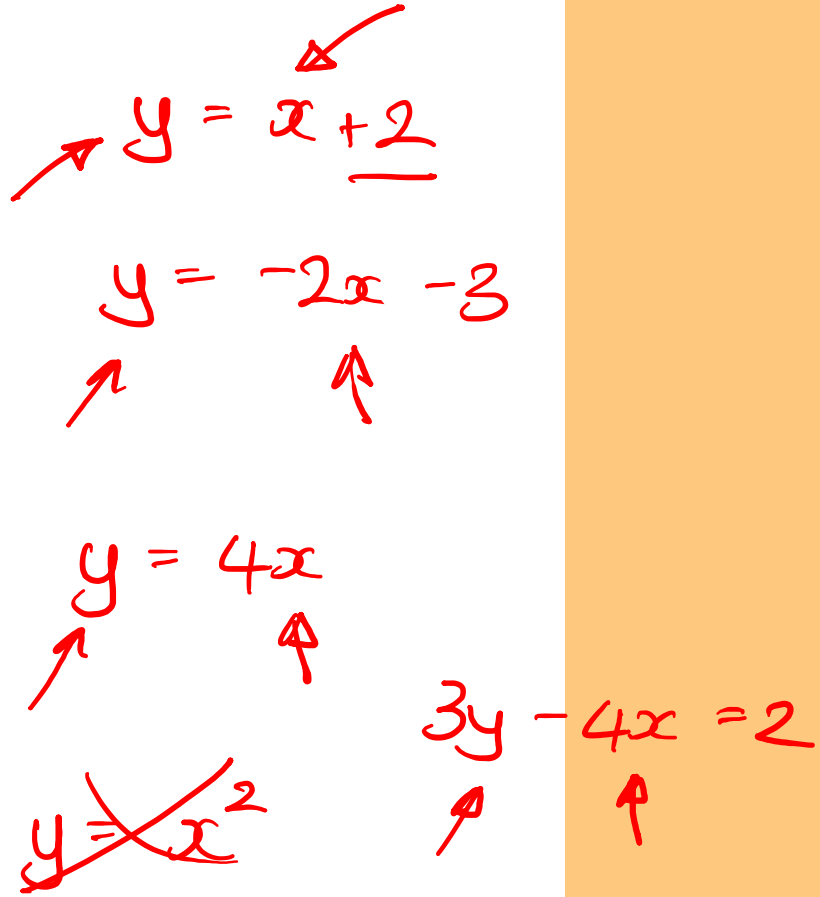
RECAP

In the first lesson of this chapter we looked at how a coordinate is nothing more than a relationship between an x- and a y-value.

This relationship can be applied to lots of coordinates which may or may not give us a straight line.

We can use a table to values to help us find relationships between coordinates.

We also looked at what intercepts were and learned they were going to be a very important part of the course!



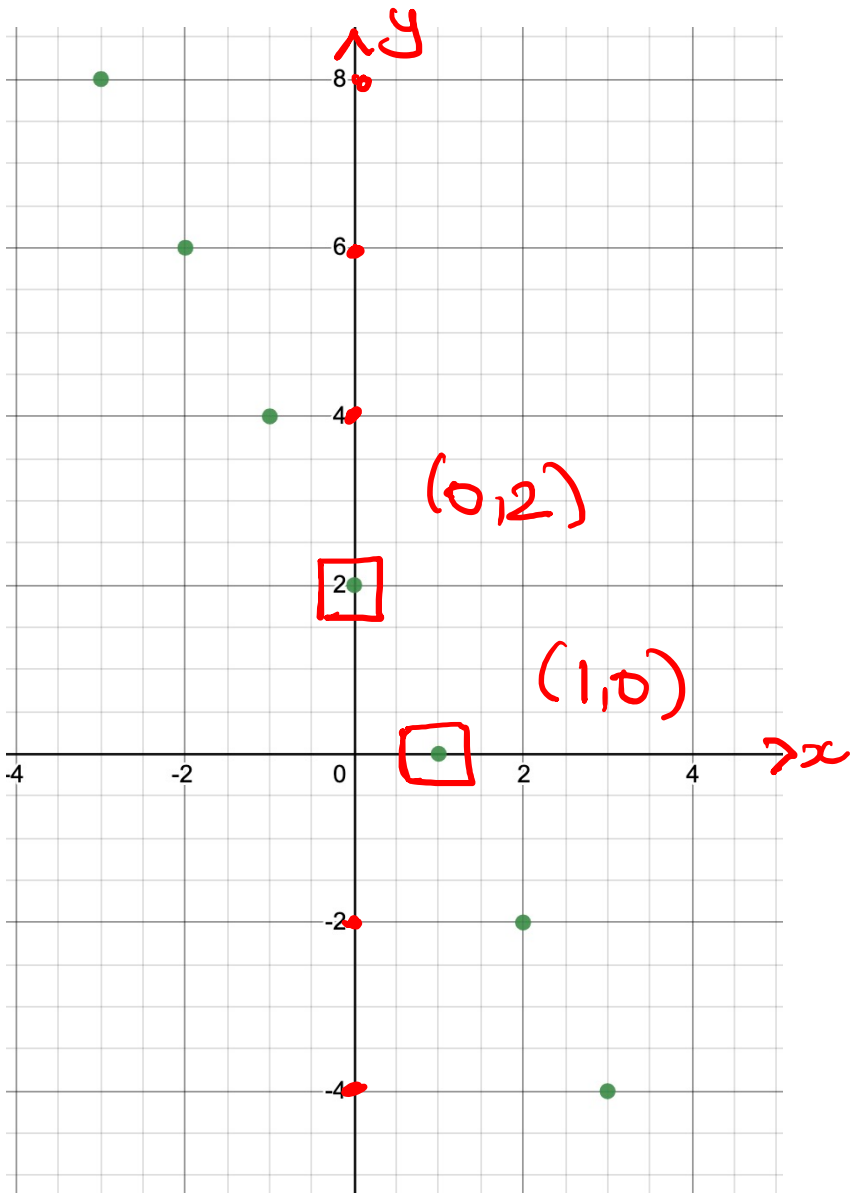
RECAP: Intercepts

Intercepts are where a line crosses the x- and y-axis.

They are called the x-axis intercept and the y-axis intercept.

We knew from a table of values, that we can find the intercepts by looking for the values where $x = 0$ and $y = 0$.

This is **very important** as it is the rule we will use later with the linear relationship (or equation). We will also be using our knowledge of algebra to help us solve these things.



Finding intercepts using algebra

We can find intercepts using the algebra known we already have.

Given a linear relationship $y = x + 3$ for example, we know the intercepts are found at the points where $x = 0$ and $y = 0$.

So, let's substitute these into the equation ($y = x + 3$) one at a time.

$y = x + 3$

y int $x = 0$

x int $y = 0$

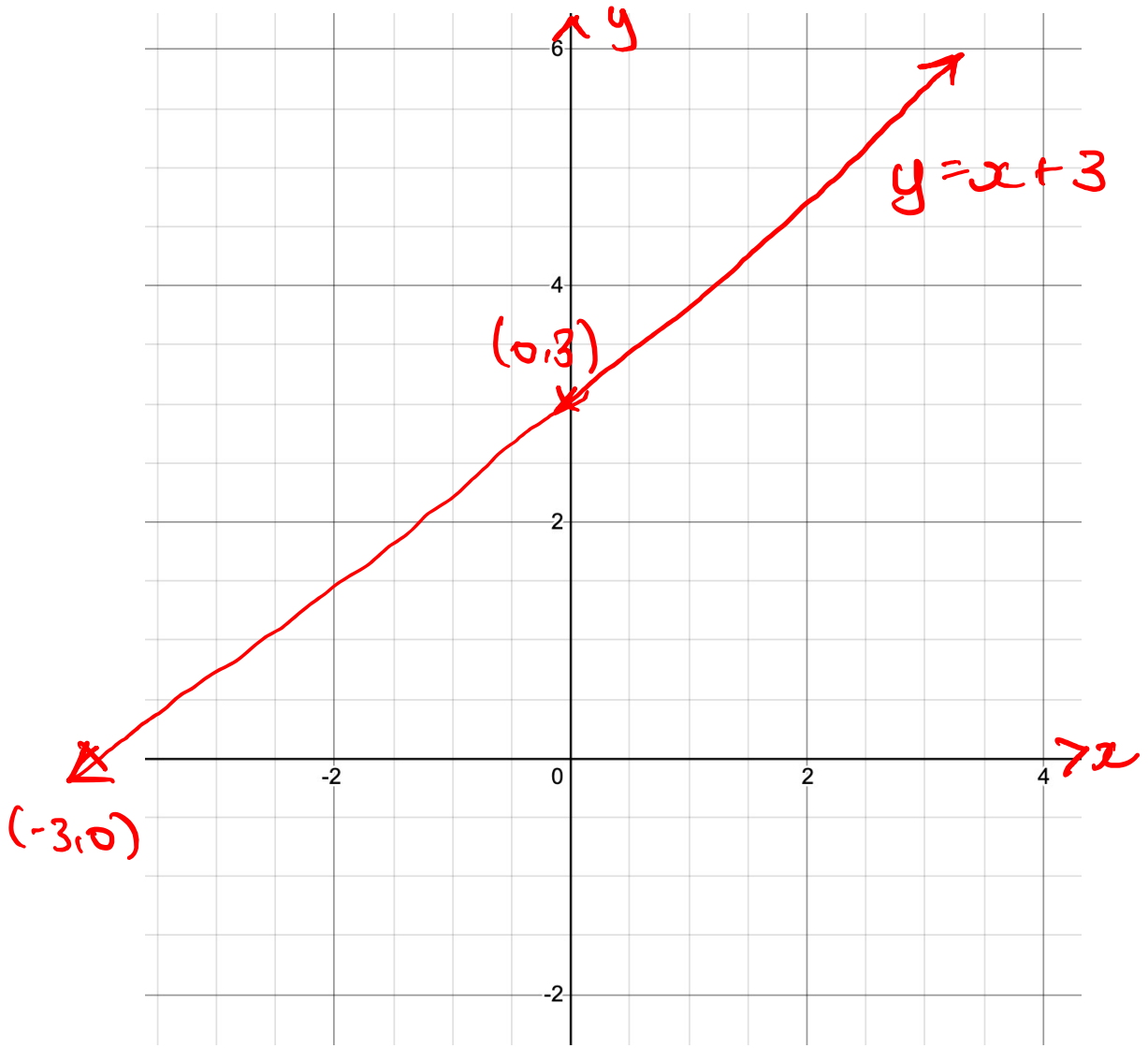
$y = x + 3$	$y = x + 3$
$y = 0 + 3$	$0 = x + 3$
$y = 3$	$-3 = x$
$(0, 3)$	$(-3, 0)$

Finding intercepts using algebra

We can find intercepts using the algebra known we already have.

Given a linear relationship $y = x + 3$ for example, we know the intercepts are found at the points where $x = 0$ and $y = 0$.

So, let's substitute these into the equation $(y = x + 3)$ one at a time and plot them on a cartesian plane.

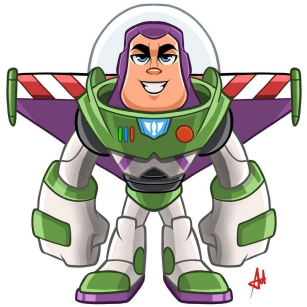


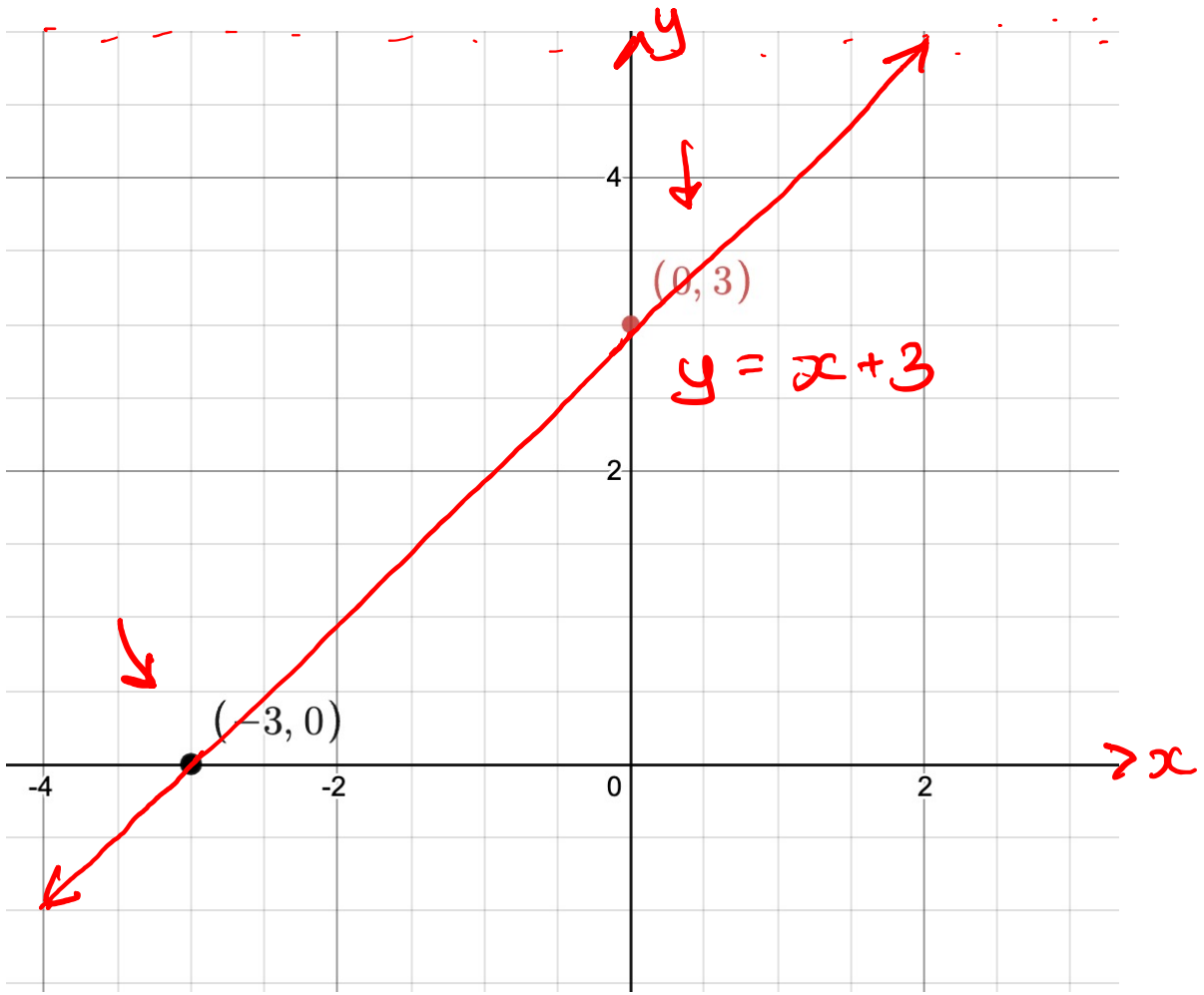
Joining the points to make a line

Knowing two points and the fact that this is a linear relationship, we can join the points together to show the rest of the straight line.

Notice that there are arrows at the end of the line.

This tells the person reading your graph that you understand the line goes to infinity and beyond and that you're only drawing a small part of it.





Different ways to express a straight line

We have seen that relationships of the form shown below give straight lines:

$$y = 2x + 3$$
$$y = x + 3$$
$$y = -x + 7$$
$$y = 3x$$

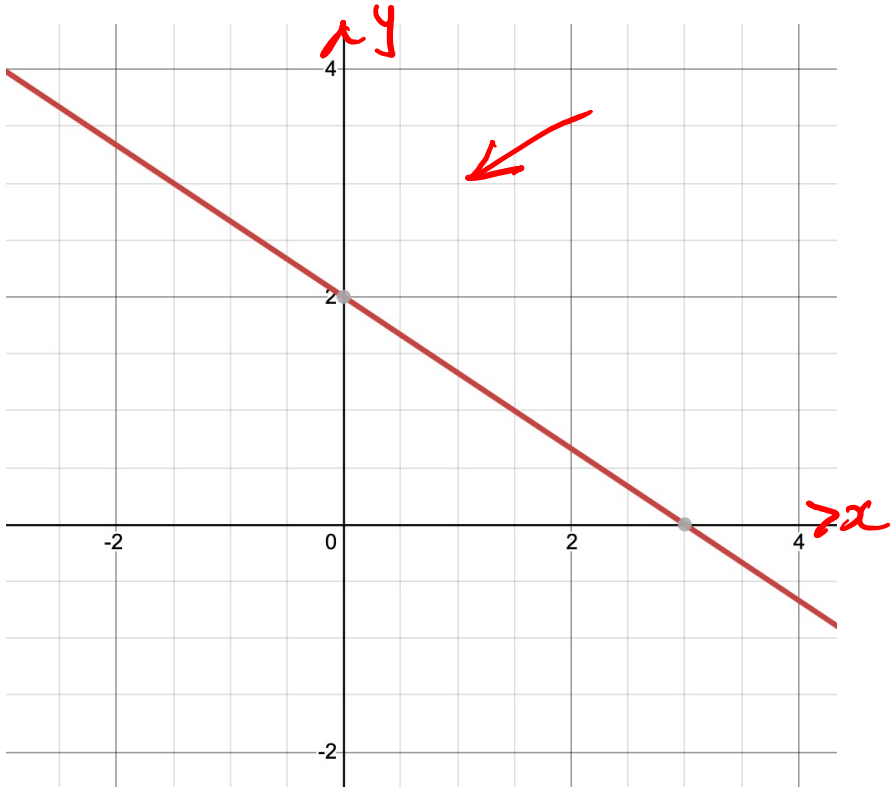
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But there is another way to express a straight line:

$$2x + 3y = 6$$

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Intercept form of a straight line

When an equation is written in the form:

$$ax + by = c$$

We call this the intercept form of a linear relationship.

Writing it this way makes is really easy to find intercepts!

We know, to find intercepts, we need to have x=0 and y=0 substituted into the linear relationship.
So, let's do it with the equation $2x + 3y = 6$

$ax+by=c$

$3x-2y=7$

$4x-6y=10$

$3x+2y=0$

1 1

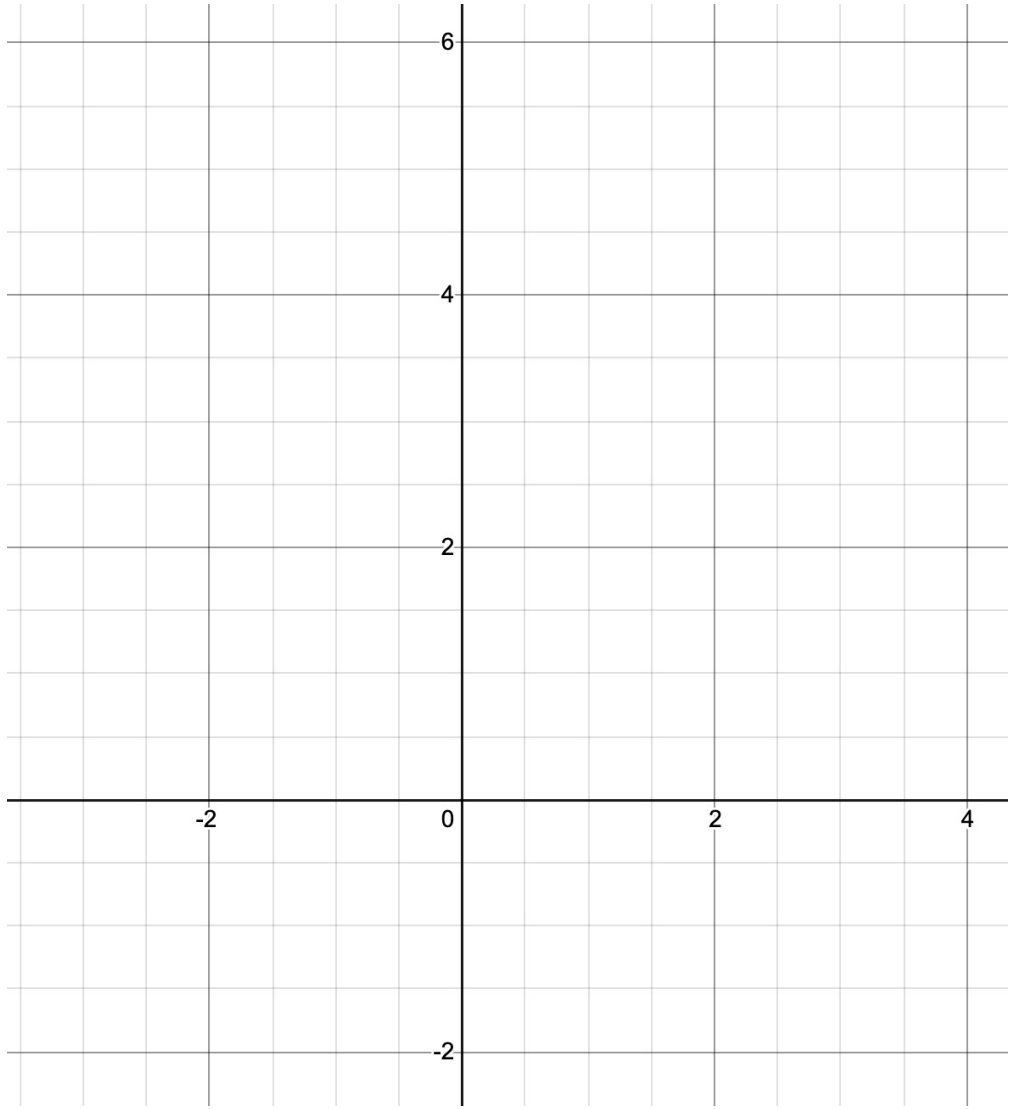
Intercept form of a straight line

We can then plot the two points we have gained and we find that, once again, we can draw a straight line!

There are other topic in Mathematics where we really like equations to be written in the form:

$$ax + by = c$$

But that it for another day!



Examples

Using the grid shown, sketch the graph of:

$3x + 5y = 15$

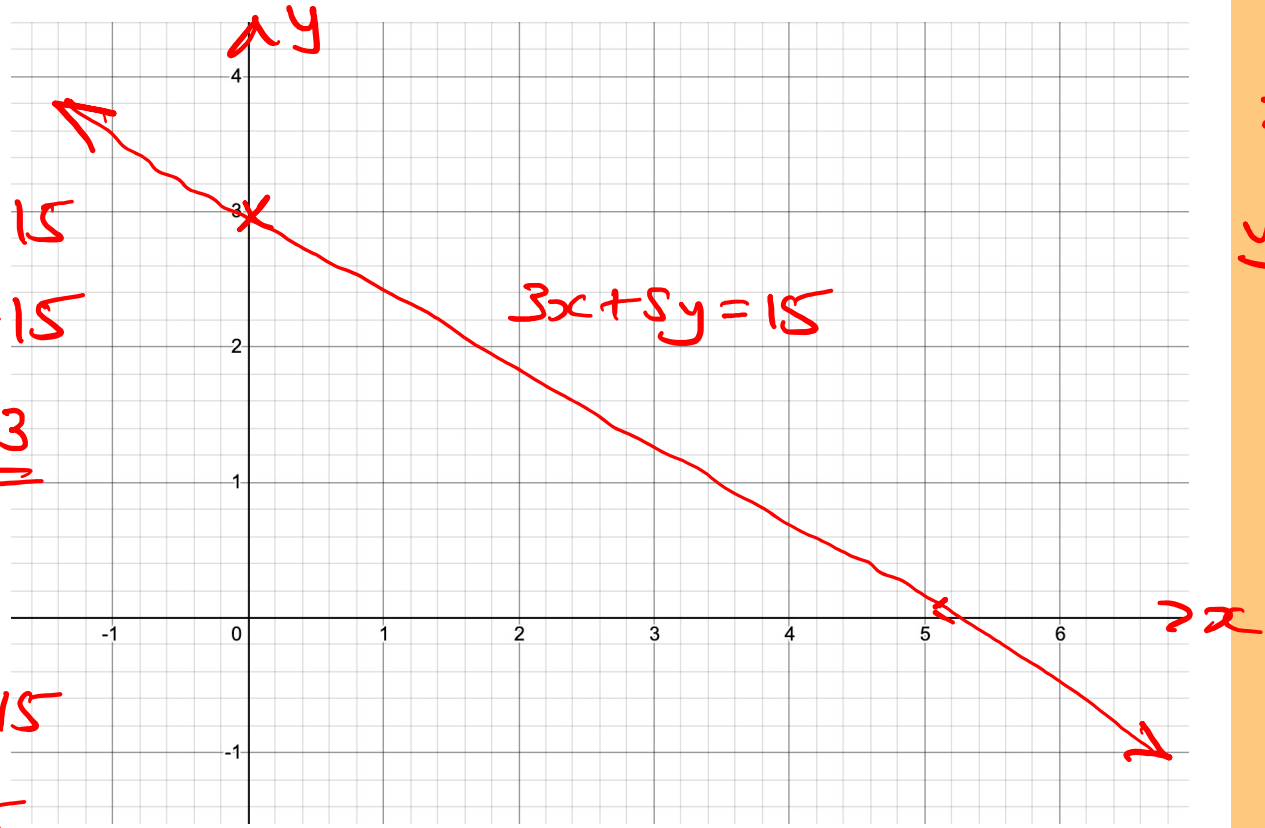
$x=0$

$3x + 5y = 15$

$5y = 15$

$y = 3$

$(0,3)$



$3x + 5y = 15$

$y=0$ $3x = 15$

$x = 5$

$(5,0)$

x int : $y=0$

y int $x=0$

Examples

Using the grid shown, sketch the graph of:

$y = 3x - 6$

$x = 0$

$y = 3x - 6$

$(0, -6)$

$y = 0$

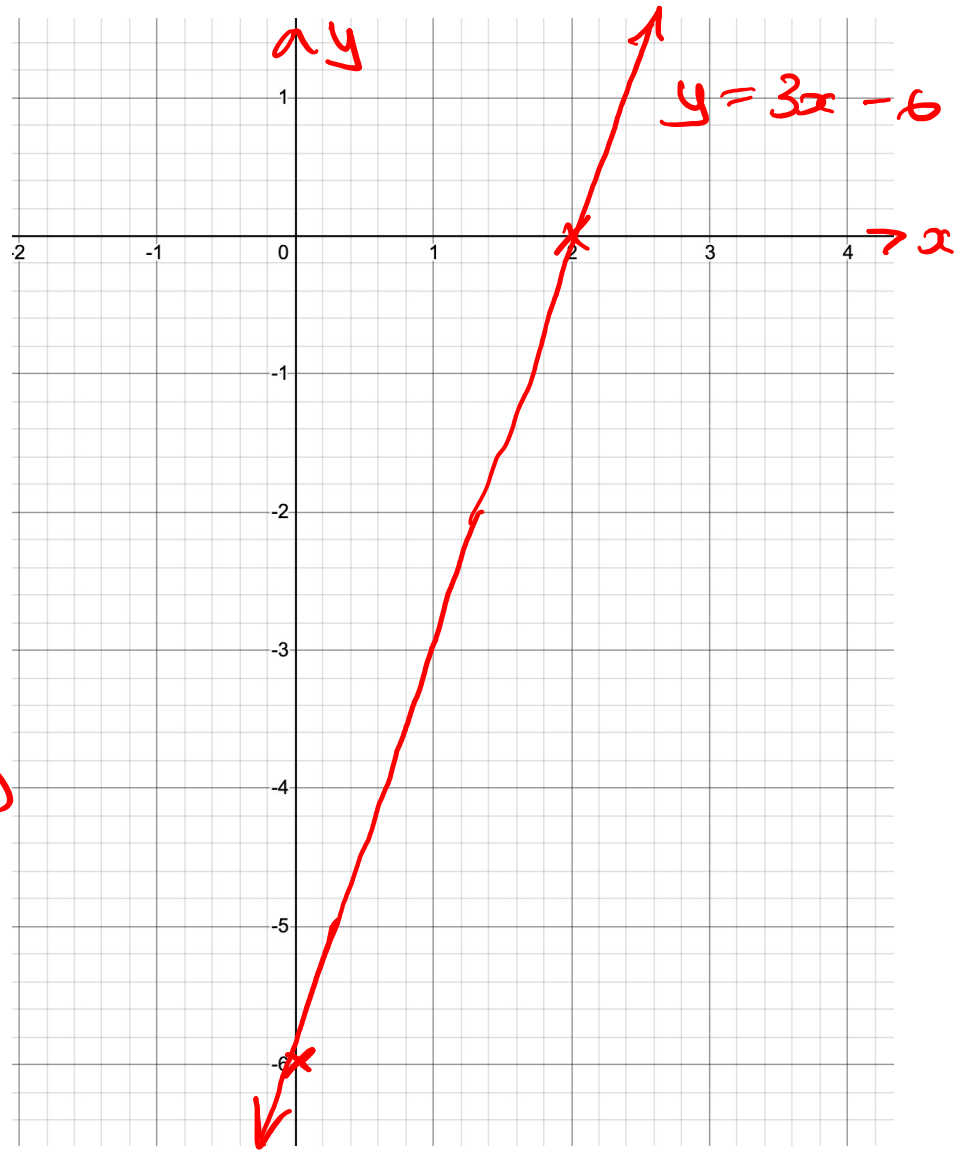
$y = 3x - 6$

$0 = 3x - 6$

$6 = 3x$

$x = 2$

$(2, 0)$



Question: What do you notice about the number at the end of the equation and the y-axis intercept?

Tricks, tricks and more tricks

Every formula we have seen, so far, has the letter x- and y in it. This is just a convention. The letters don't have to be x and y.

We can change them depending on the relationship we have been given.

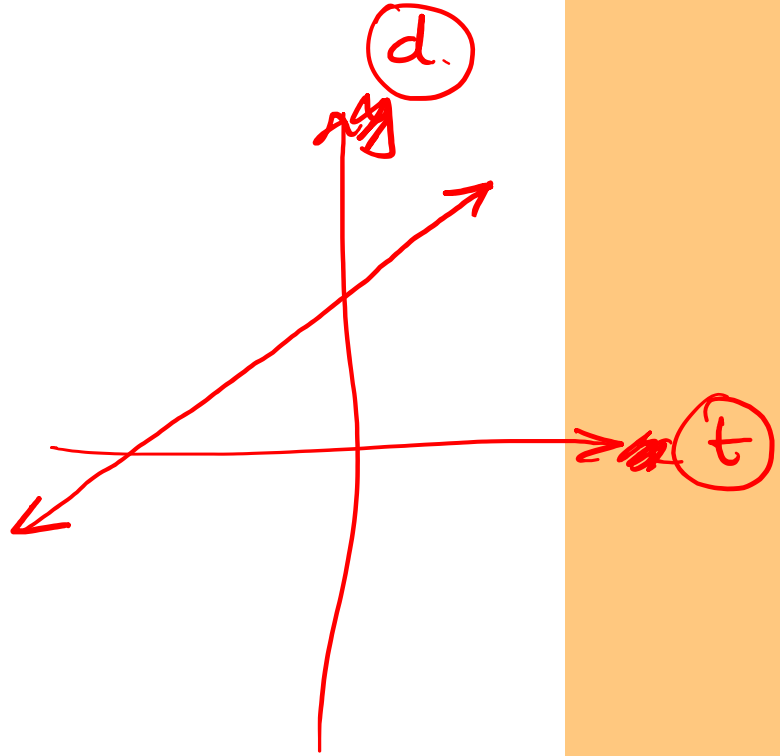
So, for example, looking at the relationship $d = -2t + 8$

We know that the axes would be labelled d and t.

But which goes where?

$y = mx + c$

$d = -2t + 8$



Finding the rule from just two points

There are lots of ways of doing this, but knowing the two axis intercepts is really handy!

There is a rule which says:

$$\frac{x}{x-axis\ intercept}+\frac{y}{y-axis\ intercept}=1$$

$$\frac{x}{3}+\frac{y}{2}=1$$

$$\frac{2x+3y}{6}=1$$

$$2x+3y=6$$

