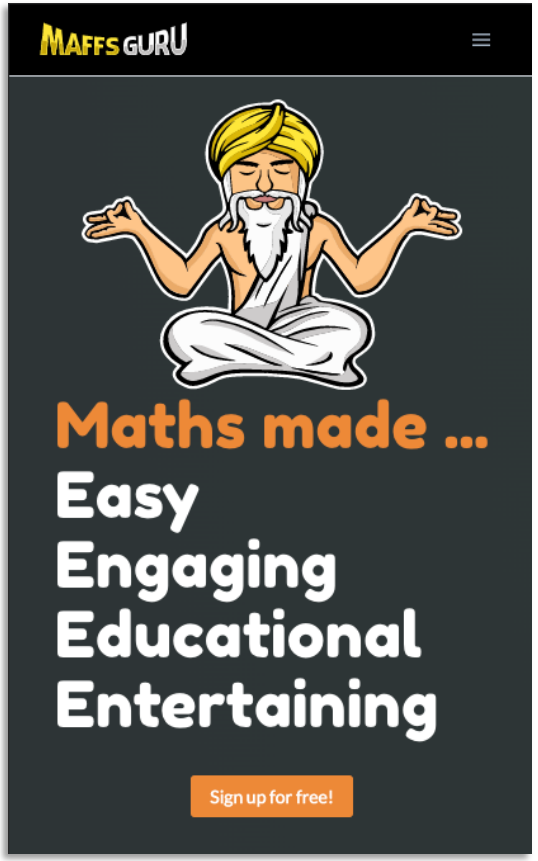
The general equation of a straight line

Year 12 Further Maths
Units 3 and 4

This is where Darren goes



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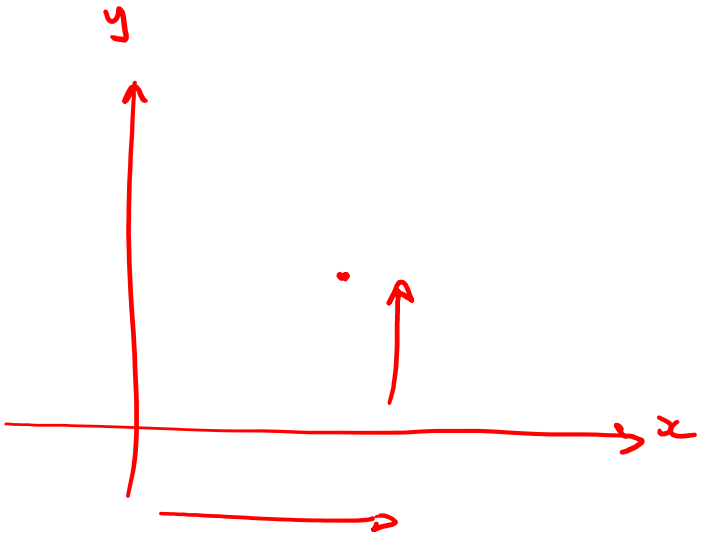
Learning Objectives

By the end of the lesson I would hope that you have an understanding and be able to apply to questions the following concepts:

- Understand what the general equation of a straight line looks like
- Understand how to express a straight line as an equation
- Read the y-axis intercept and gradient from the equation of a straight line
- Understand what make two lines parallel
- Know how to sketch a straight line given its equation



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Recap

This is a continuation of the work being studied for the Further Maths Units 3 and 4 course.

In the previous lesson we looked at finding the gradient of a straight line using one of two equations

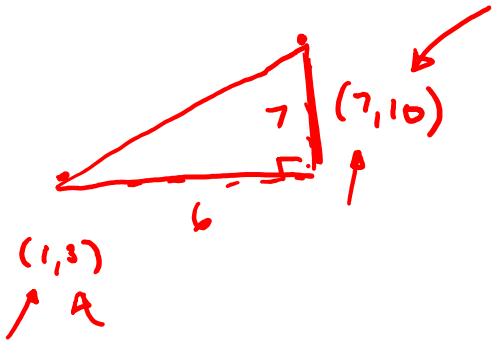
$$Gradient = \frac{rise}{run} \qquad Gradient = \frac{y_2 - y_1}{x_2 - x_1}$$

(1,3) (7,10)

$$grad = \frac{y_2 - y_1}{x_2 - x_1}$$

$$= \frac{10 - 3}{7 - 1}$$

$$= \frac{7}{6}$$



grad = 7/6

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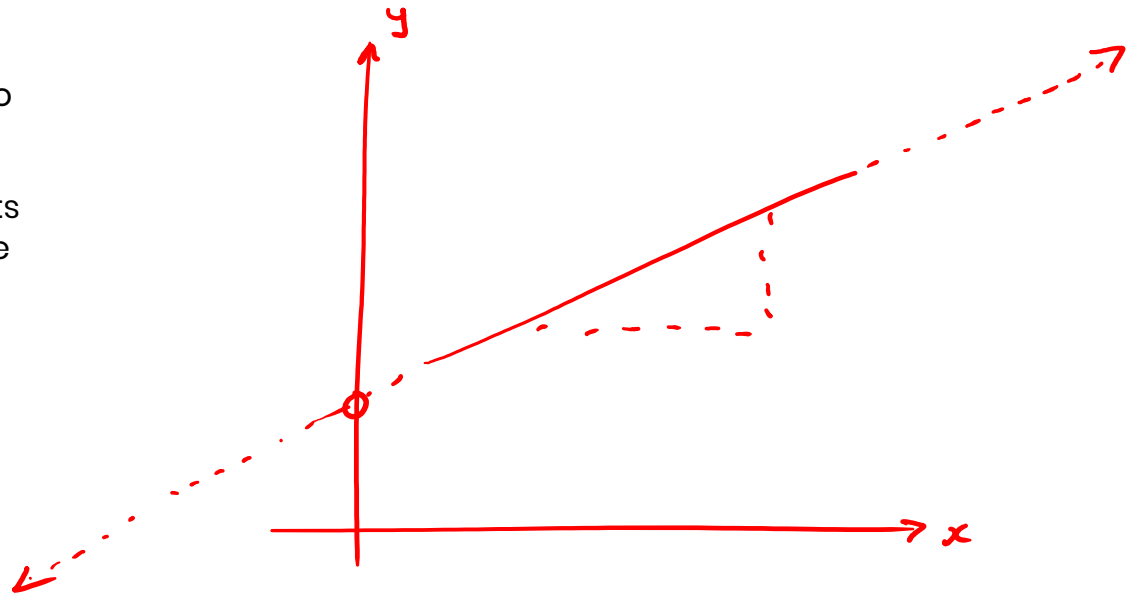
Gradients and intercepts

Straight lines have two main characteristics which help us draw them; **gradient** and **y-axis intercept**.

From a previous lesson we already know how to find the gradient. This is a measure of slope.
If we know one point which sits on the line, we can get to other points. Once I have three points (or more) I can connect them together to make a straight line.



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Drawing a line using one point and the gradient

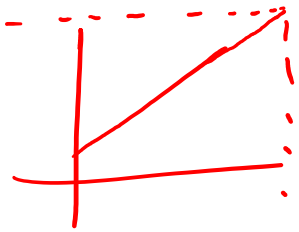
If we use the example where we have been given one coordinate $(1, 3)$ on a line and have a gradient as:

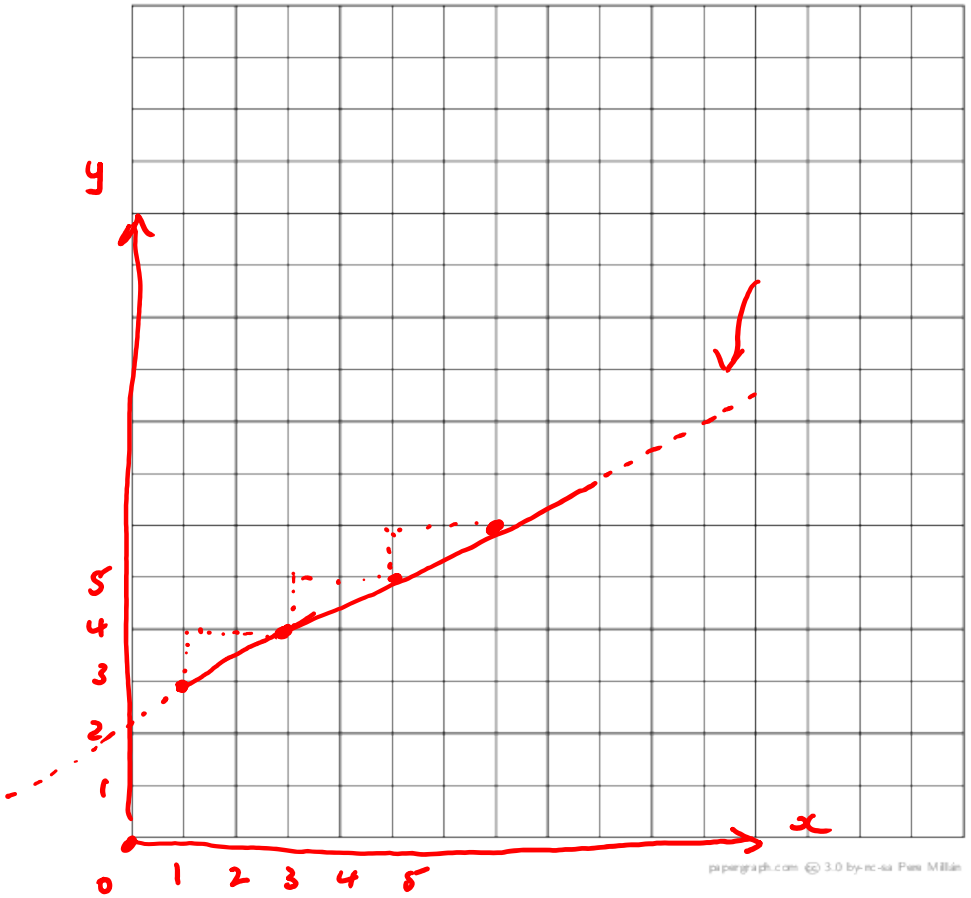
$$Gradient = \frac{1}{2} = \frac{\text{rise}}{\text{run}}$$

We can use the information to draw a straight line.

1 rise

2 runs





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The y-axis intercept as a starting point

We are normally given a point to help us draw a straight line. This point normally sits on the y-axis. It has a special name**; the y-axis intercept.**

Intercept is simply where something cuts or meets something else.

Hence, we might be told the y-axis intercept is 3.

If we have a gradient of $\frac{2}{3}$ we can draw the straight line.

$(0,3)$

$\frac{2}{3} = \frac{\text{rise}}{\text{run}}$

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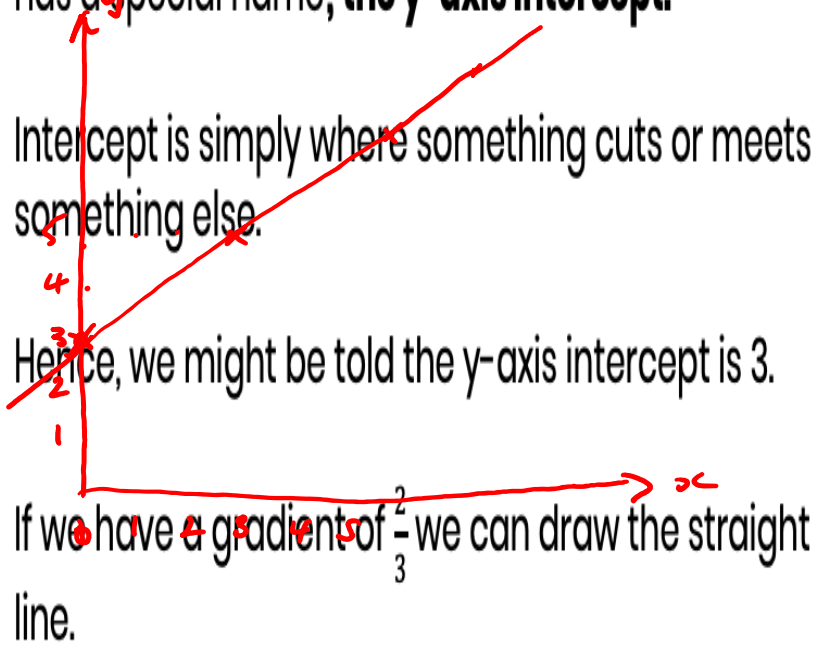
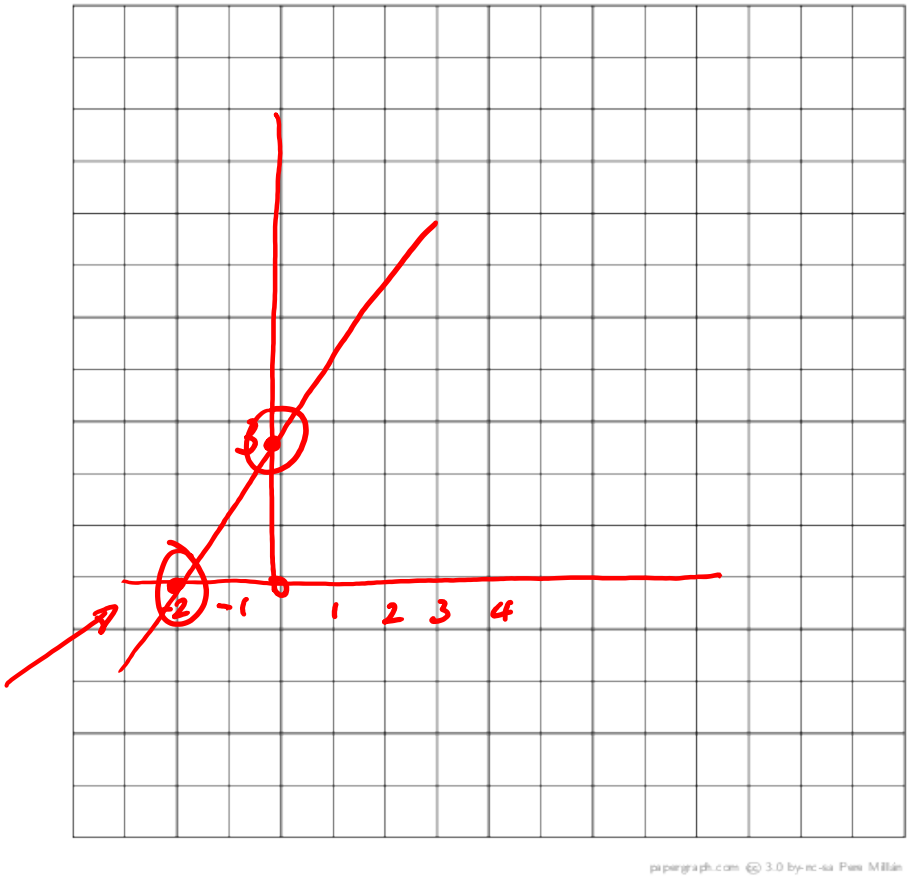


Don’t get tricked!

We must make sure that we use the y-axis and not the x–axis as the starting point!

Too many people make silly mistakes here.

y - axis



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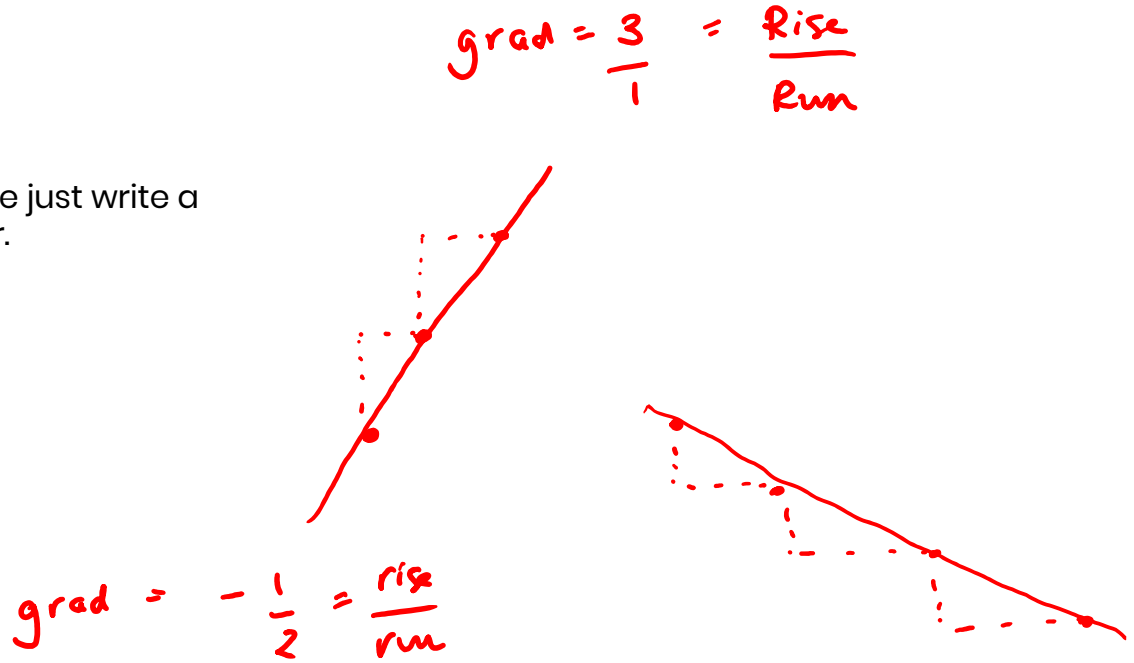
Whole numbers are gradients too!

Lots of people get tricked when we give gradients as whole numbers.

$$Gradient = 3$$

A whole number is still a fraction. We just write a divide by 1 below the whole number.



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The equation of a straight line

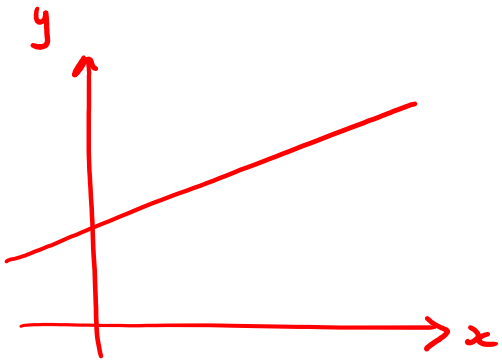
Barry just loves an equation!

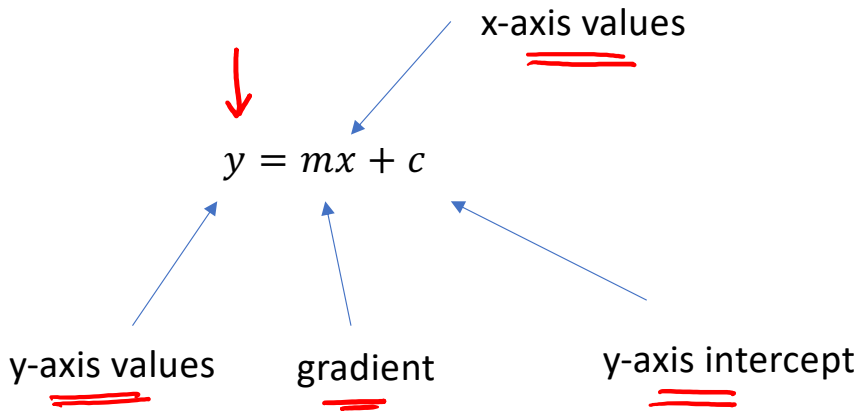
Straight lines are a **relationship**. They show a connection between an x- value and a y-value. If we know the x-value we can find the y-value (and vice-versa)

Straight lines have a standard format as shown.

It's important to know that the gradient is shown by the letter 'm' and the y-axis intercept by the letter 'c'

This version of the equation of a straight line is called the **gradient/intercept form**.





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Example

Find the gradient and y-axis intercept of the graph of $y = 3x - 4$.

$y = 3x - 4$

$y = mx + c$

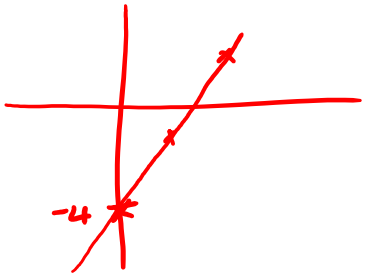
$+c = -4$

$c = -4$

$m = 3$

$c = -4$

grad $= \frac{3}{1}$



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Examples have been extracted, with permission, from the Cambridge Further Mathematics Units 3 and 4 Textbook

Example

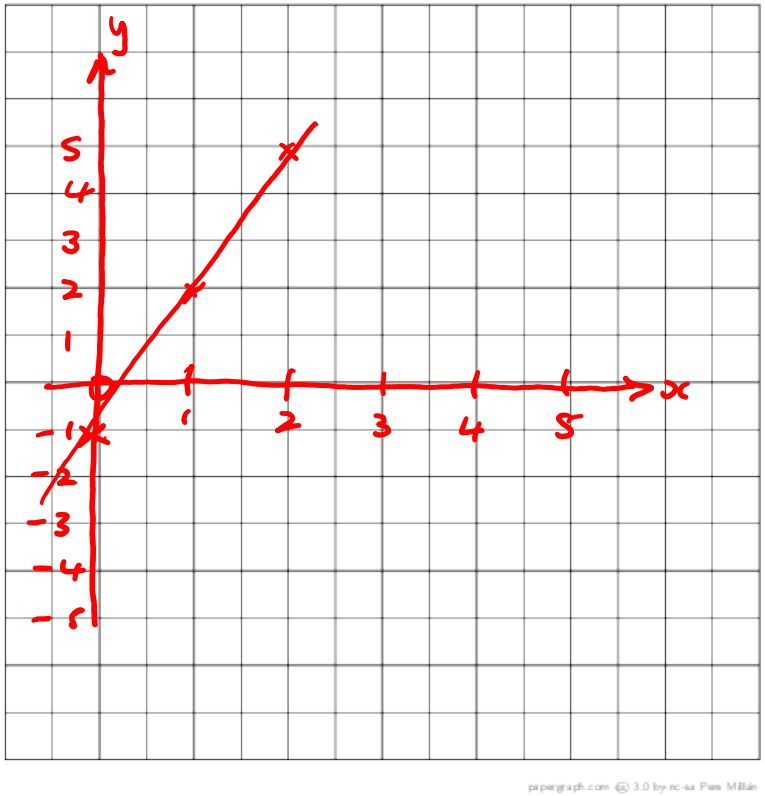
Sketch the graph of $y = 3x - 1$.

$y = 3x - 1$

$y = mx + c$

$m = \frac{3}{1} = \frac{\text{rise}}{\text{run}}$

$c = -1$



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Different ways of writing the equation of a straight line

Not happy with just having one form of the equation of a straight line, Barry wants another one.

This is called the intercept form as it helps us find two points (the intercepts) on the x- and y-axis really quickly.

$$2x + 4y = 12$$

$2x + 4y = 12$

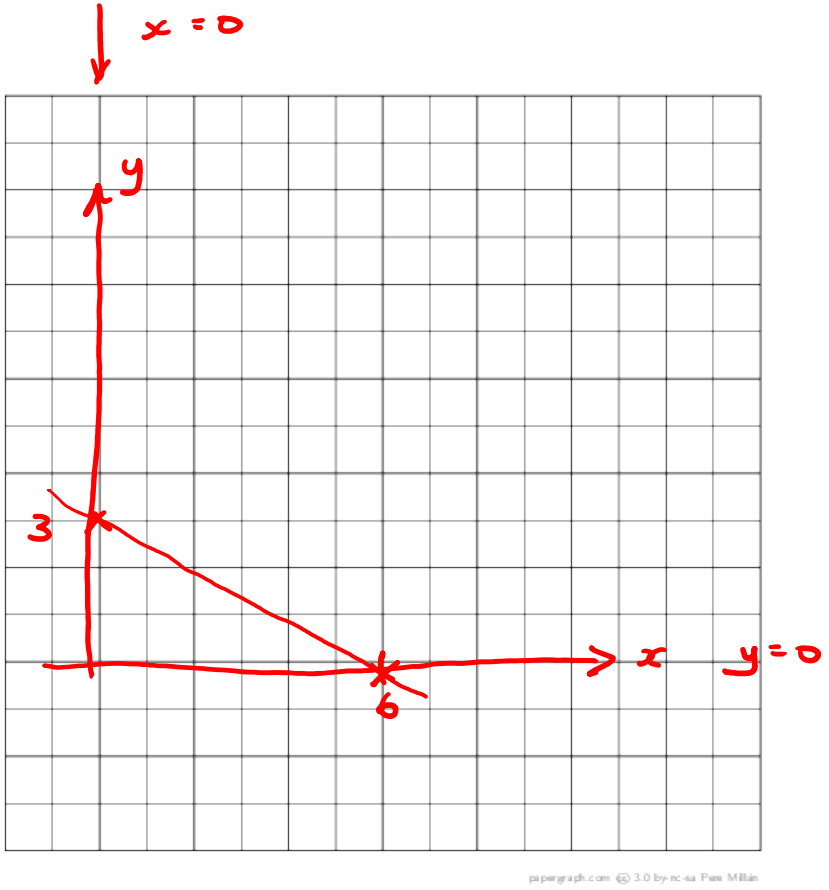
$x = 0$ $\quad 4y = 12$

$y = 3$

$2x + 4y = 12$

$y = 0$ $\quad 2x = 12$

$x = 6$



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Example

Sketch the graph of $3y + 6x = 9$.

$3y + 6x = 9$

$x = 0$ $\quad 3y = 9$

$y = 3$

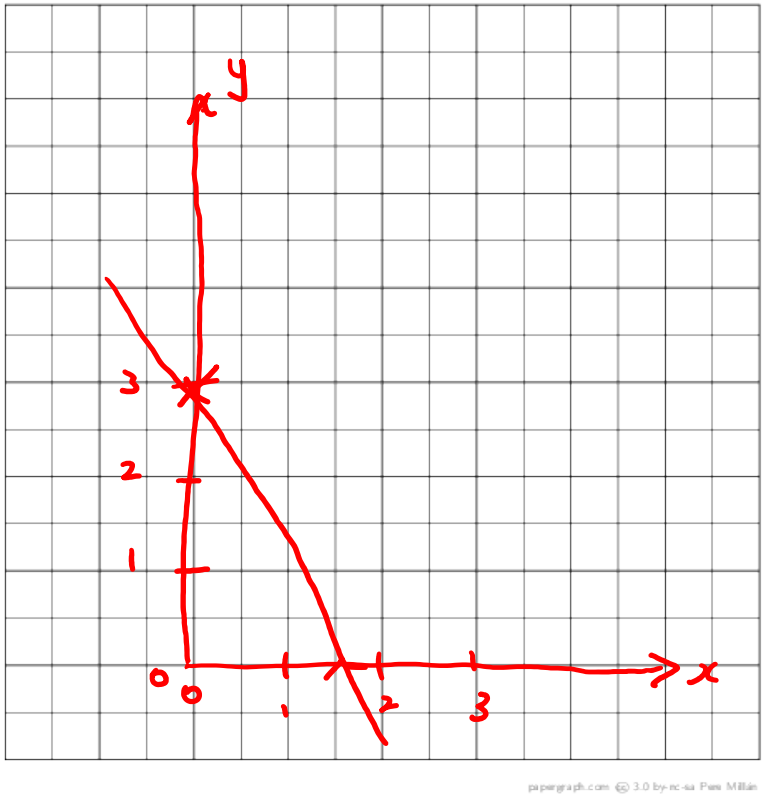
$y = 0$ $\quad 3y + 6x = 9$

$6x = 9$

$x = \frac{9}{6}$

$x = \frac{3}{2}$

$=$



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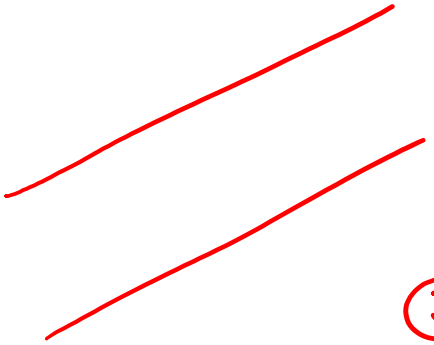
Parallel Lines

Parallel lines are such that they will never, ever, ever meet.

They have the same gradient.



$y = 3x - 2$ $\quad m = 3$

$y = 3x + 4$ $\quad m = 3$

$3x + 4y = 2$

$4y = -3x + 2$

$y = -\frac{3}{4}x + \frac{1}{2}$

$3x + 4y = 2$

$3x + 4y = 7$

$3x + 4y = 7$

$4y = -3x + 7$

$y = -\frac{3x}{4} + \frac{7}{4}$

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