

Straight line graphs (H)

Formulas for straight line graphs

Suppose you have the formula $y=2x+3$ you can substitute various values of x into the formula and build a table like this

X	-3	-2	-1	0	1	2	3
Y	-3	-1	1	3	5	7	9

See how increasing x by 1 results in y increasing by 2? That is because of the $2x$ term in the formula.

When $x=0$ the value of y is 3. That is because of the $+3$ term in the formula. If you plot a graph of the values in the table above, the result will be straight line, no scatter.

Writing the table just by looking at the formula

Suppose you have the formula $y=3x-5$

If you increase x by 1, how much will y increase by?

If $x=0$ what will the value of y be?

Use these facts to complete the table below without calculating...

X	-3	-2	-1	0	1	2	3
Y							

The word 'coefficient' means the number in front of a symbol, in this case x .

Now suppose you had a formula with a negative coefficient of x like $y=-2x+3$

When the x value is increased by 1, the y decreases by 2

Try filling in the table for the formula $y=-2x+3$ without calculating each value.

X	-3	-2	-1	0	1	2	3
Y							

Fractional coefficients: rearranging the formula (H)

Look at this formula $y=\frac{2}{3}x+4$

The fractional coefficient means that when you increase x by 1, the y value will increase by $\frac{2}{3}$.

In very few of the higher level graph questions, and in later work in maths, they will re-

arrange the formula by multiplying everything by 3...

$$3y = 2x + 12$$

To find the coefficient of x , you just divide the new formula by 3, and to find the value of y when $x=0$, again just divide the 12 by 3.

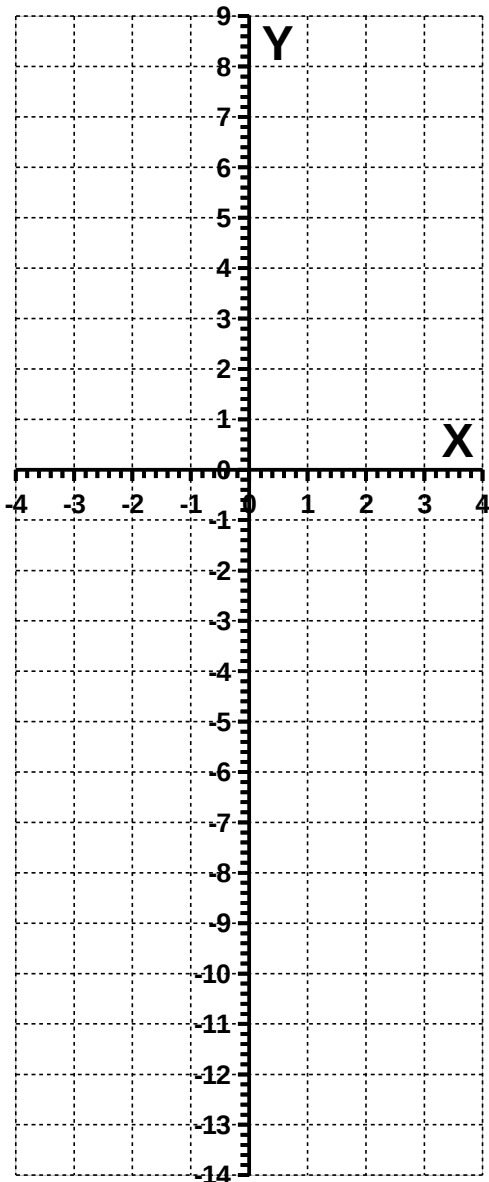
The formula can also be written $3y - 2x - 12 = 0$ but this isn't a form you will see often on the exam papers.

Try filling in the table for the formula $y = \frac{2}{3}x + 4$

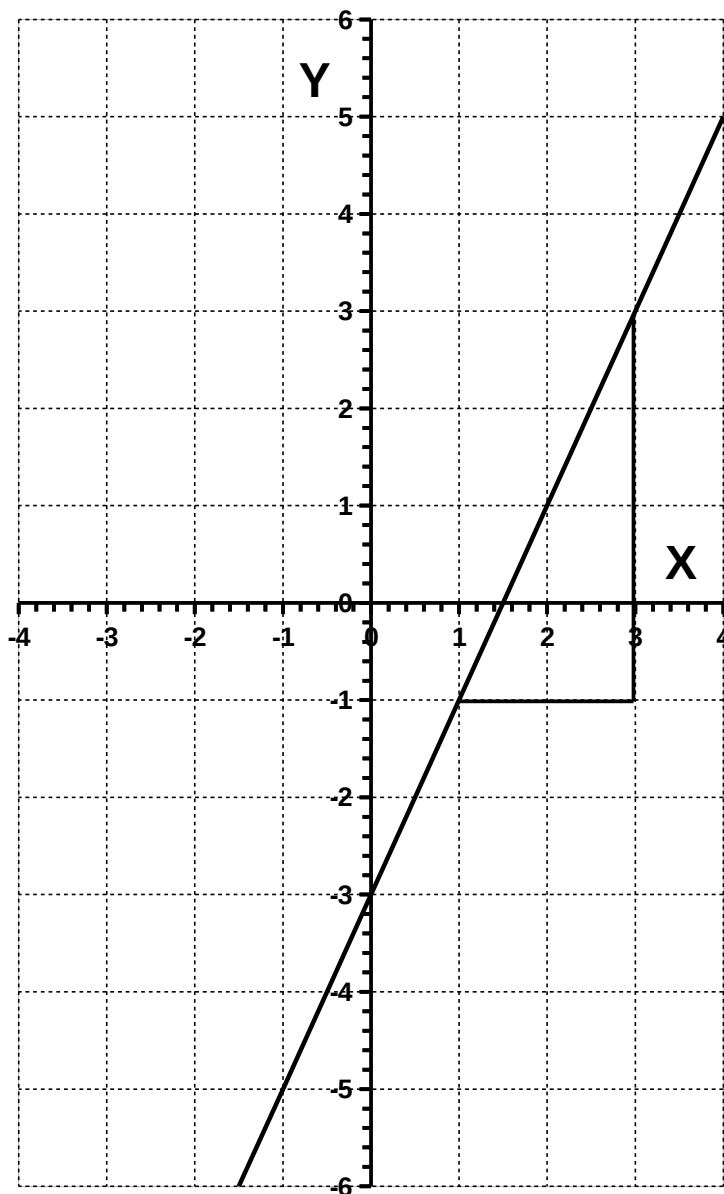
X	-3	-2	-1	0	1	2	3
Y							

Plotting graphs from the table

Use the axes below to plot and label graphs of the four formulas..



Gradient and Intercept



The gradient of the line tells you how steep the line is.

See the triangle I have drawn from two points on the line?

The base of the triangle is 2 units, and the height of the triangle is 4 units.

The gradient of the line is $4 \div 2 = 2$

The point where the line meets the Y axis is called the Intercept.

The intercept of this line is -3

The gradient of the line is also the coefficient of x in the formula for the graph.

The intercept of the line with the Y axis is the constant in the formula.

The 'general formula' for any straight line is written $y=mx+c$ where m represents the gradient and c represents the intercept.

Look at your graphs for the formulas at the beginning of the section.

Check the gradient of each graph and compare it with the coefficient of x in the formula

Check the intercept of each graph and compare that with the constant term in the formula.

Calculating the gradient from the coordinates of two points

Suppose you have two points on a straight line graph, one with coordinates (x_1, y_1) and (x_2, y_2) .

The gradient of the straight line can be calculated from $m = \frac{y_2 - y_1}{x_2 - x_1}$

For example, suppose you know that (3, 7) and (5, 13) are points on the same line. You can find the gradient of the line by calculating $m = \frac{13 - 7}{5 - 3} = \frac{6}{2} = 3$

Finding the formula from the gradient and a point

Suppose you know that a straight line has gradient 2, and passes through the point (4, 5). You can set up and solve an equation to find the intercept, c

The general formula for a straight line is $y = mx + c$, where m represents the gradient and c represents the intercept.

You know that $y = 5$ and $x = 4$ and that $m = 2$. Substituting those values into the general formula gives an equation in c ,

$$5 = 2 \times 4 + c \text{ so, } c = -3 \text{ and the formula for the line is } y = 2x - 3$$

Your turn

- 1) A line has formula $y = 5x - 9$. Write down the gradient and the intercept of the line
- 2) A straight line passes through the points (3, 2) and (7, 18). Find the gradient. Then find the Intercept and the formula for the line
- 3) A line has the formula $y = -\frac{1}{2}x + 2$. Write down the gradient and the intercept of the line.
- 4) A straight line passes through the points (4, 6) and (8, 5).
Find the gradient of the line (remember that -6 is the same as $+6$)
Find the intercept of the line and then write the formula of the line down
- 5) Use some graph paper to plot the lines in Q2 and Q4.
What do you notice about the lines?
Multiply the gradients you found in Q2 and Q4 together. What do you notice?
- 6) Plot the graph of $2y + x = 12$ on the same axes as the graph of $y = 2x + 1$. Use an x axis from 0 to 12 and a y axis from 0 to 25. Use 1cm for 1 unit on both axes.
What do you notice about the graphs?