WJEC MATHEMATICS

INTERMEDIATE

GRAPHS

STRAIGHT LINE GRAPHS (PLOTTING)

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Contents

Credits

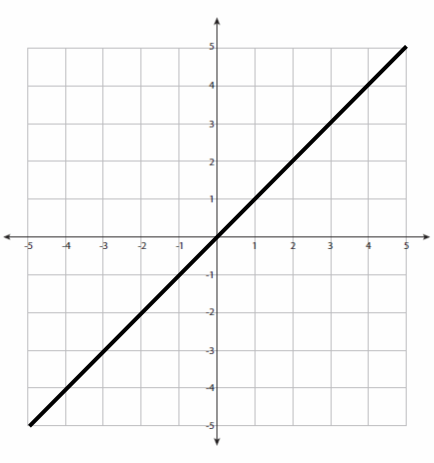
WJEC Question bank
http://www.wjec.co.uk/question-bank/question-search.html

Some Simple Straight Lines

There are some basic straight lines that you should be able to draw.

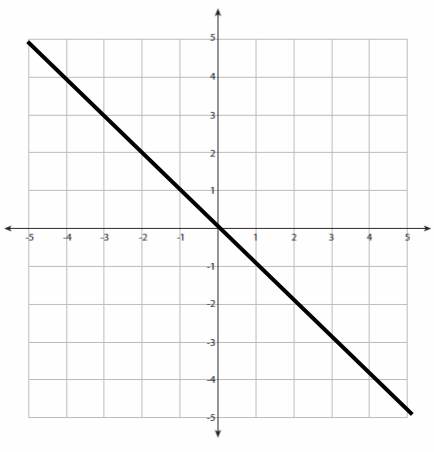
$y = x$

The line of $y = x$ is a diagonal line that does through (0,0).



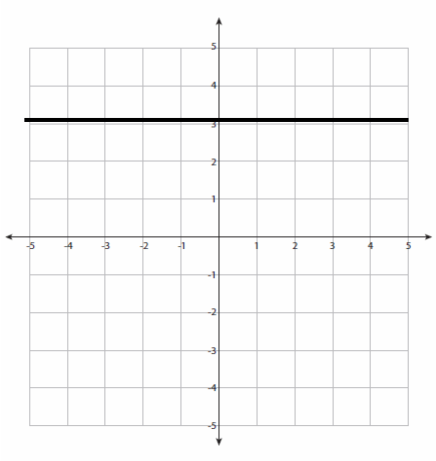
$y = -x$

The line $y = -x$ goes is a diagonal line, opposite to $y = x$



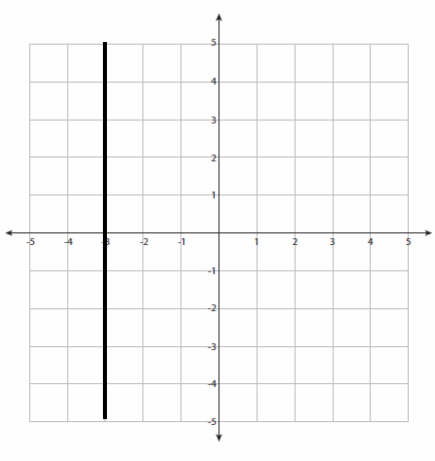
$y = ?$

If you need to plot a graph of $y = ?$ (For example, $y = 3$ as seen below), you need to find the number on the y axis and draw a **horizontal line**.



$x = ?$

If you need to plot a graph of $x = ?$ (For example, $x = -3$ as seen below), you need to find the number on the x axis and draw a **vertical line**.



Common Confusion!

Yes, the y axis is the vertical axis, but the line $y = 4$ is a horizontal line

And yes, the x axis is the horizontal axis, but the line $x = 4$ is a vertical line

Exercise G2

1. Plot, and label, the following lines of the graph paper below

a. $y = 4$

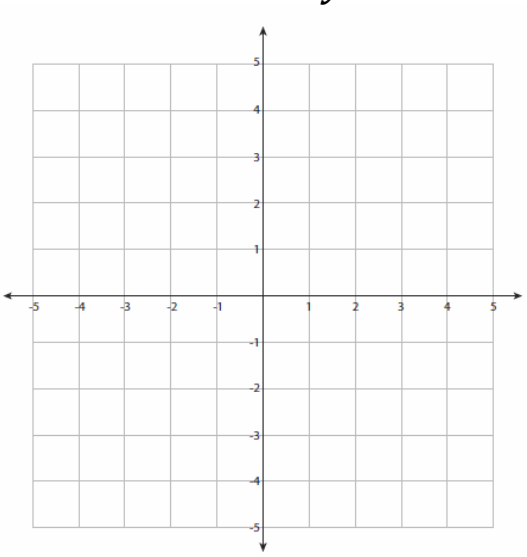
b. $y = 2$

c. $y = 1$

d. $y = -5$

e. $y = -2$

f. $y = -1$



2. Plot, and label, the following lines of the graph paper below

a. $x = 2$

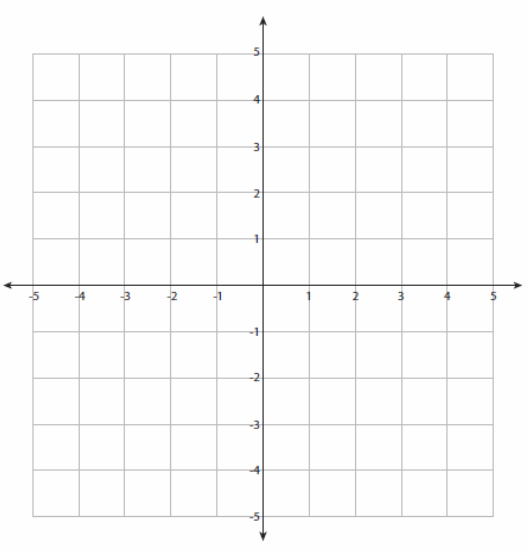
b. $x = 5$

c. $x = 3$

d. $x = -4$

e. $x = -1$

f. $x = 0$



$y = mx + c$

You may be shown a straight line and asked to write the equation of that line. The formula we use is;

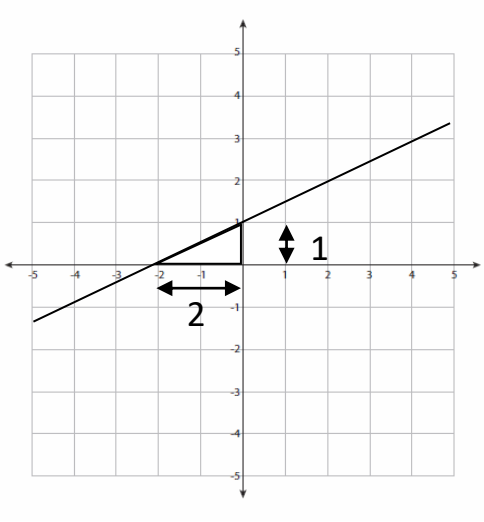
$$y = mx + c$$

where;

- m is the **gradient** of the line
- c is where the line crosses the y axis

Example

Write the equation of the following line in the form $y = mx + c$



Finding the Gradient

To find the gradient, use the line to draw a right angled triangle:

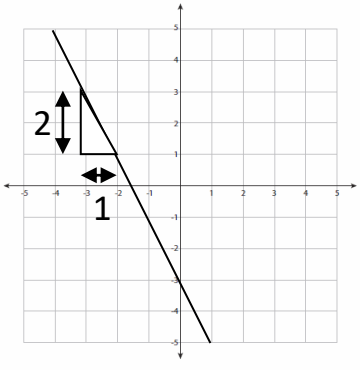
$$\frac{\textbf{length of vertical}}{\textbf{length of horizontal}}$$

If the line goes up the gradient is positive. If the line goes down, the gradient **is negative**

So for the above line

- The gradient of the line is $\frac{length\ of\ vertical}{length\ of\ horizontal} = \frac{1}{2}$
- The line passes through the y axis at 1

The equation is $y = \frac{1}{2}x + 1$



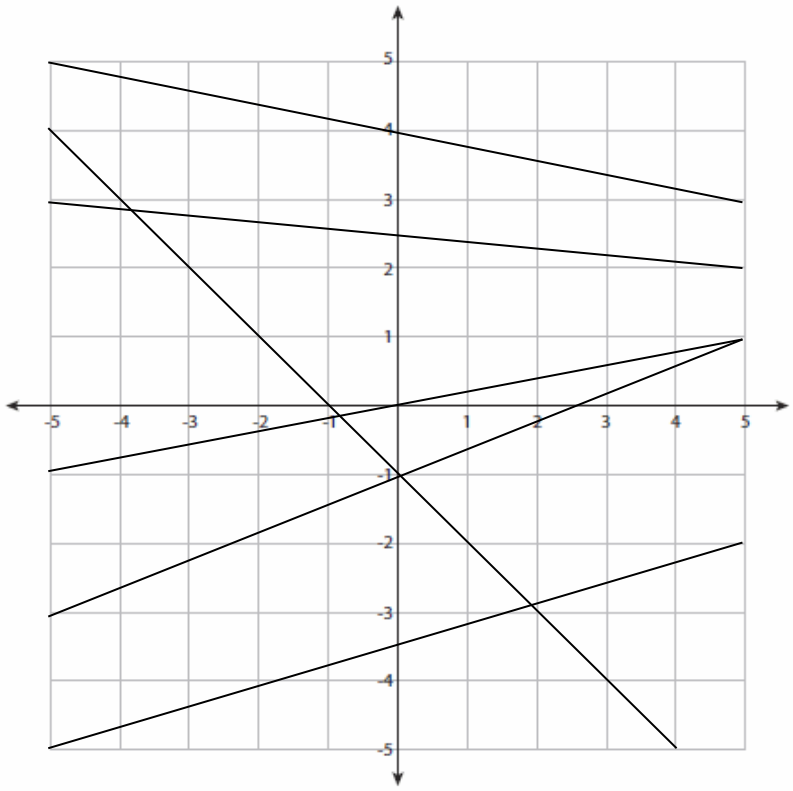
For this line,

- The gradient is $\frac{length\ of\ vertical}{lengthof\ horizontal} = \frac{2}{1} = 2$
- The line passes through the y axis at -3

The equation is $y = -2x - 3$

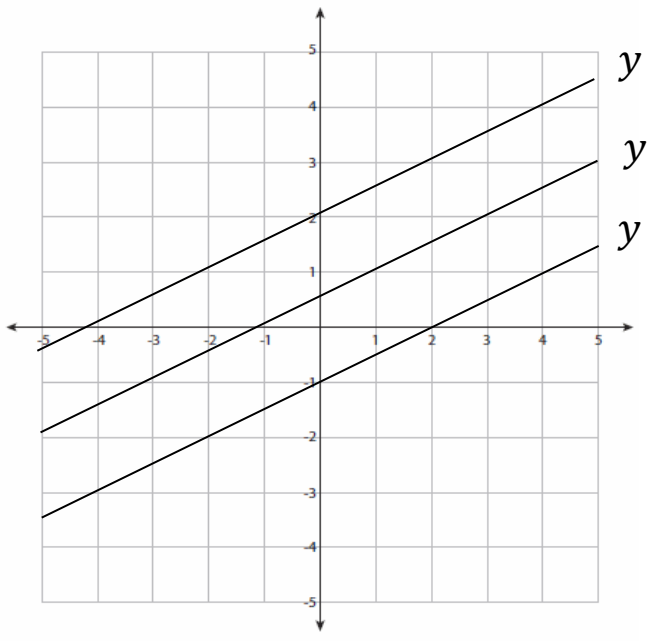
Exercise G3

Write the equations of the following lines



Parallel Lines

Parallel lines have the **SAME GRADENT**.



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

$y = \frac{1}{2}x + 0.5$

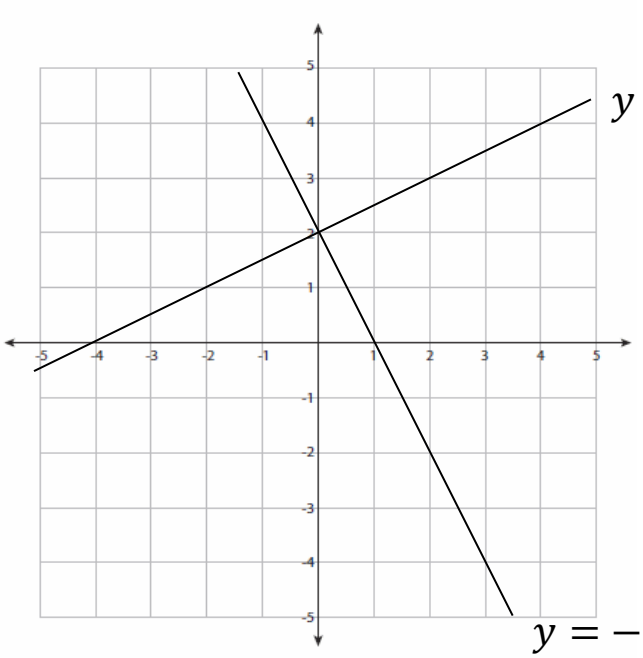
$y = \frac{1}{2}x - 1$

Gradient of Parallel Lines

You can see from the equations of these parallel lines that the gradients are the same.

Perpendicular Lines

The gradients of two lines that are perpendicular (meet at a right angle) **MULTIPLY TO GIVE -1**



Gradient of Perpendicular Lines
Multiply the gradients together
$\frac{1}{2} \times -2 = -1$
So the lines are perpendicular

Example Question

Write the equation of a line that is parallel to $y = 3x + 2$ and a line that is perpendicular to $y = 3x + 2$

Note: You only need to change the gradient, the value of c does not affect whether lines are parallel or perpendicular.

Parallel line: $y = 3x + 1$

Perpendicular line: $y = -\frac{1}{3}x + 1$

$-\frac{1}{3} \times 3 = -1$
So the lines are perpendicular

Exercise G4

Write the equation of a line that is perpendicular and a line that is parallel to the following equations:

a. $y = 2x + 1$

b. $y = -4x - 2$

c. $y = 12x - 4$

d. $y = \frac{1}{2}x + 4$

e. $y = -\frac{1}{3}x + 3$

f. $y = -\frac{1}{5}x - \frac{2}{3}$

Plotting Straight Lines

You may be given an equation and be asked to draw the line. To do this, you will need to create a table of points

x on the top →

y on the bottom →

x	1	2	3
y			

Substitute these x values into the equation to find the y value that goes with it

Once you have these points, plot them and the connect them with a line

Example

Plot the line $y = 2x - 3$ on the graph paper below.

Step one

Draw your table of points

x	1	2	3
y			

If using 1, 2, 3 isn't easy use three different values of x instead

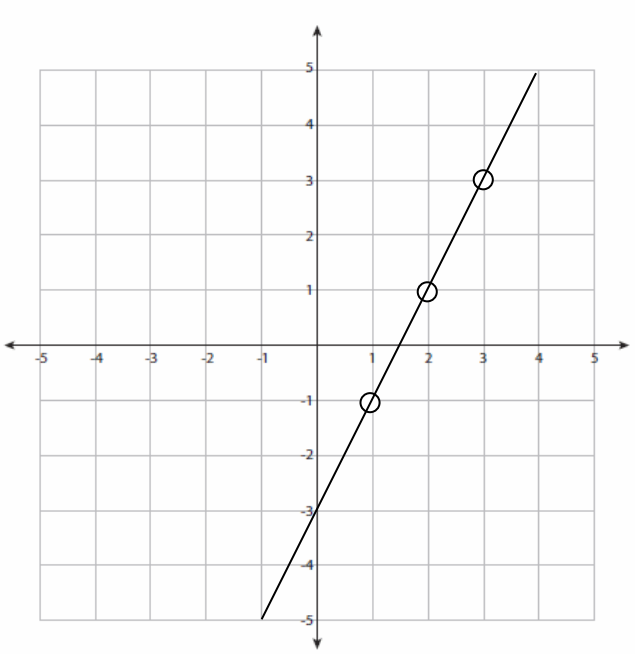
Substitute the x values into the equation (See the booklet *Substitution* for more help with this)

- $2(1) - 3 = 2 - 3 = -1$
- $2(2) - 3 = 4 - 3 = 1$
- $2(3) - 3 = 6 - 3 = 3$

x	1	2	3
y	-1	1	3

We now have three coordinate points (1,-1) (2,1) and (3,3)

To complete the question, plot the points and join them up with a line.



Make sure the equation is in the form $y = mx + c$

If the question gives you the equation in a different form, rearrange it

e.g.

$x + y = 4$

becomes

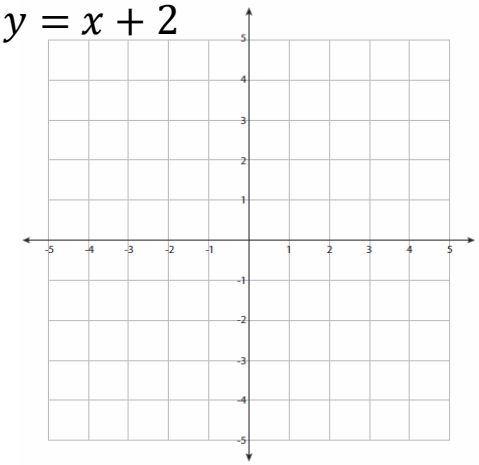
$y = -x + 4$

Make sure your line uses the entire space of the graph

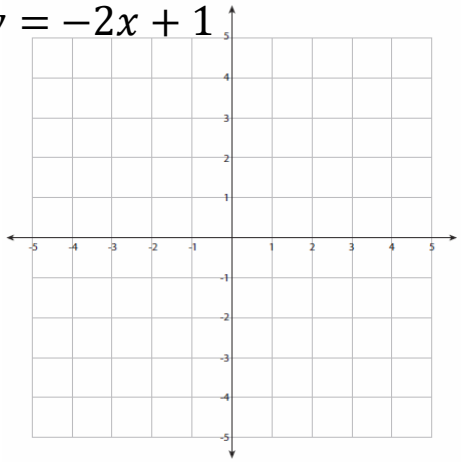
Exercise G5

Plot the following lines

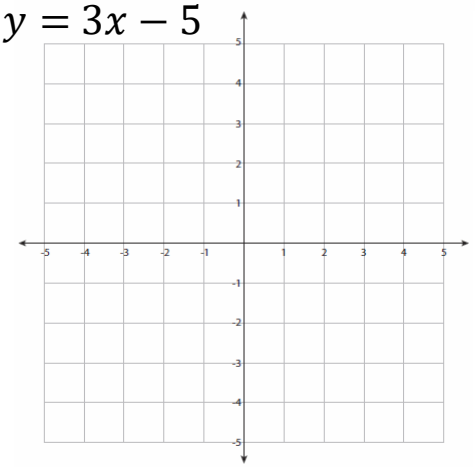
1. $y = x + 2$



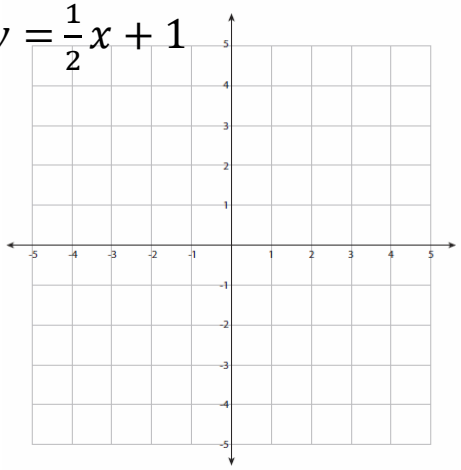
2. $y = -2x + 1$



3. $y = 3x - 5$



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



Exam Questions G8

1. *(a)* Use the grid below to draw graphs to represent each of the following equations.

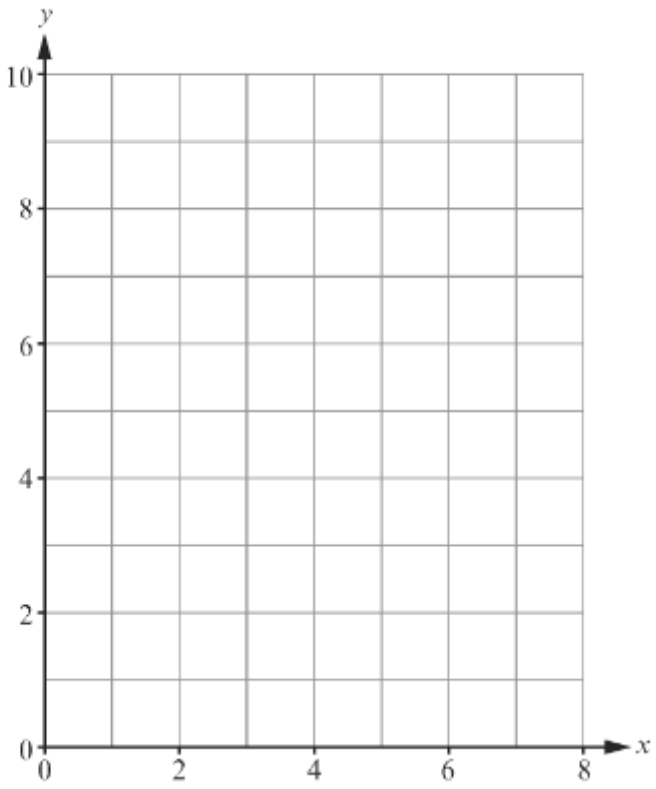
(i) $y = \frac{1}{2}x + 6$

(ii) $x + y = 8$

.....

.....

Label your lines (i) and (ii) as appropriate.

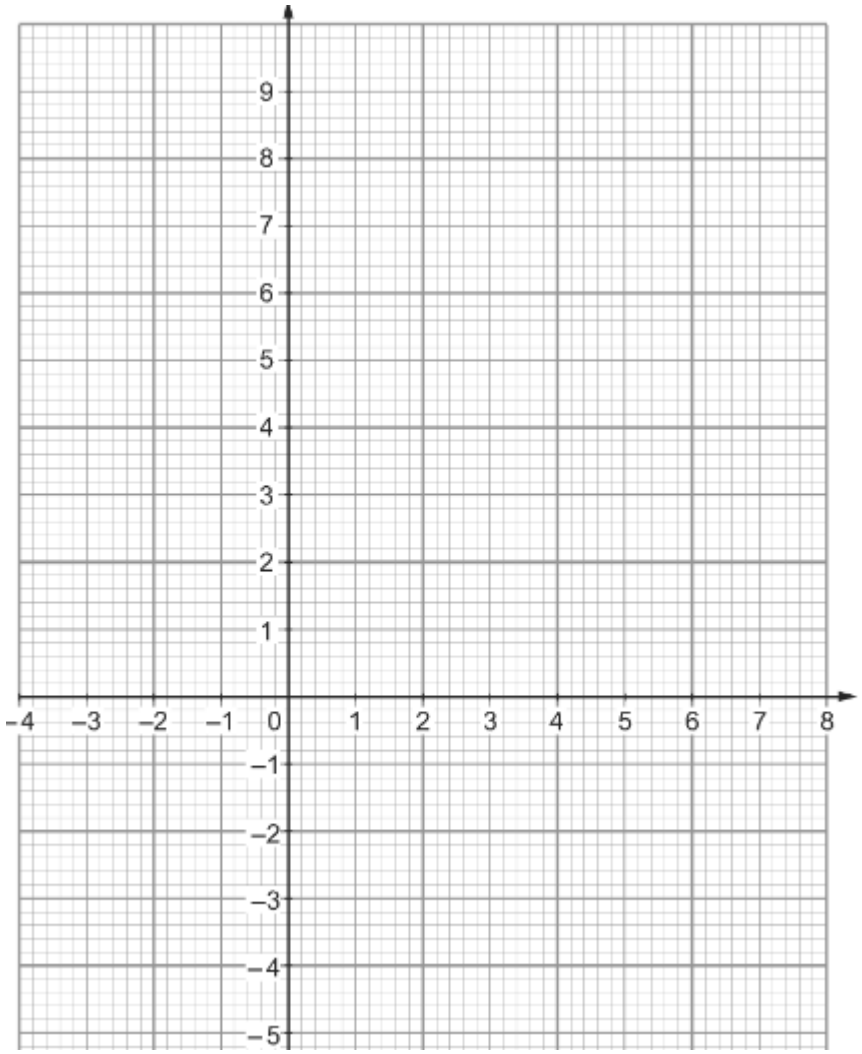


(b) Using your answer to *(a)*, are the lines $y = \frac{1}{2}x + 6$ and $x + y = 8$ perpendicular to each other?
Give a reason for your answer.

.....

2. In a game, the rule for plotting points is $(x, 2x)$.

On the graph below, plot the points when $x = 1$, $x = 4$ and when $x = -2$. [3]



3.

Line	Equation
A	$y = 3x + 4$
B	$y = -3x + 3$
C	$y = -2x - 4$
D	$y = 3x - 5$
E	$y = 4x + 4$

(a) Which two of the above lines are parallel?
You must give a clear reason for your answer.

(b) Which two of the above lines intersect each other on the y-axis?

Shaded Regions (Inequalities)

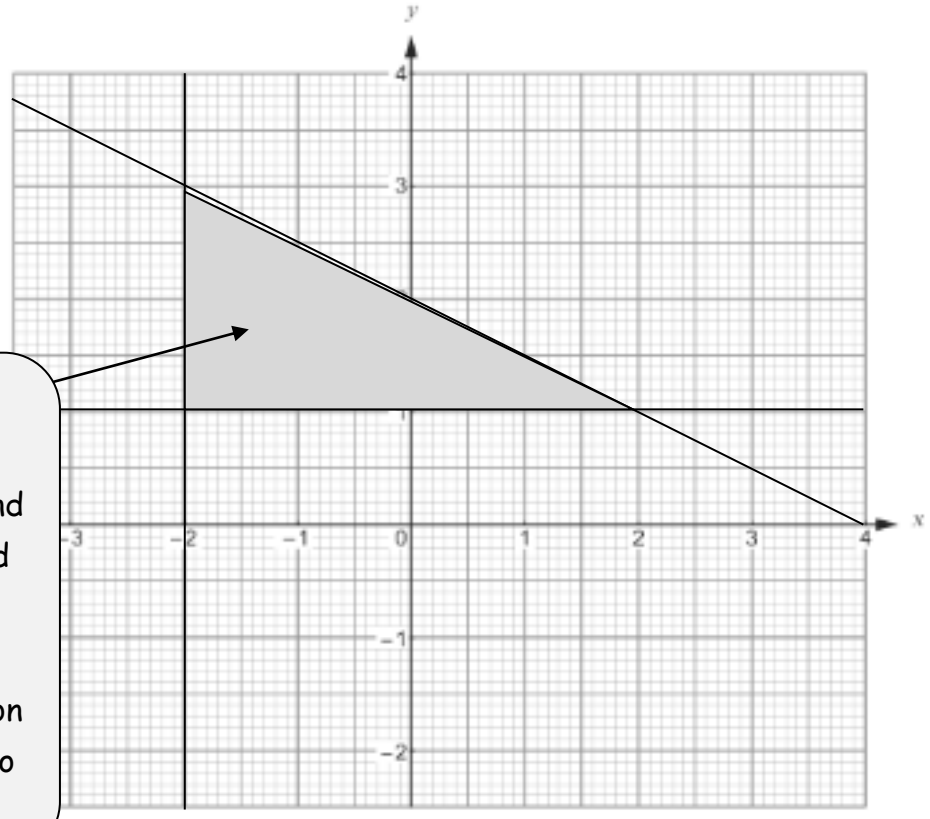
Common questions will give you multiple straight line equations. Once all the equations have been plotted there will be a region (part of the graph) that is contained **within** all the lines.

Example

Using the axes below, find the region defined by the following inequalities

$$x \geq -2$$
$$y \geq 1$$
$$x + 2y \leq 4$$

Don't be worried by the inequalities. For now, assume they are all '=' signs, rearrange them to the correct form, and plot them.



Once you have drawn all the lines, you will find an area created by the three lines.
This is the region that you need to shade.

Exam Questions G9

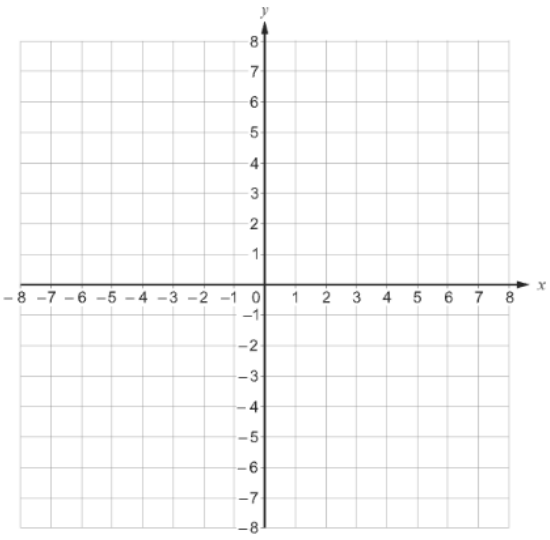
1. On the grid below, draw the region which satisfies all of the following inequalities.

$$x \geqslant -5$$

$$y \leqslant 3$$

$$y - x + 2 \geqslant 0$$

You must clearly indicate the region that represents your answer. [4]



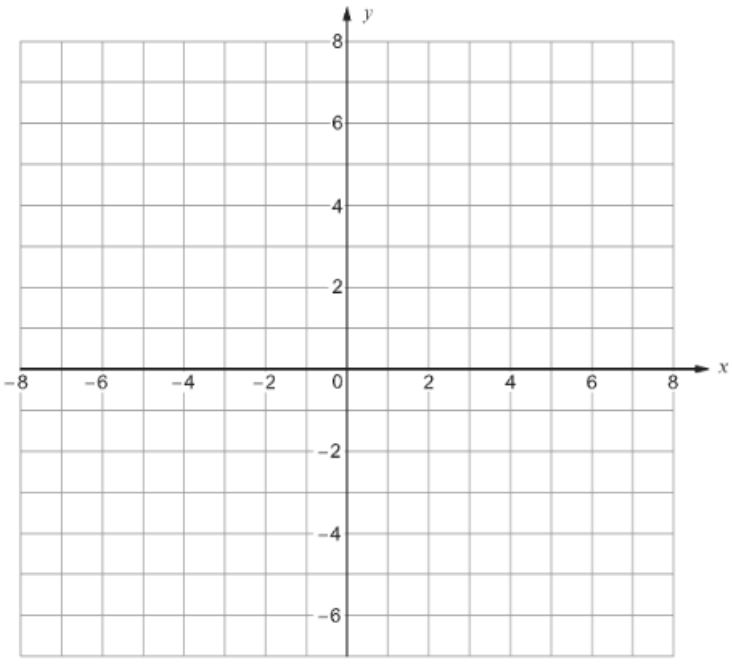
2. On the squared paper below, draw the region which satisfies all of the following inequalities.

$$x \leqslant 7$$

$$x + y \geqslant 6$$

$$y \leqslant \frac{x}{2}$$

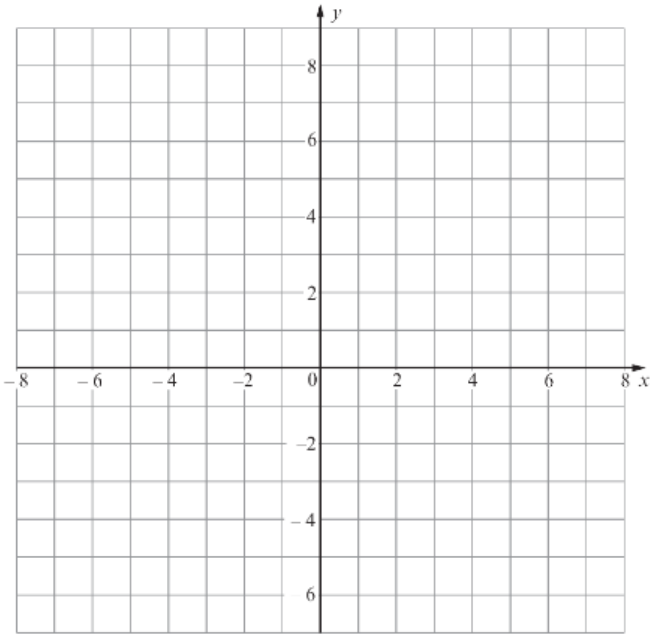
Make sure that you clearly indicate the region that represents your answer. [3]



3. On the squared paper provided, draw the region which satisfies all of the following inequalities.

$$y \leqslant 8$$
$$x + y \geqslant 2$$
$$y \geqslant 2x - 4$$

Make sure that you clearly indicate the region that represents your answer.



4. *(a)* Rafi has been asked to paint a region on a coordinate grid.
He is given the following criteria.
The region must be such that

- $y \leqslant x$
- $x \leqslant 1$
- $y \geqslant -2$

Use the grid below to show the region that Rafi needs to paint.