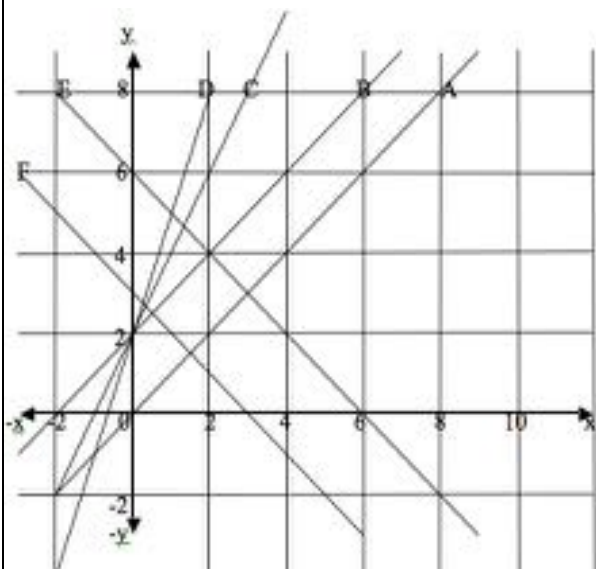


LINES



1. For each line fill in your answers to the following questions in the table below: (Line E has been done for you.)

(i) Write down the coordinates $(0; c)$ of the point of intersection of the line with the y-axis (the y intercept).

(ii) Choose two points on the line $(x_1; y_1), (x_2; y_2)$.

Find the gradient of the line from the formula

$$m = (y_2 - y_1)/(x_2 - x_1)$$

(iii) Use the values of c and m you have found to write the equation of the line in the form $y = mx + c$.

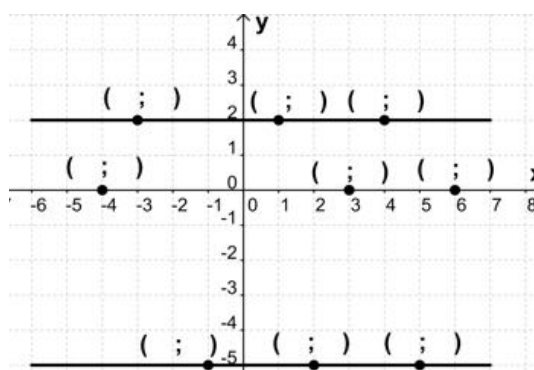
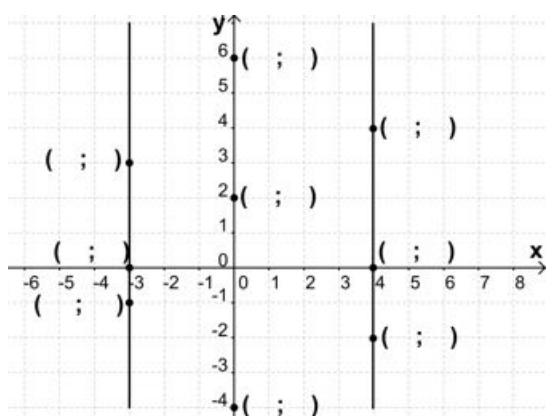
2. What do you notice when you compare the equations of these lines?

Line	Choose any 2 points on the line	Gradient Rise/Tread m	Intercept c	Equation of line
A	(;) (;)			
B	(;) (;)			
C	(;) (;)			
D	(;) (;)			
E	(-2 ; 8) (2 ; 4)	Rise/Tread = $-4/4 = -1$		$y = -x + 6$
F	(;) (;)			

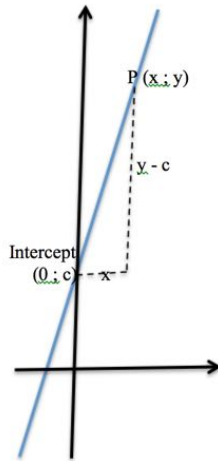
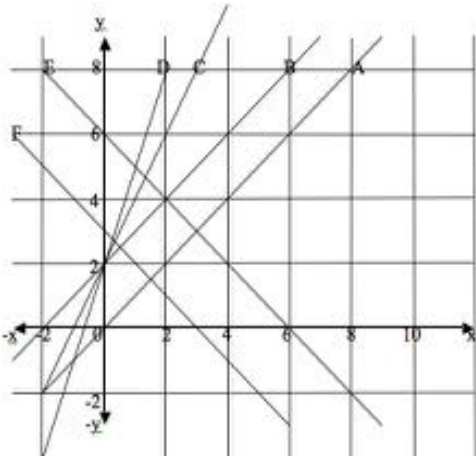
3. Copy the graphs below and fill in the coordinates of the points.

What are the gradients of the x-axis, the y-axis and the other 4 lines shown?

Write down the equations of the x-axis, the y-axis and the other 4 lines shown.



SOLUTION



Equations of lines

The line joining 2 points $(x_1 ; y_1), (x_2 ; y_2)$ has gradient $m = (y_2 - y_1)/(x_2 - x_1)$

If a straight line has gradient m and intercept on the y -axis $(0 ; c)$ then for any general point on the line with coordinates $(x ; y)$

the gradient is given by $m = \frac{y - c}{x}$

Rearranging this equation gives the equation of the line in the form **$y = mx + c$**

1. Fill in the table below from this diagram.

Line	Choose any 2 points on the line	Gradient Rise/Tread m	Intercept c	Equation of line
A	$(8 ; 8) (0 ; 0)$	$8/8 = 1$	0	$y = x$
B	$(6 ; 8) (0 ; 2)$	$6/6 = 1$	2	$y = x + 2$
C	$(3 ; 8) (0 ; 2)$	$6/3 = 2$	2	$y = 2x + 2$
D	$(2 ; 8) (0 ; 2)$	$6/2 = 3$	2	$y = 3x + 2$
E	$(-2 ; 8) (2 ; 4)$	Rise/Tread = $-4/4 = -1$	6	$y = -x + 6$
F	$(-2 ; 5) (3 ; 0)$	$-5/5 = -1$	3	$y = -x + 3$

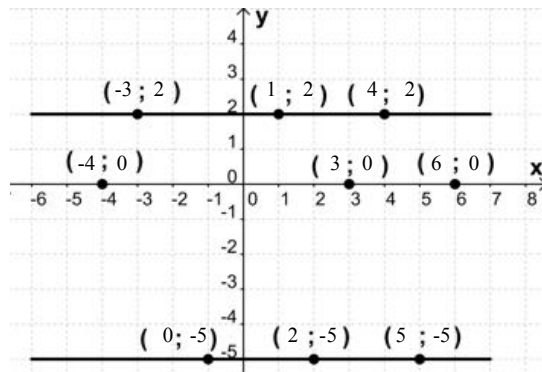
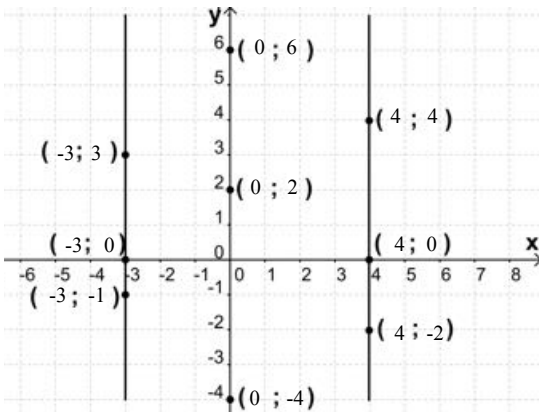
2. The coefficient of x gives the gradient of the line.

The constant term gives the y coordinate of the point where the line cuts the y -axis (the y -intercept).

Lines A and B are parallel and have equal gradients.

Lines E and F are parallel and have equal gradients.

3. Fill in the missing coordinates:



3.1 The lines are parallel to the y axis and have infinite gradient. The equation of the y - axis is $x = 0$ and the other lines have equations $x = -3$ and $x = 4$.

3.2 The lines are parallel to the x axis and have gradient zero. The equation of the x - axis is $y = 0$ and the other lines have equations $y = 2$ and $y = -5$.

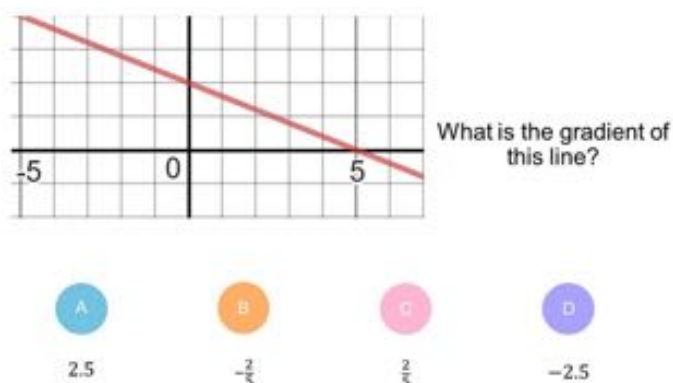
4. Match Column B to column A:

Column A		Column B	
2.1	Equation of the y -axis	→	$x = k$ (k is a real number)
2.2	Equation of a line parallel to the y -axis	→	$y = 0$
2.3	Equation of the x -axis	→	$y = c$ (c is a real number)
2.4	Equation of a line parallel to the x -axis	→	$x = 0$

NOTES FOR TEACHERS

Diagnostic Assessment This should take about 5 minutes.

1. Write the question on the board and ask the class to
“Put up 1 finger if you think the answer is A, 2 fingers for B, 3 fingers for C and 4 fingers for D”.
2. Ask a learner who gave answer A to explain why he or she gave that answer and DO NOT say whether it is right or wrong but simply thank them for giving the answer.
3. Then do the same for answers B, C and D. Try to make sure that learners listen to these reasons and try to decide if their own answer was right or wrong.
4. Ask the class **again** to vote for the right answer by putting up 1, 2, 3 or 4 fingers. Notice if there is a change and who gave right and wrong answers.
5. If the concept is needed for the lesson to follow, explain the right answer or give a remedial task.



B. is the correct answer.

Common Misconceptions

A. Here the learner is confused between x and y and is dividing 5 by 2.

C. Learners may give this answer when they know it is rise/run but they get $\frac{2}{5}$ because they work out $(2-0)/(5-0)$ instead of $(2-0)/(0-5)$ and they don't recognise the negative gradient.

D. Learners who give this answer recognise the negative gradient but (as in A) they divide change in x or 'run' by change in y or 'rise' instead of rise/run.

<https://diagnosticquestions.com>

Why do this activity?

This activity engages learners in working out the gradients and equations of lines. They should notice that they get the same gradient whatever two points on the line they choose. The activity prompts learners to notice features such as when lines are parallel, where they cut the y-axis and when they have zero gradient or infinite gradient.

Intended Learning Objectives (Grades 10 and 11)

To use the Cartesian co-ordinate system to derive and apply the gradient of a line through two given points and the equation of a line through two given points.

Possible approach

You might print the worksheet and ask learners to work individually or in pairs or you might copy the question on the board with the diagrams.

After the learners have completed the work then have a class discussion where learners supply the answers and check their work and you provide a summary of the main facts.

You should emphasise that only 2 points are required for drawing a straight line.

Key questions

How do you know when two lines are parallel?

What is the equation of the y-axis?

What is the equation of the x-axis?

Possible extension

See Graphical Triangle: <https://aiminghigh.aimssec.ac.za/grades-8-to-10-graphical-triangle/>

Possible support

Perhaps the learners could work in pairs so, if some learners have difficulty with this activity, you could ask other learners to help them.