THE BRITISH INTERNATIONAL SCHOOL ABU DHABI

A NORD ANGLIA EDUCATION SCHOOL

Year 9 Maths

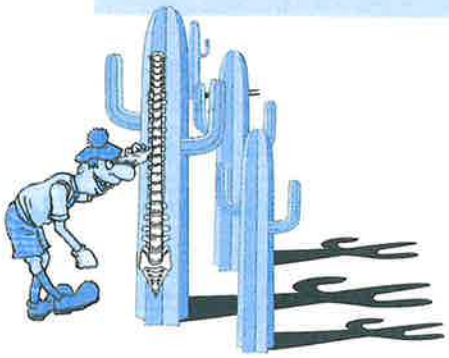
Topic 4–5–6 Workbook

In the table below translate the key terms into your home language and write a short definition for each term [if needed visit www.mathsisfun.com/definitions/].

TOPIC 4 – STATISTICAL MEASURES		
Mean Average		
Median Average		
Modal Average		
Range		
Frequency Table		
TOPIC 5 – EXPRESSIONS & FORMULAE		
Algebra		
Expression		
Formula		
Inverse Operation		
TOPIC 6 – GRAPHS		
Coordinates		
Midpoint		
Gradient		
Equation		
y-intercept		

Mean, Median, Mode and Range

1. Dudley counts how many spines there are on 12 cacti. His results are shown on the right.



321	234	214	118
279	156	178	478
192	349	225	406

a) Calculate the mean.

.....

b) Find the median.

.....

2. The table below shows the number of weeks it took to train 10 guide dogs.

Number of weeks	24	25	26	27
Frequency	1	2	5	2

a) Write down the modal number of weeks.

..... weeks

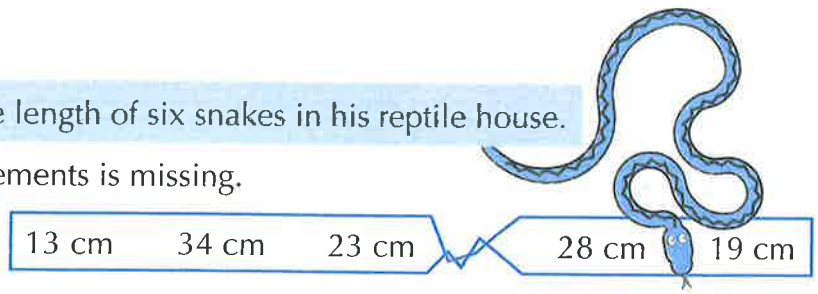
b) Calculate the mean number of weeks taken to train a guide dog.

Add a third row to the bottom of the table showing 'number of weeks × frequency'.

..... weeks

3. Lewis measures the length of six snakes in his reptile house.

One of his measurements is missing.



The mean length is 25 cm. Find the missing length.

Start off by using the mean to find the sum of the heights.

..... cm

Mean, Median, Mode and Range

4. Beth asks a group of people how many times they've been to Scunthorpe. The results are shown in this frequency table.

a) Find the range of Beth's data.

.....

b) Calculate the mean, giving your answer to one decimal place.

.....

c) Find the median.

Work out the position of the median, then count up through the frequencies to find which row it's in.

.....

Number of times they've been to Scunthorpe	Frequency
0	0
1	1
2	2
3	3
4	5
5	0
6	4

5. Look at the set of data values on the right. 23 29 21 93 28 27 24

The value of 93 is much greater than the other values. It is called an 'outlier'.

a) Which average do you think is most likely to be affected by the outlier?

.....

b) Which average do you think would be the most sensible to use for this data?

.....

6. Steph records the number of glasses of water that she drinks each day in November and then summarises the data in the incomplete frequency table below.

Number of glasses	4	5	6	7	8
Frequency	4	.....	10	.....	.....

The range of Steph's data is 3 and the mode is 6.
She drinks 5 glasses on more days than she drinks 7 glasses.
Use this information to fill in the missing values in Steph's table.

Remember that there are 30 days in November.

How did you do?

Why did the mode fall out with the median? Because he was really *mean*... Hey — if you don't like that joke, I've got a whole *range* of them... ☹ I'll only stop if you promise that you know how to:

- ☐ **Find the mean, median, mode and range of a set of data and use these values to solve problems.**
- ☐ **Find the mean, median, mode and range of a set of data from frequency tables.**

Averages and Range from Tables

1. The grouped frequency table below shows information on the areas of 30 parks.

Area (a hectares)	$0 < a \leq 30$	$30 < a \leq 60$	$60 < a \leq 90$	$90 < a \leq 120$	$120 < a \leq 150$	Total
Frequency (f)	4	3	7	10	6	30
Mid-interval value (m)	.....	.....	.....	.....	.....	—
$f \times m$	.....	.....	.....	.....	.....	.....

a) Write down the modal class.

.....

b) Which class contains the median?

.....

c) (i) Complete the table.

(ii) Work out an estimate for the mean area.

Estimate the mean by dividing the total from the f × m row by the total from the frequency row.

..... hectares

2. The table shows the number of hours of sleep that workers in an office say they got last night.

Number of hours of sleep	4	5	6	7	8	9	10
Frequency	3	4	6	5	1	1	0

a) What is the range?

..... hours

b) Work out the median number of hours of sleep.

..... hours

c) One of the workers claims that the mean number of hours of sleep is the same as the mode for this data. Are they correct? Show your working below.

Averages and Range from Tables

3. Rita went into a number of restaurants and counted how many dessert options were available. She has summarised the results in the table below.

Number of desserts	Frequency
0 - 3	4
4 - 5	2
6 - 7	7
8 - 9	1

a) Find the group that contains the median.

.....

b) What is the smallest possible range of the data?

.....

4. The time it takes 40 monkeys to each peel 10 bananas is recorded in this table.

Time (t seconds)	Frequency
$20 \leq t < 40$	9
$40 \leq t < 60$	14
$60 \leq t < 80$	11
$80 \leq t < 100$	6

a) (i) Find the maximum possible range of the times taken.

..... seconds

(ii) If you knew that the longest time taken by a monkey to peel the bananas was 89 seconds, what would the maximum possible range be?

..... seconds

b) (i) Use the values in the table to estimate the mean time taken by the monkeys.

Add a couple of extra columns to the table to help you find the mean.

..... seconds

(ii) Explain why it isn't possible to calculate the actual mean time taken.

.....

.....

.....

How did you do?

Frequency tables can be a really useful way of tidying up your data — but they're no good if you don't know how to work out averages from them. Before you continue, check that you can:

- ☐ **Find the mean, median, mode and range from frequency tables.**
- ☐ **Find or estimate averages and the range from grouped frequency tables.**

Grouped Frequency Tables

1 The table shows the time it took 32 pupils to run a 200 m sprint. (D)

Time (t seconds)	Frequency
$22 < t \leq 26$	4
$26 < t \leq 30$	8
$30 < t \leq 34$	13
$34 < t \leq 38$	6
$38 < t \leq 42$	1

a) All pupils with a time of 30 seconds or less qualified for the next round. What percentage of pupils did not qualify for the next round?

.....%

[2]

b) Estimate how long it would take the four quickest runners to run a 4×200 m relay race (where they each run 200 m one after the other).

..... seconds

[2]

[Total 4 marks]

2 The grouped frequency table below shows the number of hours of exercise 44 adults did in one week. (D)

Hours of exercise (x)	Frequency
$0 \leq x < 2$	15
$2 \leq x < 4$	9
$4 \leq x < 6$	8
$6 \leq x < 8$	6
$8 \leq x < 10$	3
$10 \leq x < 12$	3

Work out an estimate for the total time spent exercising by the 44 adults that week.

..... hours

[Total 3 marks]

3 32 pupils in a class sat an exam in Science.
The distribution of their marks is given in the table below.

Exam mark	Frequency
$10 < x \leq 20$	2
$20 < x \leq 30$	5
$30 < x \leq 40$	7
$40 < x \leq 50$	8
$50 < x \leq 60$	4
$60 < x \leq 70$	6

Use the table to find:

a) the modal class.

.....

[1]

b) an estimate of the mean (give your answer to 3 s.f.).

Tip: add a couple of columns to the table to help you.

..... marks

[4]

[Total 5 marks]

4 During a science experiment 10 seeds were planted and their growth was measured in cm after 12 days. The results were recorded in the table below.

Growth in cm	Number of plants
$0 \leq x \leq 2$	2
$3 \leq x \leq 5$	4
$6 \leq x \leq 8$	3
$9 \leq x \leq 11$	1

a) Use the table to find an estimate of the mean growth.

..... cm

[4]

b) Explain why you can only find an estimate of the mean.

.....

.....

[1]

[Total 5 marks]

Score: ☐/17

Writing Formulas

1. Write a formula for x in terms of y for each of the following descriptions.

a) (i) x is 5 less than y. .....

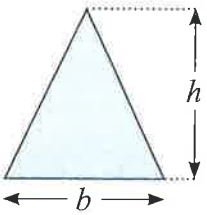
(ii) x is two-thirds of y. .....

b) Find the value of x when $y = 9$, for each of the formulas in part a).

(i) $x =$ ..... (ii) $x =$ .....

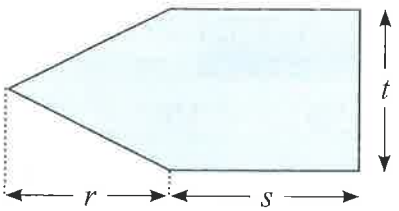
2. Write a formula for the area, A, of each shape below, in terms of the given letters.

a)



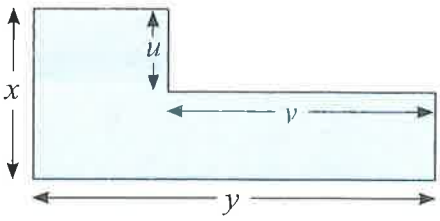
$A =$ .....

b)



$A =$ .....

c)



$A =$ .....

3. Lisa is trading collectable stickers with Evan.
There are two types of stickers: regular and ultra-rare shiny foil.

On the schoolyard market, regular stickers are worth 25p and shiny foil stickers are worth a whopping £1.50.

a) Write a formula for the value, p (in £), of a collection containing r regular stickers and f shiny foil stickers.

.....

b) Lisa has 12 regular stickers and 2 shiny foils. How much is Lisa's collection worth?

£ .....

c) Evan's collection is worth exactly the same as Lisa's.
He has 6 regular stickers. How many shiny foil stickers does he have?

.....

How did you do?

Let's formulate a plan to corner the market in collectable stickers — we'd make £billions. Meanwhile, check off the following boxes when you are able to:

- ☐ **Write algebraic formulas from descriptions.**
- ☐ **Substitute numbers into formulas.**
- ☐ **Write and use formulas to describe geometric properties and to model real-life situations.**

Formulas

1. For each of these formulas, find the value of s when $u = 4$ and $t = -6$.

a) $s = ut$

$s =$ .....

b) $s = \frac{u - 2t}{4}$

$s =$ .....

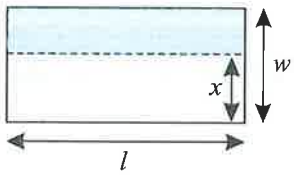
2. Abigail is thinking of a number, N. She multiples it by 3, divides the result by 2 and then adds 1 to get M. Which of these is the correct formula to calculate M? Circle your answer.

$M = 3 \times \frac{N+1}{2}$ $\quad$ $M = \frac{3N}{2} + 1$ $\quad$ $M = \frac{3N+1}{2}$ $\quad$ $M = \frac{N^3}{2} + 1$

3. Write down a formula for the area, A, of the shaded regions of these shapes.

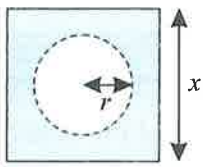
A circle with radius r has an area of πr^2.

a)



$A =$ .....

b)



$A =$ .....

4. Morris's mobile plan charges £1.80 per gigabyte (GB) of data used.

a) (i) Write down a formula for the cost C (in £) of using d GB of data.

.....

(ii) Use your formula to calculate the cost of using 25 GB of data.

£.....

b) Morris changes to a plan that charges a flat fee of £10, plus 40p for every GB of data used. Write down a formula for the cost C (in £) of using d GB of data on this plan.

.....

5. Rearrange the following formulas to make y the subject.

a) $x = y + 5$ $\quad$ $y =$ .....

b) $x = 2y$ $\quad$ $y =$ .....

c) $x = \frac{y}{5}$ $\quad$ $y =$ .....

d) $x = 3y - 1$ $\quad$ $y =$ .....

Formulas

6. Rearrange the formulas below to make v the subject.

a) $u = 5 - 2v$

.....

b) $u = 2vw$

.....

c) $w = \dfrac{v-1}{u}$

.....

d) $v + u = w - v$

.....

7. Misha has been told to mind her p's and q's. Help her out by answering this question.

a) Which of these is a correct rearrangement of $p = \sqrt{2q}$? Circle your answer.

$q = 2p^2$ $\quad$ $q = \frac{1}{2}p^2$ $\quad$ $q = \left(\frac{p}{2}\right)^2$ $\quad$ $q = (2p)^2$

b) Rearrange the formula $p = 1 + q^3$ to make q the subject.

.....

8. The surface area of a sphere, S, is given by the formula $S = 4\pi r^2$, where r is the radius.

a) Rearrange the formula to make r the subject.

$r =$ .....

b) What is the radius of a sphere that has a surface area of 36π cm^2?

$r =$ ..... cm

9. Sadie visits a hair salon to get her hair dyed. The stylist charges a fixed cost of £35, plus £4.50 for each colour used.

a) Write a formula for the price, P (in £), of getting your hair dyed using n colours.

.....

b) (i) Rearrange your formula to make n the subject.

.....

(ii) Sadie paid £62 to have her hair dyed. How many colours did the stylist use?

.....

How did you do?

How many shades of blue can you name? I'm quite fond of "workbook blue" myself. Now let's get some formalities out of the way — tick these boxes when you can:

- ☐ **Write algebraic formulas from descriptions.**
- ☐ **Substitute numbers into formulas.**
- ☐ **Rearrange formulas to change their subject.**

☹ ☐ 😐 ☐ 🙂 ☐

Formulas

1 The relationship between x and y is given by the formula $y = \frac{x-2}{3}$. (C)

a) Rearrange this formula to make x the subject.

.....

[2]

b) Find the value of x when $y = 5$.

$x =$ .....

[2]

[Total 4 marks]

2 The formula for finding the volume of a pyramid is $V = \frac{1}{3}Ah$, where A is the base area of the pyramid, and h is the height of the pyramid. (C)

a) Rearrange the formula to make h the subject.

.....

[2]

b) Find the height of a pyramid which has volume 18 cm^3 and base area 12 cm^2.

..... cm

[2]

[Total 4 marks]

3 The formula $s = \frac{1}{2}gt^2$ is often used in physics. (B)

a) Work out the value of s when $g = -9.8$ and $t = 8$.

$s =$ .....

[2]

b) Rearrange the equation to make t the subject, where t is positive.

.....

[2]

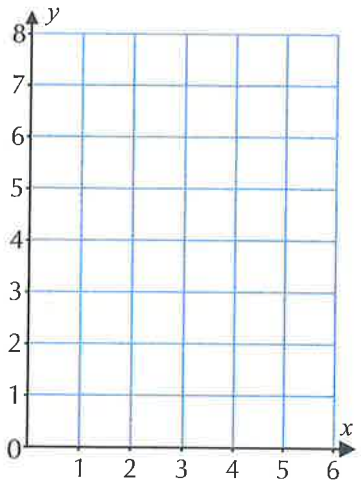
[Total 4 marks]

Plotting Straight Line Graphs

1. The graph of $y = x + 2$ is a straight line.

a) Complete this table of values for the equation $y = x + 2$.

x	0	2	4	6
y		4		



b) (i) Plot each pair of x and y values from your table as coordinates on the axes.

(ii) Plot the graph of $y = x + 2$ by drawing a straight line through these points.

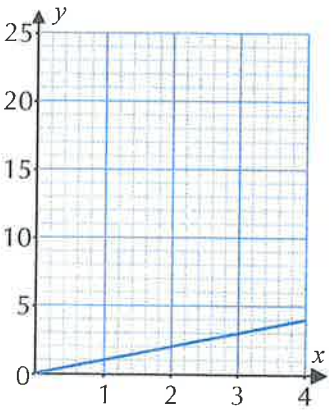
c) Write down the coordinates of the point where the line $y = x + 2$ intersects the y-axis.

(....., ...)

2. The graph of $y = x$ has been drawn on the axes on the right.

a) Complete this table of values for the equations $y = 3x$ and $y = 6x$.

x	0	1	2	3	4
$y = 3x$	0	3	6		
$y = 6x$	0	6			



b) Use your table of values to plot the graphs of $y = 3x$ and $y = 6x$.

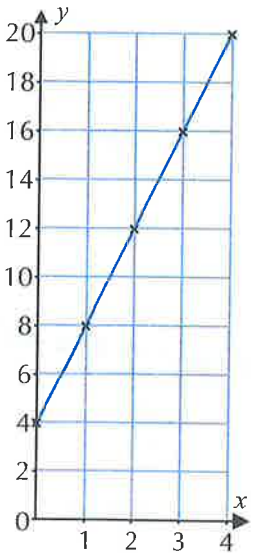
c) Which equation has the steepest graph? Circle your answer.

$y = x$ $\quad$ $y = 3x$ $\quad$ $y = 6x$

3. Alasdair has plotted a straight line graph on the axes on the right.

a) Complete this table of values for the equation $y = 4x + 2$.

x	0	1	2	3	4
y	2				



b) Use your table of values to plot the graph of $y = 4x + 2$.

c) (i) What does your graph have in common with Alasdair's graph?

.....

(ii) Write the coordinates of where the graph crosses the y-axis for...

Your line: (....., ...) $\quad$ Alasdair's line: (....., ...)

(iii) Which equation describes Alasdair's line? Circle your answer.

$y = 4x$ $\quad$ $y = 4x + 2$ $\quad$ $y = 4x + 4$

Finding the Equation of a Straight Line

1. Write down the gradient and y-intercept of the lines with the following equations.

a) $y = 2x + 1$

gradient = ..., y-intercept = ...

b) $y = 6 - 4x$

gradient = ..., y-intercept = ...

2. Write down the equation in the form $y = mx + c$ of the graph that has:

a) a gradient of 6 and a y-intercept of -5

.....

b) a gradient of -7 and a y-intercept of 8

.....

3. Calculate the gradient of the line segment between these pairs of points.

a) (5, 1) and (6, 4)

b) (–2, 8) and (0, 6)

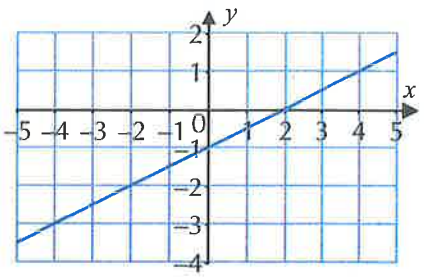
To find the gradient, divide the change in the y-coordinates by the change in the x-coordinates.

.....

.....

4. Val has drawn a line on the axes on the right.

a) Calculate the gradient of Val's line.



.....

b) Tick the equation of each line that is parallel to Val's line.

Parallel lines have the same gradient.

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

5. Rearrange these equations into the form $y = mx + c$ and then write down the gradient and the coordinates of the y-intercept.

Equation	$y = mx + c$ form	Gradient	Coordinates of y-intercept
$-5 = y - 6x$	.....	.....	(....., ...)
$2y - 4x = 6$	.....	.....	(....., ...)
$\frac{y}{2} + 2x = 3$	.....	.....	(....., ...)

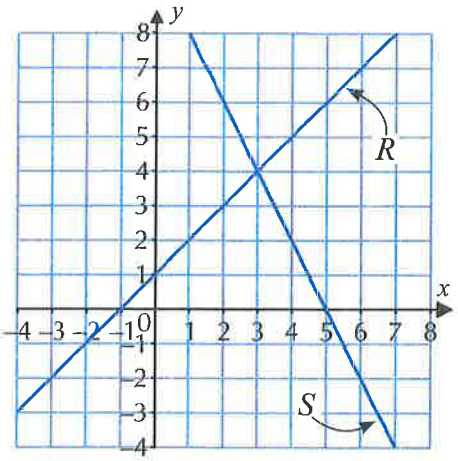
Finding the Equation of a Straight Line

6. A line passes through the points (0, 3) and (2, 13). What is the equation of this line?

Circle your answer.

$y = -3x + 5$ $y = 5x - 3$ $y = -5x + 3$ $y = 5x + 3$ $y = 3x + 5$

7. Find the equations of the lines drawn on these axes.



Give your answers in the form $y = mx + c$.

a) Line R

.....

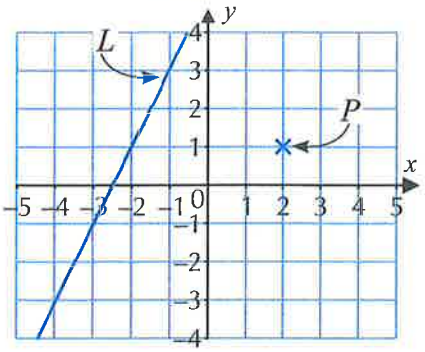
b) Line S

.....

8. Robbie has drawn a line, L, and plotted a point, P, on the axes below.

a) Find the gradient of L.

.....



b) (i) Use your answer to part a) to find the equation of the line parallel to L that passes through P.

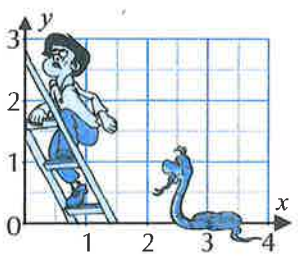
.....

(ii) Sketch the line on the axes.

How did you do?

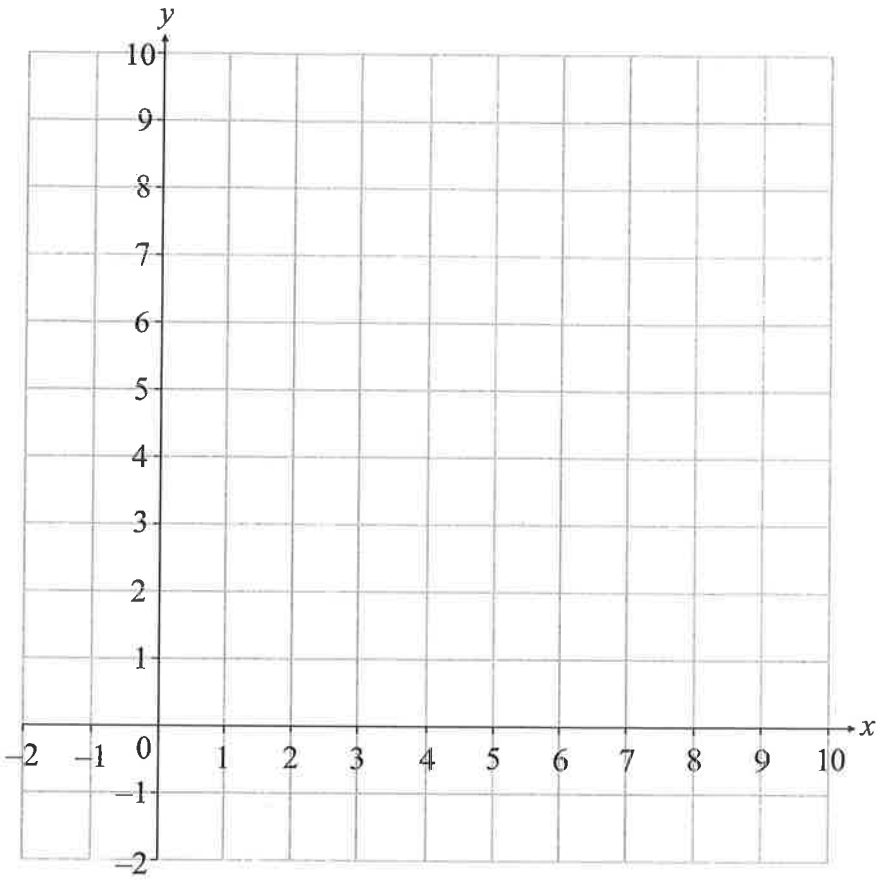
There's a fine line between an empty set of axes and a correctly plotted graph. If you've completed all these questions, you should now be able to:

- ☐ **Calculate the gradient of a line or line segment.**
- ☐ **Write the equation of a line in the form y = mx + c.**
- ☐ **Find the equation of a line.**



Straight Line Graphs

1 Draw the graph $2y + x = 7$ on the axes below, for values of x in the range $-2 \leq x \leq 10$.



[Total 3 marks]

2 Point P has coordinates $(6, 2)$ and point Q has coordinates $(-4, 1)$.

a) Find the coordinates of the midpoint of PQ.

(..... , ...)

[2]

b) Point R has coordinates (a, b). The midpoint of PR is $(3, 5)$. Find the values of a and b.

$a =$ .....

$b =$ .....

[3]

[Total 5 marks]

3 Line L passes through the points (0, –3) and (5, 7), as shown below.

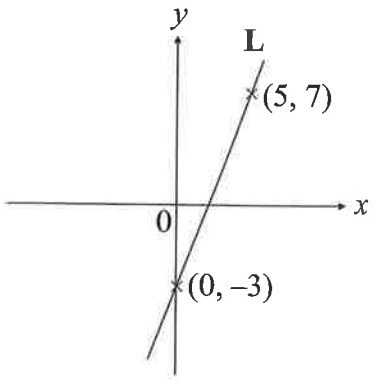


Diagram **NOT** to scale

a) Find the gradient of line **L**. (C)

.....

[2]

b) Find the equation of line **L**. (C)

.....

[1]

c) Find the equation of the line which is parallel to line **L** and passes through the point (2, 10). (B)

.....

[2]

[Total 5 marks]

4 The lines with equations $4y - 5x = 8$ and $3y - 2x = 20$ intersect at the point M. (A)

a) Find the gradient of the line with equation $4y - 5x = 8$.

.....

[3]

b) Find the coordinates of point M.

.....

[5]

[Total 8 marks]

Score: ☐/**21**

☹☐ 😐☐ 😊☐