Name: _____

IGCSE (9–1) Maths new topics: Perpendicular lines

Date:

Time: 60 minutes

Total marks available: 53

Total marks achieved: _____

[GCSE]

Q1. (*a*) Write down the equation of a straight line that is parallel to $y = 5x + 6$

(1)

(*b*) Find an equation of the line that is perpendicular to the line $y = 5x + 6$ and passes through the point (–2, 5).

(3)

(Total 4 marks)

[GCSE]

Q2. (*a*) Write down an equation of a straight line that is parallel to the straight line $y = 3x – 5$

(1)

A straight line, L, is perpendicular to the straight line $y = 3x – 5$ and passes through the point (6, 5)

(*b*) Find an equation of L.

(3)

(Total 4 marks)

[GCSE]

Q3. The straight line **L** has equation $y = 3x – 4$

(*a*) Write down an equation of the line parallel to **L** which passes through the origin.

(2)

(*b*) Find an equation of the straight line that passes through (0, 5) and is perpendicular to **L**.

(2)

(Total 4 marks)

[GCSE]

Q4. The straight line **L** has equation $y = 2x − 5$

Find an equation of the straight line perpendicular to **L** which passes through (−2, 3).

(Total 3 marks)

Q5. (*a*) Find an equation of the line that passes through the points (−3, 5) and (1, 2)
Give your answer in the form $ax + by = c$ where a, b and c are integers.

(4)

Line $\mathbf{L_1}$ has equation $y = 3x + 5$
Line $\mathbf{L_2}$ has equation $6y + 2x = 1$

(*b*) Show that $\mathbf{L_1}$ is perpendicular to $\mathbf{L_2}$

(2)

(Total 6 marks)

[GCSE]

Q6.

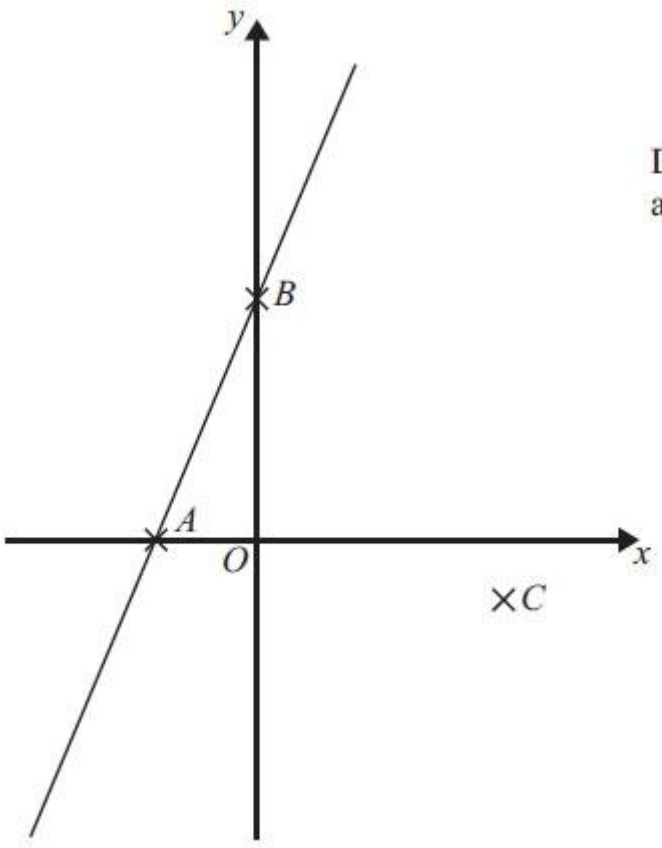


Diagram **NOT** accurately drawn

In the diagram	A is the point	$(-2, 0)$
	B is the point	$(0, 4)$
	C is the point	$(5, -1)$

Find an equation of the line that passes through C and is perpendicular to AB.

(Total 4 marks)

[GCSE]

Q7. A straight line, ***L***, is perpendicular to the line with equation $y = 1 - 3x$.
The point with coordinates (6, 3) is on the line ***L***.

Find an equation of the line ***L***.

(Total 3 marks)

[GCSE]

Q8. Find an equation of the straight line that is perpendicular to the straight line $x + 2y = 5$ and that passes through the point (3, 7).

(Total 4 marks)

[GCSE]

Q9.

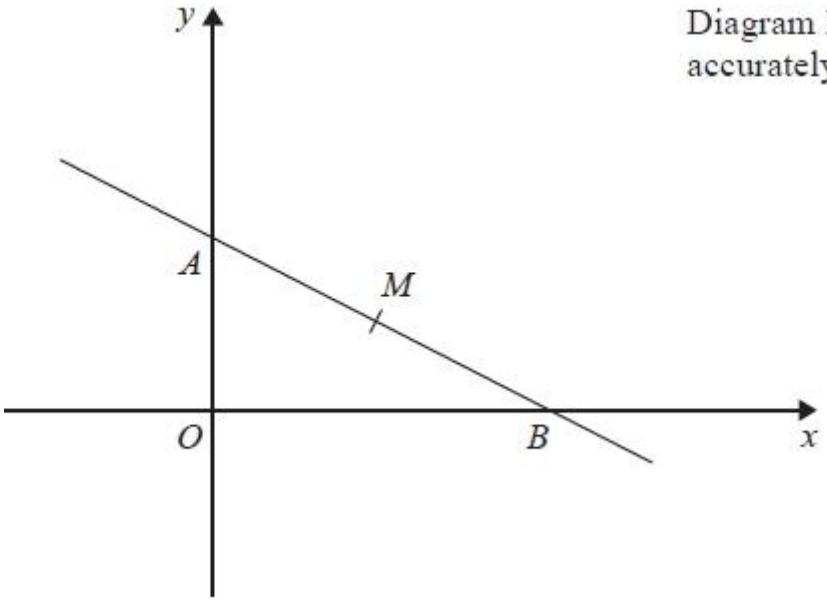


Diagram **NOT** accurately drawn

In the diagram

A is the point (0, 4)
B is the point (6, 0)
M is the midpoint of *AB*.

Find an equation of the line that passes through *M* and is perpendicular to *AB*.

(Total 4 marks)

[GCSE]

Q10. The points *A*(6, 1) and *B* (−2, 5) are on the line with equation $y = -\frac{1}{2}x + 4$

M is the midpoint of *AB*.

Find an equation of the line through *M* that is perpendicular to $y = -\frac{1}{2}x + 4$

(Total 4 marks)

[GCSE]

Q11. *A* is the point with coordinates (1, 3)
B is the point with coordinates (4, −1)

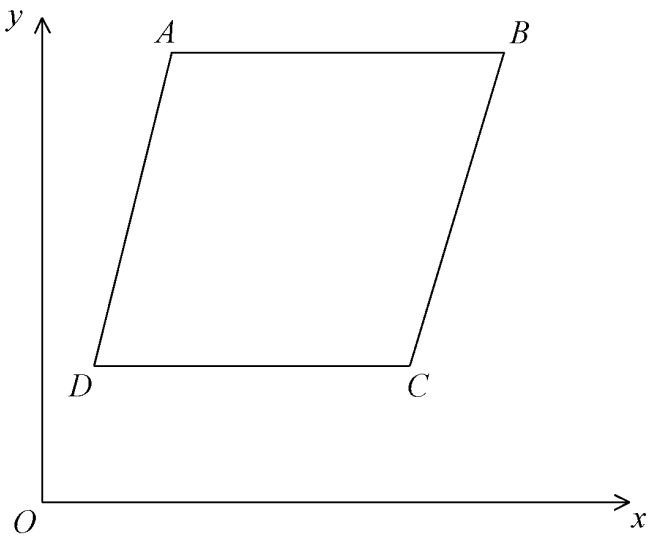
The straight line *L* goes through both *A* and *B*.

Is the line with equation $2y = 3x - 4$ perpendicular to line *L*?
You must show how you got your answer.

(Total 4 marks)

[GCSE]

Q12.



ABCD is a rhombus.
The coordinates of *A* are (5,11)

The equation of the diagonal *DB* is $y = \frac{1}{2}x + 6$

Find an equation of the diagonal *AC*.

(Total 4 marks)

[GCSE]

Q13. *P* has coordinates (–9, 7)
Q has coordinates (11, 12)

M is the point on the line segment *PQ* such that *PM* : *MQ* = 2 : 3

Line **L** is perpendicular to the line segment *PQ*.
L passes through *M*.

Find an equation of **L**.

(Total 5 marks)

Mark Scheme

Q1.

Question	Working	Answer	Mark	Notes
(a)		$y = 5x + c$	1	B1 for $y = 5x + c$ oe $c \neq 6$
(b)	gradient = $-\frac{1}{m} = -\frac{1}{5}$ $y = -\frac{1}{5} + c$ $x = -2$, $y = 5$ $5 = \frac{2}{5} + c$ $c = 5 - \frac{2}{5} = 4\frac{3}{5}$ $y = -\frac{1}{5}x + 4\frac{3}{5}$	$y = -\frac{1}{5}x + 4\frac{3}{5}$	3	M1 recognition that gradient = $-\frac{1}{m} = -\frac{1}{5}$ oe M1 substitution of $x = -2$, $y = 5$ in $y = mx + c$ where $m = -\frac{1}{5}, \frac{1}{5}$ or -5 A1 $y = -\frac{1}{5}x + 4\frac{3}{5}$ oe

Q2.

		Working	Answer	Mark	Notes
	(a)		equation	1	B1 for $y = 3x + k$, $k \neq -5$ or any other equivalent form
	(b)		$y = -\frac{1}{3}x + 7$	3	B1 for $-\frac{1}{3}$ or $3m = -1$ oe M1 for $y = -\frac{1}{3}x + c$ or $5 = -\frac{1}{3} \times 6 + c$ or $\frac{y-5}{x-6} = -\frac{1}{3}$ A1 for $y = -\frac{1}{3}x + 7$ oe OR B1 for $x + 3y + k = 0$ or $x + 3y = k$ M1 for $6 + 3\times5 + k = 0$ A1 for $x + 3y - 21 = 0$ oe

Q3.

		Working	Answer	Mark	Notes
	(a)		$y = 3x$	2	M1 for equation $y = 3x + k$ ($k \neq -4$) A1 for $y = 3x$
	(b)		$y = -\frac{1}{3}x + 5$	2	M1 for gradient $-\frac{1}{3}$ A1 $y = -\frac{1}{3}x + 5$ oe

Q4.

PAPER: 5MB2H_01					
Question		**Working**	**Answer**	**Mark**	**Notes**
			$y=-\frac{1}{2}x+2$	3	M1 for gradient $=-\frac{1}{m}$ or $-\frac{1}{2}$ M1 for substitution of $x=-2,\ y=3$ into their $y=mx+c$ where c is a constant to be found A1 for $y=-\frac{1}{2}x+2$ oe eg accept $2y+x=4$

Q5.

Question	Working	Answer	Mark	AO	Notes
a	$m=\frac{5-2}{-3-1}$ or $-\frac{3}{4}$ oe			AO1	M1 for gradient
	eg. $2=-\frac{3}{4}\times 1+c$ or				M1 for method to find c
	$y-2=-\frac{3}{4}(x-1)$				
	$y=-\frac{3}{4}x+\frac{11}{4}$				M1 found values of m and c substituted in $y=mx+c$
		$3x+4y=11$	4		A1
b	$y=\frac{1-2x}{6}$ or $m=-\frac{1}{3}$ oe			AO1	M1
		shown	2		A1 for conclusion from correct gradients

Q6.

Question		Working	Answer	Mark	Notes
		Gradient of AB = 2 Gradient of perpendicular line = − ½ $y = -\frac{1}{2}x + c$ $-1 = -\frac{1}{2} \times 5 + c$ $c = \frac{3}{2}$	$y = -\frac{1}{2}x + \frac{3}{2}$	4	M1 for attempt to find gradient of AB M1 (dep) for attempt to find gradient of perpendicular line eg use of -1/m M1(dep on M2) for substitution of x = 5, y = − 1 A1 for $y = \frac{1}{2}x + \frac{3}{2}$ oe

Q7.

Question		Working	Answer	Mark	Notes
		Grad = ⅓ 3 = 6 × ⅓ + *c* *c* = 1	*y* = ⅓ *x* + 1	3	M1 for –3 × *m* = –1 oe or ⅓ seen M1 for 3 = 6 × '⅓' + *c* or *y* – 3 = '⅓'(*x* – 6) A1 for *y* = ⅓ *x* + 1 oe

Q8.

Question		Working	Answer	Mark	Notes
		y = – ½ *x* + 2.5 *mm'* = –1 shows gradient is 2 *y* = 2*x* + *c* goes through (3, 7) 7 = 2 × 3 + *c*	y = 2*x* + 1	4	M1 for establishing gradient of original line is – ½ or sight of y = – ½ *x* + c M1 (indep) for (gradient of perpendicular) × "– ½ " = –1 This can be implied by a gradient of 2 or ft on "– ½ " M1 (dep on the previous M1) for substituting (3, 7) into y = "2"*x* + c A1 for y = 2*x* + 1 (or equivalent algebraic equation)

Q9.

5MB2H_01 November 2015					
Question		Working	Answer	Mark	Notes
			$y = \frac{3}{2}x - \frac{5}{2}$	4	M1 for attempt to find gradient of AB M1 (dep) for attempt to find gradient of perpendicular line eg use of $-\frac{1}{m}$ M1 for substituting $x = 3, y = 2$ into $y =$ "m" $x + c$ A1 for complete correct equation $y = \frac{3}{2}x - \frac{5}{2}$ oe

Q10.

5MB2H/01 June 2015				
Question	**Working**	**Answer**	**Mark**	**Notes**
		$y = 2x - 1$	4	M1 for $\left(\frac{6+-2}{2}, \frac{1+5}{2}\right)$ oe M1 for $\frac{-1}{-0.5}$ oe (=2) M1(dep on previous M1) for using $y =$ '2'$x + c$ with their coordinates for the midpoint used correctly to find c A1 for $y = 2x - 1$ oe

Q11.

PAPER: 1MA0_1H					
Question		**Working**	**Answer**	**Mark**	**Notes**
*		$2y = 3x - 4$ $y = \frac{3}{2}x - 2;$ $m = \frac{3}{2}$ $\frac{3--1}{1-4} = -\frac{4}{3}$ $\frac{3}{2} \times -\frac{4}{3} = -2$	No with reason	4	M1 for $\frac{3}{2}$ oe or $y = \frac{3}{2}x\left(-\frac{4}{2}\right)$ oe M1 for method to find gradient of AB, eg $\frac{3--1}{1-4}$ **or** $\frac{-1-3}{4-1}$ **or** $-\frac{4}{3}$ oe A1 for identifying gradients as $\frac{3}{2}$ oe **and** $-\frac{4}{3}$ oe C1 (dep on M1) for a conclusion with a correct reason, eg No as product of $\frac{3}{2}$ and $-\frac{4}{3}$ is not -1, ft from their two gradients

Q12.

Paper: 1MA1/1H				
Question	**Working**	**Answer**	**Mark**	**Notes**
		$y = -2x + 21$	P1 P1 P1 A1	shows evidence of understanding that *AC* is perpendicular to *DB*, or states the gradient of *DB* as 0.5 oe shows a process to find the gradient of a perp. line e.g. use of $-\frac{1}{m}$ or states $y = -2x + c$ or states the gradient of AC as −2 (dep on P2) for sub. of $x = 5$, $y = 11$ into $y = mx + c$ where *m* is their found gradient for AC. oe

Q13.

Mock Paper 1MA1: 2H					
Question		**Working**	**Answer**	**Mark**	**Notes**
			$y = -4x + 5$	5	P1 for appropriate process to find gradient e.g. $\frac{12-7}{11--9}$ $(= \frac{1}{4})$ P1 process to find *y* coordinate $7 + \frac{2}{5} \times 5$ (= 9) or *x* coordinate $-9 + \frac{2}{5} \times 20$ (= −1) P1 method to find gradient of line *L* $\frac{-1}{\frac{1}{4}}$ (= −4) M1 substitution of found values for *x*, *y* and *m* into equation for straight line A1 $y = -4x + 5$