Topic 5

Straight Line Graphs

Bronze, Silver, Gold
Worksheets for
AS Level Mathematics

Teacher Notes

These Bronze, Silver and Gold worksheets are designed to be used either straight after the content has been taught or as part of a skills gap analysis, especially as students move into year 13.

They are drawn from the latest specification questions and legacy questions. The papers are between 25 and 35 marks.

The topic number on this worksheet relates to the corresponding chapter number in the 'Pearson Edexcel AS and A Level Mathematics: Pure Mathematics Year 1/AS' textbook.

Non-Calculator Questions

The new specification allows calculators to be used in all papers. **We have, however, put these questions together with the intention that students can complete them without a calculator.** It's important for pupils to be able to maintain their non-calculator skills, especially on topics such as surds or indices, to support question that use the keywords "show that" or "prove". If you wish to ease the difficulty slightly then you can, of course, allow students to attempt them with the support of a calculator.

Quick Links

(Press Ctrl, as you click with your mouse to follow these links)

- Bronze Questions
- Bronze Mark Scheme
- Silver Questions
- Silver Mark Scheme
- Gold Questions
- Gold Mark Scheme

Extension and Enrichment

If you have students that have enjoyed the challenge of the Gold questions, then they should have a go at the more challenging question from our Advanced Extension Award (AEA) papers. The Mathematics AEA is a single, 3 hour non-calculator paper, taken at the end of year 13. It helps students to develop high level problem solving and proof skills. It is entirely based on the content of the A Level Mathematics Course. No extra material needs to be covered to take the AEA in Mathematics. A second important difference is that marks are awarded for the clarity and quality of their solution. Developing this key skill, alongside the extra problem-solving experience, can pay dividends in the way they approach A Level Mathematics and Further Mathematics problems.

More information about the Advanced Extension Award can be found here on the Pearson Edexcel Website, or here on the Maths Emporium

Bronze Questions

Calculators may not be used

The total mark for this section is 34

Q1

The line l passes through the points A (3, 1) and B (4, – 2).

Find an equation for l

(Total for Question 1 is 6 marks)

Q2

The line L_1 has equation $4x + 2y - 3 = 0$

(a) Find the gradient of L_1

(2)

The line L_2 is perpendicular to L_1 and passes through the point (2, 5)

(b) Find the equation of L_2 in the form $y = mx + c$, where m and c are constants.

(3)

(Total for Question 2 is 5 marks)

Q3

The line l_1 has equation $4y – 3x = 10$

The line l_2 passes through the points (5, –1) and (–1, 8)

Determine, giving full reasons for your answer, whether lines l_1 and l_2 are parallel, perpendicular or neither.

(Total for Question 3 is 4 marks)

Q4

The line l_1 has equation $y = -2x + 3$

The line l_2 is perpendicular to l_1 and passes through the point (5, 6).

(a) Find an equation for l_2 in the form $ax + by + c = 0$, where a , b and c are integers.

(3)

The line l_2 crosses the x-axis at the point A and the y-axis at the point B.

(b) Find the x-coordinate of A and the y-coordinate of B.

(2)

Given that O is the origin,

(c) find the area of the triangle OAB.

(2)

(Total for Question 4 is 7 marks)

Q5

The point A (–6, 4) and the point B (8, –3) lie on the line L.

(a) Find an equation for L in the form $ax + by + c = 0$, where a, b and c are integers.

(4)

(b) Find the distance AB, giving your answer in the form $k\sqrt{5}$, where k is an integer.

(3)

(Total for Question 5 is 7 marks)

Q6

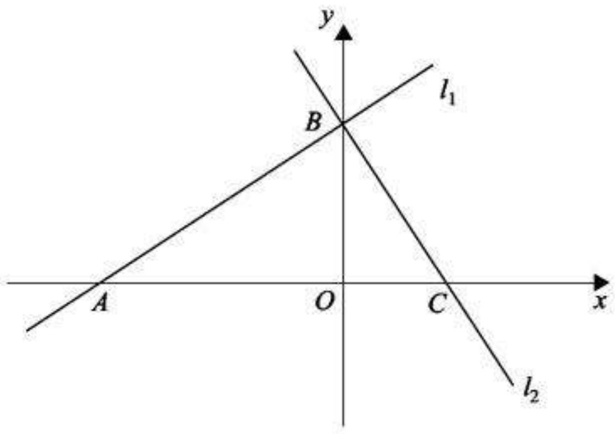

Figure 1

The line l_1 has equation $2x - 3y + 12 = 0$

(a) find the gradient of l_1.

(1)

The line l_1 crosses the x-axis at the point A and the y-axis at the point B, as shown in Figure 1.

The line l_2 is perpendicular to l_1 and passes through B.

(b) Find an equation of l_2.

(3)

The line l_2 crosses the x-axis at the point C.

(c) Find the area of triangle ABC.

(4)

(Total for Question 6 is 8 marks)

End of Questions

Bronze Mark Scheme

Q1

Question	Scheme	Marks	AOs
(Way 1)	Uses $y = mx + c$ with both (3,1) and (4, -2) and attempt to find m or c	M1	1.1b
	$m = -3$	A1	1.1b
	$c = 10$ so $y = -3x + 10$ o.e.	A1	1.1b
		(3)	
Or (Way 2)	Uses $\frac{y - y_1}{x - x_1} = \frac{y_2 - y_1}{x_2 - x_1}$ with both (3,1) and (4, -2)	M1	1.1b
	Gradient simplified to -3 (may be implied)	A1	1.1b
	$y = -3x + 10$ o.e.	A1	1.1b
		(3)	
Or (Way 3)	Uses $ax + by + k = 0$ and substitutes both $x = 3$ when $y = 1$ and $x = 4$ when $y = -2$ with attempt to solve to find a, b or k in terms of one of them	M1	1.1b
	Obtains $a = 3b$, $k = -10b$ or $3k = -10a$	A1	1.1b
	Obtains $a = 3$, $b = 1$, $k = -10$ Or writes $3x + y - 10 = 0$ o.e.	A1	1.1b
		(3)	
			(3 marks)

Notes

M1: Need correct use of the given coordinates
A1: Need fractions simplified to -3 (in ways 1 and 2)
A1: Need constants combined accurately
N.B. Answer left in the form $(y - 1) = -3(x - 3)$ or $(y - (-2)) = -3(x - 4)$ is awarded M1A1A0 as answers should be simplified by constants being collected
Note that a correct answer implies all three marks in this question.

Q2

Question Number	Scheme	Notes	Marks
(a)	$4x+2y-3=0 \Rightarrow y=-2x+\frac{3}{2}$	Attempt to write in the form $y=$	M1
	$\Rightarrow$ gradient $=-2$	Accept any un-simplified form and allow even with an incorrect value of "c"	A1
(a) Way 2	Alternative: $4+2\frac{dy}{dx}=0$	Attempt to differentiate Allow $p \pm q\frac{dy}{dx}=0,\ p,q \neq 0$	M1
	$\Rightarrow$ gradient $=-2$	Accept any un-simplified form	A1
	Answer only scores M1A1		
			[2]
(b)	Using $m_N=-\frac{1}{m_T}$	Attempt to use $m_N=$ $-\frac{1}{\text{gradient from (a)}}$	M1
	$y-5='\frac{1}{2}'(x-2)$ or Uses $y=mx+c$ in an attempt to find c	Correct straight line method using a 'changed' gradient and the point (2, 5)	M1
	$y=\frac{1}{2}x+4$	Cao (Isw)	A1
			(3)
			[5]

Q3

Question	Scheme	Marks	AOs
	States gradient of $4y-3x=10$ is $\frac{3}{4}$ oe or rewrites as $y=\frac{3}{4}x+\ldots$	B1	1.1b
	Attempts to find gradient of line joining $(5,-1)$ and $(-1,8)$	M1	1.1b
	$=\frac{-1-8}{5-(-1)}=-\frac{3}{2}$	A1	1.1b
	States neither with suitable reasons	A1	2.4
		(4)	
			(4 marks)

Notes

B1: States that the gradient of line l_1 is $\frac{3}{4}$ or writes l_1 in the form $y=\frac{3}{4}x+\ldots$

M1: Attempts to find the gradient of line l_2 using $\frac{\Delta y}{\Delta x}$ Condone one sign error Eg allow $\frac{9}{6}$

A1: For the gradient of l_2 $=\frac{-1-8}{5-(-1)}=-\frac{3}{2}$ or the equation of l_2 $y=-\frac{3}{2}x+\ldots$

Allow for any equivalent such as $-\frac{9}{6}$ or -1.5

A1: CSO (on gradients)

Explains that they are neither parallel as the gradients not equal nor perpendicular as $\frac{3}{4}\times-\frac{3}{2}\neq-1$

oe

Allow a statement in words "they are not negative reciprocals " for a reason for not perpendicular and "they are not equal" for a reason for not being parallel

Q4

Question Number	Scheme	Marks
(a)	Gradient of l_2 is $\frac{1}{2}$ or 0.5 or $\frac{-1}{-2}$	B1
	Either $y-6="\frac{1}{2}"(x-5)$ or $y="\frac{1}{2}"x+c$ and $6="\frac{1}{2}"(5)+c \Rightarrow c=("\frac{7}{2}")$	M1
	$x-2y+7=0$ or $-x+2y-7=0$ or $k(x-2y+7)=0$ with **k an integer**	A1
		[3]
(b)	Puts $x=0$, or $y=0$ in **their** equation and solves to find appropriate co-ordinate	M1
	x-coordinate of A is -7 and y-coordinate of B is $\frac{7}{2}$.	A1 cao
		[2]
(c)	Area $OAB=\frac{1}{2}(7)\left(\frac{7}{2}\right)=\frac{49}{4}$ (units)^2 Applies $\pm\frac{1}{2}$(base)(height)	M1
	$\frac{49}{4}$	A1cso
		[2]
		7 marks
	Notes	
(a)	**B1**: Must have ½ or 0.5 or $\frac{-1}{-2}$ o.e. stated and stops, or used in their line equation **M1:** Full method to obtain an equation of the line through (5,6) with their "m". So $y-6=m(x-5)$ with their gradient or uses $y=mx+c$ with $(5, 6)$ and their gradient to find c. Allow any numerical gradient here including -2 or -1 but **not zero** . (Allow (6,5) as a slip **if** $y-y_1=m(x-x_1)$ is quoted first) **A1:** Accept any multiple of the correct equation, provided that the coefficients are integers and equation = 0 e.g. $-x+2y-7=0$ or $k(x-2y+7)=0$ or even $2y-x-7=0$	
(b)	**M1:** Either one of the x or y coordinates using their equation **A1:** Needs both correct values. Accept any correct equivalent.. Need not be written as co-ordinates. **Even** just -7 and 3.5 with **no** indication which is which may be awarded the A1.	
(c)	**M1:** Any correct method for area of triangle AOB, with their values for co-ordinates of A and B (may include negatives) *Method usually half base times height but determinants could be used.* **A1**: Any exact equivalent to 49/4, e.g. 12.25. (**negative final** answer is A0 but replacing by **positive** is A1) Do not need units. **c.s.o.** implies if A0 is scored in (b) then A0 is scored in (c) as well. **However** if candidate has correct line equation in (a) of wrong form may score A0 in (a) and A1 in (b) and (c)	
	Note: Special cases: $\frac{1}{2}(-7)\left(+\frac{7}{2}\right)=-\frac{49}{4}$ (units)^2 is M1 A0 but changing sign to area $=+\frac{49}{4}$ gets M1A1 (recovery) **N.B.** Candidates making sign errors in (b) and obtaining +7 and $-\frac{7}{2}$. may also get $\frac{49}{4}$ as their answer following previous errors. They should be awarded A0 as this answer is not ft and is for correct **solution** only **Special Case**: In (a) and (b): Produces parallel line instead of perpendicular line: So uses $m=-2$ This is not treated as a misread as it simplifies the question. The marks will usually be B0 M1 A0, M1 A0, M1 A0 i.e. maximum of 3/7	

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Q5

Question number	Scheme	Marks	
	(a) $m = \frac{4-(-3)}{-6-8}$ or $\frac{-3-4}{8-(-6)}$, $= \frac{7}{-14}$ or $\frac{-7}{14}$ $\left(= -\frac{1}{2}\right)$	M1, A1	
	Equation: $y-4 = -\frac{1}{2}(x-(-6))$ or $y-(-3) = -\frac{1}{2}(x-8)$	M1	
	$x+2y-2=0$ (or equiv. with <u>integer</u> coefficients… must have '= 0')	A1	(4)
	(e.g. $14y+7x-14=0$ and $14-7x-14y=0$ are acceptable)		
	(b) $(-6-8)^2+(4-(-3))^2$	M1	
	14^2+7^2 or $(-14)^2+7^2$ or $14^2+(-7)^2$ (M1 A1 may be implied by 245)	A1	
	$AB = \sqrt{14^2+7^2}$ or $\sqrt{7^2(2^2+1^2)}$ or $\sqrt{245}$		
	$7\sqrt{5}$	A1cso	(3)
			7
	(a) 1st M: Attempt to use $m = \frac{y_2-y_1}{x_2-x_1}$ (may be implicit in an equation of L). 2nd M: Attempting straight line equation in any form, e.g $y-y_1 = m(x-x_1)$, $\frac{y-y_1}{x-x_1} = m$, with any value of m (except 0 or ∞) and either (–6, 4) or (8, –3). N.B. It is also possible to use a different point which lies on the line, such as the midpoint of AB (1, 0.5). Alternatively, the 2nd M may be scored by using $y = mx+c$ with a numerical gradient and substituting (–6, 4) or (8, –3) to find the value of c. Having coords the <u>wrong way round</u>, e.g. $y-(-6) = -\frac{1}{2}(x-4)$, loses the 2nd M mark <u>unless</u> a correct general formula is seen, e.g. $y-y_1 = m(x-x_1)$. (b) M: Attempting to use $(x_2-x_1)^2+(y_2-y_1)^2$. <u>Missing bracket</u>, e.g. -14^2+7^2 implies M1 if no earlier version is seen. -14^2+7^2 with no further work would be M1 A0. -14^2+7^2 followed by 'recovery' can score full marks.		

Q6

Question	Scheme	Marks
(a)	$(m=)\frac{2}{3}$ (or exact equivalent)	B1 (1)
(b)	B: $(0, 4)$ [award when first seen – may be in (c)]	B1
	Gradient: $\frac{-1}{m}=-\frac{3}{2}$	M1
	$y-4=-\frac{3x}{2}$ or equiv. e.g. $\left(y=-\frac{3x}{2}+4,\quad 3x+2y-8=0\right)$	A1 (3)
(c)	A: $(-6,0)$ [award when first seen – may be in (b)]	B1
	C: $\frac{3x}{2}=4 \Rightarrow x=\frac{8}{3}$ [award when first seen – may be in (b)]	B1ft
	Area: Using $\frac{1}{2}(x_C-x_A)y_B$	M1
	$=\frac{1}{2}\left(\frac{8}{3}+6\right)4=\frac{52}{3}\ \left(=17\frac{1}{3}\right)$	A1 cso (4)
ALT	$BC=\frac{4}{6}\sqrt{52}$ (from similar triangles) (or possibly using C)	2nd B1ft
	Area: Using $\frac{1}{2}(AB\times BC)$ N.B. $AB=\sqrt{6^2+4^2}=\sqrt{52}$	M1
	$=\frac{1}{2}\times\sqrt{52}\times\left(\frac{2}{3}\sqrt{52}\right)=\frac{52}{3}\ \left(=17\frac{1}{3}\right)$	A1
		8 marks
	Notes	
(a)	B1 for $\frac{2}{3}$ seen. Do not award for $\frac{2}{3}x$ and must be in part (a)	
(b)	B1 for coordinates of B. Accept 4 marked on y-axis (clearly labelled) M1 for use of perpendicular gradient rule. Follow through their value for m A1 for a correct equation (any form, need not be simplified). Answer only 3/3	
(c)	1st B1 for the coordinates of A (clearly labelled). Accept – 6 marked on x-axis 2nd B1ft for the coordinates of C (clearly labelled) or $AC=\frac{26}{3}$. Accept $x=\frac{8}{3}$ marked on x-axis. Follow through from l_2 if >0 M1 for an expression for the area of the triangle (all lengths > 0). Ft their 4, - 6 and $\frac{8}{3}$ A1 cso for $\frac{52}{3}$ or exact equivalent seen but must be a single fraction or $17\frac{1}{3}$ or $17\frac{2}{6}$ etc $17\frac{1}{3}$ on its own can only score full marks if A, B and C are all correct.	
ALT	2nd B1ft If they use this approach award this mark for C (if seen) or BC	
Use of Det	2nd M1 must get as far as: $\frac{1}{2}\lvert x_A\times y_B-x_C\times y_B\rvert$	

Silver Questions

Calculators may not be used

The total mark for this section is 31

Q1

The points P and Q have coordinates $(-1, 6)$ and $(9, 0)$ respectively.

The line l is perpendicular to PQ and passes through the mid-point of PQ.

Find an equation for l, giving your answer in the form $ax + by + c = 0$, where a, b and c are integers.

(5)

(Total for Question 1 is 5 marks)

Q2

The straight line L_1 passes through the points $(-1, 3)$ and $(11, 12)$.

(a) Find an equation for L_1 in the form $ax + by + c = 0$, where a, b and c are integers.

(4)

The line L_2 has equation $3y + 4x - 30 = 0$.

(b) Find the coordinates of the point of intersection of L_1 and L_2.

(3)

(Total for Question 2 is 7 marks)

Q3

The line L_1 has equation $2y - 3x - k = 0$, where k is a constant.

Given that the point A (1, 4) lies on L_1, find

(a) the value of k,

(1)

(b) the gradient of L_1.

(2)

The line L_2 passes through A and is perpendicular to L_1

(c) Find an equation of L_2 giving your answer in the form $ax + by + c = 0$, where a, b and c are integers.

(4)

The line L_2 crosses the x-axis at the point B.

(d) Find the coordinates of B.

(2)

(e) Find the exact length of AB.

(2)

(Total for Question 3 is 11 marks)

Q4

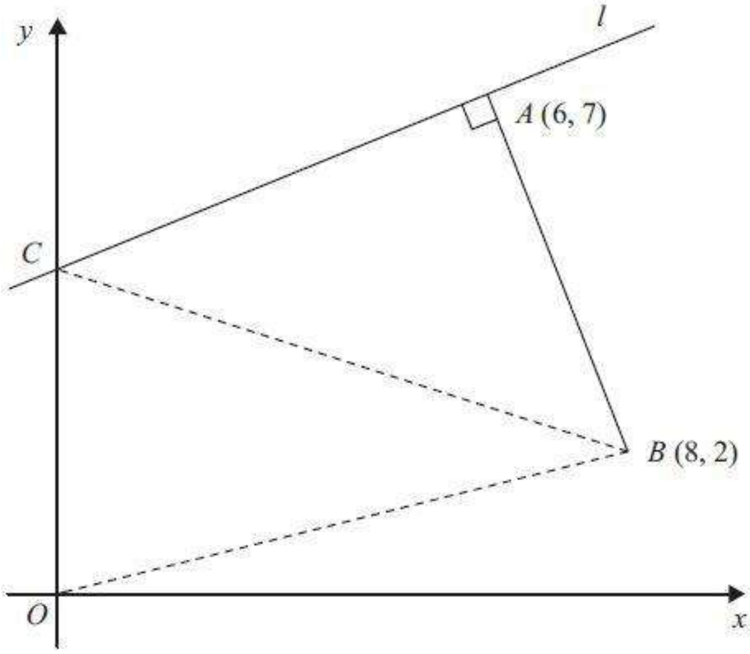

Figure 1

The points A and B have coordinates (6, 7) and (8, 2) respectively.

The line l passes through the point A and is perpendicular to the line AB, as shown in Figure 1.

(a) Find an equation for l in the form $ax + by + c = 0$, where a, b and c are integers.

(4)

Given that l intersects the y-axis at the point C, find

(b) the coordinates of C,

(2)

(c) the area of ΔOCB, where O is the origin.

(2)

(Total for Question 4 is 8 marks)

End of Questions

Silver Mark Scheme

Q1

Question Number	Scheme	Marks
	Mid-point of PQ is (4, 3)	B1
	PQ: $m = \dfrac{0-6}{9-(-1)}$, $\left(= -\dfrac{3}{5}\right)$	B1
	Gradient perpendicular to PQ $= -\dfrac{1}{m}$ $\left(= \dfrac{5}{3}\right)$	M1
	$y - 3 = \dfrac{5}{3}(x-4)$	M1
	$5x - 3y - 11 = 0$ or $3y - 5x + 11 = 0$ or multiples e.g. $10x - 6y - 22 = 0$	A1 (5)
		5
	Notes B1: correct midpoint. B1: correct numerical expression for gradient – need not be simplified 1st M: Negative reciprocal of their numerical value for m 2nd M: Equation of a line through **their** (4, 3) with any gradient except 0 or ∞. If the 4 and 3 are the wrong way round the 2nd M mark can still be given if a correct formula (e.g. $y - y_1 = m(x - x_1)$) is seen, otherwise M0. If (4, 3) is substituted into $y = mx + c$ to find c, the 2nd M mark is for attempting this. A1: Requires integer form with an = zero (see examples above)	

Q2

Question Number	Scheme		Marks
	(-1, 3) , (11, 12)		
(a)	$m = \dfrac{y_2 - y_1}{x_2 - x_1} = \dfrac{12-3}{11-(-1)}, = \dfrac{3}{4}$	M1:Correct method for the gradient A1: Any correct fraction or decimal	M1,A1
	$y-3 = ¾\,(x+1)$ or $y - 12 = ¾\,(x - 11)$ or $y = ¾\,x + c$ with attempt at substitution to find c	Correct straight line method using either of the given points and a numerical gradient.	M1
	$4y - 3x - 15 = 0$	Or equivalent with integer coefficients (= 0 is required)	A1
	This A1 should only be awarded in (a)		
			(4)
(a) Way 2	$\dfrac{y-y_1}{y_2-y_1} = \dfrac{x-x_1}{x_2-x_1} \Rightarrow \dfrac{y-3}{12-3} = \dfrac{x+1}{11+1}$	M1: Use of a correct formula for the straight line A1: Correct equation	M1A1
	$12(y-3) = 9(x+1)$	Eliminates fractions	M1
	$4y - 3x - 15 = 0$	Or equivalent with integer coefficients (= 0 is required)	A1
			(4)
(b)	Solves their equation from part (a) and L_2 simultaneously to eliminate one variable	Must reach as far as an equation in x only or in y only. (Allow slips in the algebra)	M1
	$x = 3$ or $y = 6$	One of $x = 3$ or $y = 6$	A1
	Both $x = 3$ **and** $y = 6$	Values can be un-simplified fractions.	A1
	Fully correct answers with no working can score 3/3 in (b)		
			(3)
(b) Way 2	$(-1,3) \to -a + 3b + c = 0$ $(11,12) \to 11a + 12b + c = 0$	Substitutes the coordinates to obtain two equations	M1
	$\therefore a = -\dfrac{3}{4}b,\ b = -\dfrac{4}{15}c$	Obtains sufficient equations to establish values for a, b and c	A1
	e.g. $c = 1 \Rightarrow b = -\dfrac{4}{15},\ a = \dfrac{3}{15}$	Obtains values for a, b and c	M1
	$\dfrac{3}{15}x - \dfrac{4}{15}y + 1 = 0 \Rightarrow 4y - 3x - 15 = 0$	Correct equation	A1
			(4)
			[7]

Q3

Question Number	Scheme	Marks
(a)	$(8-3-k=0)$ so $\underline{k=5}$	B1 (1)
(b)	$2y=3x+k$ $y=\frac{3}{2}x+\ldots$ and so $m=\frac{3}{2}$ o.e.	M1 A1 (2)
(c)	Perpendicular gradient $=-\frac{2}{3}$ Equation of line is: $y-4=-\frac{2}{3}(x-1)$ $\underline{3y+2x-14=0}$ o.e.	B1ft M1A1ft A1 (4)
(d)	$y=0, \Rightarrow B(7,0)$ or $\underline{x=7}$ $\quad x=7$ or $-\frac{c}{a}$	M1A1ft (2)
(e)	$AB^2=(7-1)^2+(4-0)^2$ $AB=\sqrt{52}$ or $2\sqrt{13}$	M1 A1 (2) 11
	Notes	
(b)	M1 for an attempt to rearrange to $y=\ldots$ A1 for clear statement that gradient is 1.5, can be $m=1.5$ o.e.	
(c)	B1ft for using the perpendicular gradient rule correctly on their "1.5" M1 for an attempt at finding the equation of the line through A using their gradient. Allow a sign slip 1st A1ft for a correct equation of the line follow through their changed gradient 2nd A1 as printed or equivalent with integer coefficients – allow $\underline{3y+2x=14}$ or $\underline{3y=14-2x}$	
(d)	M1 for use of $y=0$ to find $x=\ldots$in their equation A1ft for $x=7$ or $-\frac{c}{a}$	
(e)	M1 for an attempt to find AB or AB^2 A1 for any correct surd form- need not be simplified	

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Q4

Question Number	Scheme	Marks
Q (a)	AB: $m = \frac{2-7}{8-6}$, $\left(= -\frac{5}{2}\right)$	B1
	Using $m_1 m_2 = -1$: $m_2 = \frac{2}{5}$	M1
	$y - 7 = \frac{2}{5}(x-6)$, $\quad 2x - 5y + 23 = 0 \quad$ (o.e. with integer coefficients)	M1, A1 (4)
(b)	Using $x = 0$ in the answer to (a), $y = \frac{23}{5}$ or 4.6	M1, A1ft (2)
(c)	Area of triangle = $\frac{1}{2} \times 8 \times \frac{23}{5} = \frac{92}{5}$ (o.e) e.g. $\left(18\frac{2}{5},\ 18.4,\ \frac{184}{10}\right)$	M1 A1 (2)
		[8]
(a)	B1 for an expression for the gradient of AB. Does not need the $= -2.5$ 1st M1 for use of the perpendicular gradient rule. Follow through their m 2nd M1 for the use of (6, 7) and their changed gradient to form an equation for l. Can be awarded for $\frac{y-7}{x-6} = \frac{2}{5}$ o.e. Alternative is to use (6, 7) in $y = mx + c$ to <u>find a value</u> for c. Score when $c = \ldots$ is reached. A1 for a correct equation in the required form and must have "= 0" and integer coefficients	
(b)	M1 for using $x = 0$ in their answer to part (a) e.g. $-5y + 23 = 0$ A1ft for $y = \frac{23}{5}$ provided that $x = 0$ clearly seen <u>or</u> C (0, 4.6). Follow through their equation in (a) If $x = 0$, $y = 4.6$ are clearly seen but C is given as (4.6,0) apply ISW and award the mark. This A mark requires a simplified fraction or an exact decimal Accept their 4.6 marked on diagram next to C for M1A1ft	
(c)	M1 for $\frac{1}{2} \times 8 \times y_C$ so can follow through their y coordinate of C. A1 for 18.4 (o.e.) but their y coordinate of C must be positive <u>Use of 2 triangles or trapezium and triangle</u> Award M1 when an expression for area of OCB only is seen <u>Determinant approach</u> Award M1 when an expression containing $\frac{1}{2} \times 8 \times y_C$ is seen	

Gold Questions

Calculators may not be used

The total mark for this section is 27

Q1

(a) Find an equation of the line joining $A(7, 4)$ and $B(2, 0)$, giving your answer in the form $ax+by+c = 0$, where a, b and c are integers.

(3)

(b) Find the length of AB, leaving your answer in surd form.

(2)

The point C has coordinates $(2, t)$, where $t > 0$, and $AC = AB$.

(c) Find the value of t.

(1)

(d) Find the area of triangle ABC.

(2)

(Total for Question 1 is 8 marks)

Q2

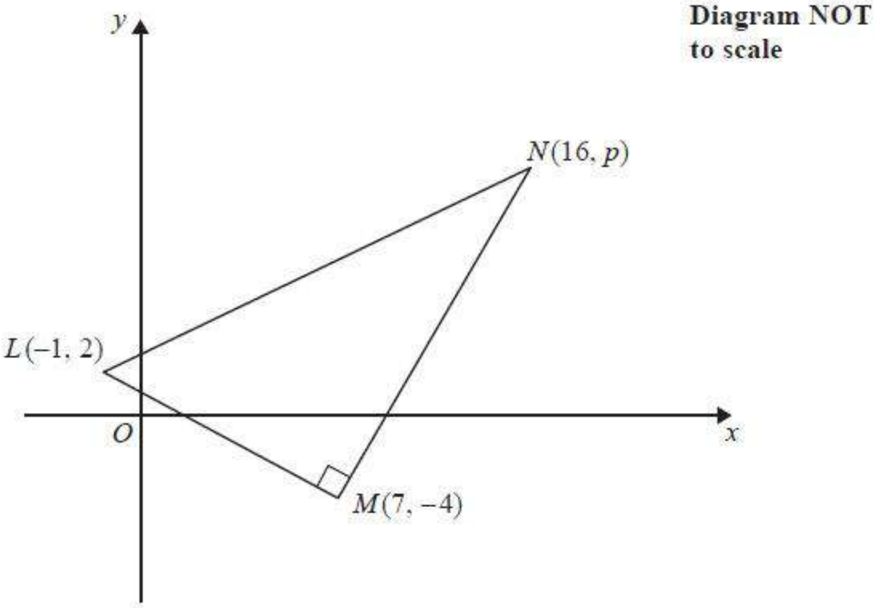


Figure 2

Figure 2 shows a right angled triangle *LMN*.

The points *L* and *M* have coordinates $(-1, 2)$ and $(7, -4)$ respectively.

(a) Find an equation for the straight line passing through the points *L* and *M*.

Give your answer in the form $ax + by + c = 0$, where a, b and c are integers.

(4)

Given that the coordinates of point *N* are $(16, p)$, where p is a constant, and angle LMN = 90°,

(b) find the value of p.

(3)

Given that there is a point *K* such that the points *L, M, N*, and *K* form a rectangle,

(c) find the y coordinate of *K*.

(2)

(Total for Question 2 is 9 marks)

Q3

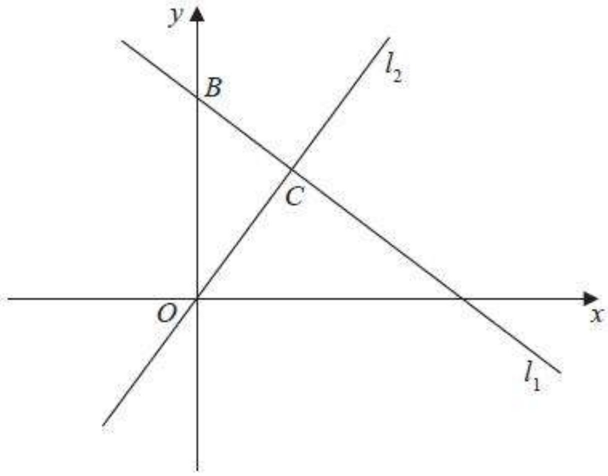


Figure 2

The line l_1, shown in Figure 2 has equation $2x + 3y = 26$

The line l_2 passes through the origin O and is perpendicular to l_1

(a) Find an equation for the line l_2

(4)

The line l_2 intersects the line l_1 at the point C

Line l_1 crosses the y-axis at the point B as shown in Figure 2.

(b) Find the area of triangle OBC

Give your answer in the form $\frac{a}{b}$, where a and b are integers to be determined.

(6)

(Total for Question 3 is 10 marks)

End of Questions

Gold Mark Scheme

Q1

Question Number	Scheme	Marks	
(a)	$m_{AB} = \frac{4-0}{7-2} \quad \left(= \frac{4}{5}\right)$	M1	
	Equation of AB is: $y - 0 = \frac{4}{5}(x-2)$ or $y - 4 = \frac{4}{5}(x-7)$ (o.e.)	M1	
	$\underline{4x - 5y - 8 = 0}$ (o.e.)	A1	(3)
(b)	$(AB =)\sqrt{(7-2)^2 + (4-0)^2}$	M1	
	$= \sqrt{41}$	A1	(2)
(c)	Using isos triangle with $AB = AC$ then $t = 2 \times y_A = 2 \times 4 = 8$	B1	(1)
(d)	Area of triangle $= \frac{1}{2} t \times (7-2)$	M1	
	$= \underline{20}$	A1	(2)
			8

	Notes
(a)	**Apply the usual rules for quoting formulae here.** For a correctly quoted formula with some correct substitution award M1 If no formula is quoted then a fully correct expression is needed for the M mark 1st M1 for attempt at gradient of AB. Some correct substitution in correct formula. 2nd M1 for an attempt at equation of AB. Follow through their gradient, not e.g. $-\frac{1}{m}$ Using $y = mx + c$ scores this mark when c is found. Use of $\frac{y-y_1}{y_2-y_1} = \frac{x-x_1}{x_2-x_1}$ scores 1st M1 for denominator, 2nd M1 for use of a correct point A1 requires integer form but allow $5y + 8 = 4x$ etc. Must have an "=" or A0
(b)	M1 for an expression for AB or AB^2. Ignore what is "left" of the equals sign
(c)	B1 for $t = 8$. May be implied by correct coordinates (2, 8) or the value appearing in (d)
(d)	M1 for an expression for the area of the triangle, follow through their t ($\neq 0$) but must have the $(7-2)$ or 5 and the $\frac{1}{2}$.
DET	e.g. $\begin{matrix} 2 & 7 & 2 & 2 \\ 0 & 4 & t & 0 \end{matrix}$ Area $= \frac{1}{2}\left[8 + 7t + 0 - (0 + 8 + 2t)\right]$ Must have the $\frac{1}{2}$ for M1

Pearson

Q2

Question Number	Scheme	Marks
(a)	**Method 1**: $gradient = \dfrac{y_1 - y_2}{x_1 - x_2} = \dfrac{2-(-4)}{-1-7}, = -\dfrac{3}{4}$ **Method 2**: $\dfrac{y - y_1}{y_2 - y_1} = \dfrac{x - x_1}{x_2 - x_1}$, so $\dfrac{y - y_1}{6} = \dfrac{x - x_1}{-8}$	M1, A1
	$y-2 = -\dfrac{3}{4}(x+1)$ or $y+4 = -\dfrac{3}{4}(x-7)$ or $y = their\text{'}-\dfrac{3}{4}\text{'}x + c$	M1
	$\Rightarrow \pm(4y+3x-5)=0$	A1 (4)
	Method 3: Substitute $x = -1$, $y = 2$ and $x = 7$, $y = -4$ into $ax + by + c=0$	M1
	$-a + 2b + c = 0$ and $7a - 4b + c = 0$	A1
	Solve to obtain $a = 3$, $b = 4$ and $c = -5$ or multiple of these numbers	M1 A1 (4)
(b)	Attempts $gradient\ LM \times gradient\ MN = -1$ so $-\dfrac{3}{4}\times\dfrac{p+4}{16-7} = -1$ or $\dfrac{p+4}{16-7} = \dfrac{4}{3}$ Or $(y+4) = \dfrac{4}{3}(x-7)$ equation with $x = 16$ substituted	M1
	$p+4 = \dfrac{9\times 4}{3} \Rightarrow p = ...$, $p = 8$ So $y =$, $y = 8$	M1, A1
		(3)
Alternative for (b)	Attempt Pythagoras: $(p+4)^2 + 9^2 + (6^2+8^2) = (p-2)^2 + 17^2$	M1
	So $p^2 + 8p + 16 + 81 + 36 + 64 = p^2 - 4p + 4 + 289 \Rightarrow p = ...$	M1
	$p = 8$	A1
		(3)
(c)	Either $(y=)\ p+6$ or $2+p+4$ Or use 2 perpendicular line equations through L and N and solve for y	M1
	$(y =)\ 14$	A1
		(2) (9 marks)

(a) M1 Uses the gradient formula with points L and M i.e. quote $gradient = \dfrac{y_1 - y_2}{x_1 - x_2}$ and attempt to substitute correct numbers. Formula may be implied by the correct $\dfrac{2-(-4)}{-1-7}$ or equivalent.

A1 Any correct single fraction gradient i.e $\dfrac{6}{-8}$ or equivalent

M1 Uses their gradient with either (-1, 2) or (7, -4) to form a linear equation
Eg $y-2 = their\text{'}-\dfrac{3}{4}\text{'}(x+1)$ or $y+4 = their\text{'}-\dfrac{3}{4}\text{'}(x-7)$ or $y = their\text{'}-\dfrac{3}{4}\text{'}x+c$ then find a value for c by substituting (-1,2) or (7, -4) in the correct way(not interchanging x and y)

A1 Accept $\pm k(4y+3x-5)=0$ with k an integer (This implies previous M1)

(b) M1 Attempts to use $gradient\ LM \times gradient\ MN = -1$. ie. $-\dfrac{3}{4}\times\dfrac{p+4}{16-7} = -1$ (allow sign errors)

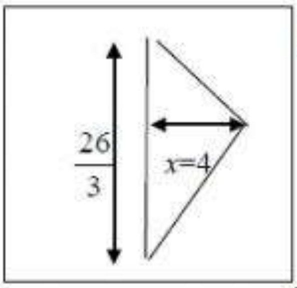
Or Attempts Pythagoras correct way round (allow sign errors)

M1 An attempt to solve their linear equation in 'p'. A1 cao $p = 8$

(c) M1 For using their numerical value of p and adding 6 . This may be done by any complete method (vectors, drawing, perpendicular straight line equations through L and N) or by no method. Assuming $x = 7$ is M0

A1 Accept 14 for both marks as long as no incorrect working seen (Ignore left hand side – allow k) . If there is wrong working resulting fortuitously in 14 give M0A0. Allow (8, 14) as the answer.

Q3

Question Number	Scheme	Marks
	(a) $2x+3y=26 \Rightarrow 3y=26\pm 2x$ and attempt to find m from $y=mx+c$	M1
	$(\Rightarrow y=\frac{26}{3}-\frac{2}{3}x)$ so gradient $= -\frac{2}{3}$	A1
	Gradient of perpendicular $=\frac{-1}{\text{their gradient}}$ $(=\frac{3}{2})$	M1
	Line goes through (0,0) so $y=\frac{3}{2}x$	A1
		(4)
	(b) Solves their $y=\frac{3}{2}x$ with their $2x+3y=26$ to form equation in x or in y	M1
	Solves their equation in x or in y to obtain $x=$ **or** $y=$	dM1
	x=4 or any equivalent e.g. 156/39 or $y=6$ o.a.e	A1
	$B=(0,\frac{26}{3})$ used or stated in (b)	B1
	 **Method 1** (see other methods in notes below)	
	Area $=\frac{1}{2}\times"4"\times\frac{"26"}{3}$	dM1
	$=\frac{52}{3}$ (oe with integer numerator and denominator)	A1
		(6)
		(10 marks)

Pearson

Notes

(a) M1 Complete method for finding gradient. (This may be implied by later correct answers.) e.g. Rearranges $2x + 3y = 26 \Rightarrow y = mx + c$ so $m =$

Or finds coordinates of two points on line and finds gradient e.g. (13, 0) *and* (1, 8) *so m* $= \frac{8-0}{1-13}$

A1 States or implies that gradient $= -\frac{2}{3}$ condone $-\frac{2}{3}x$ if they continue correctly. Ignore errors in constant term in straight line equation

M1 Uses $m_1 \times m_2 = -1$ to find the gradient of l_2. This can be implied by the use of $\frac{-1}{\text{their gradient}}$

A1 $y = \frac{3}{2}x$ or $2y - 3x = 0$ Allow $y = \frac{3}{2}x + 0$ Also accept $2y = 3x$, $y = 39/26x$ or even $y - 0 = \frac{3}{2}(x - 0)$ and isw

(b) M1 Eliminates variable between their $y = \frac{3}{2}x$ and their (possibly rearranged) $2x + 3y = 26$ to form an equation in x or y. (They may have made errors in their rearrangement)

dM1 (Depends on previous M mark) Attempts to solve their equation to find the value of x or y

A1 $x = 4$ or equivalent or $y = 6$ or equivalent

B1 y coordinate of B is $\frac{26}{3}$ (stated or implied) – isw if written as $(\frac{26}{3}, 0)$. **Must be used or stated in (b)**

dM1 (Depends on previous M mark) Complete method to find area of triangle OBC (using their values of x and/or y at point C and their 26/3)

A1 Cao $\frac{52}{3}$ or $\frac{104}{6}$ or $\frac{1352}{78}$ o.e.

Method 1:
Uses the area of a triangle formula $\frac{1}{2} \times OB \times (x$ coordinate of $C)$

Alternative methods:
Several Methods are shown below. The only mark which differs from Method 1 is the last M mark and its use in each case is described below:

Method 2 in (b) using $\frac{1}{2} \times BC \times OC$

dM1 Uses the area of a triangle formula $\frac{1}{2} \times BC \times OC$ Also finds OC $(= \sqrt{52})$ and $BC = (\frac{4}{3}\sqrt{13})$

Method 3 in (b) using $\frac{1}{2}\begin{vmatrix} 0 & 4 & 0 & 0 \\ 0 & 6 & \frac{26}{3} & 0 \end{vmatrix}$

dM1 States the area of a triangle formula $\frac{1}{2}\begin{vmatrix} 0 & 4 & 0 & 0 \\ 0 & 6 & \frac{26}{3} & 0 \end{vmatrix}$ or equivalent with their values

Method 4 in (b) using area of triangle OBX – area of triangle OCX where X is point (13, 0)

dM1 Uses the correct subtraction $\frac{1}{2} \times 13 \times "\frac{26}{3}" - \frac{1}{2} \times 13 \times "6"$

Method 5 in (b) using area = ½ (6 × 4) + ½ (4 × 8/3) drawing a line from *C* parallel to the *x* axis and dividing triangle into two right angled triangles

dM1 for correct method area = ½ ("6" × "4") + ½ ("4" × ["26/3" − "6"])

Method 6 Uses calculus

dM1 $\int_0^4 "\frac{26}{3}" - \frac{2x}{3} - \frac{3x}{2} dx = \left[\frac{26}{3}x - \frac{x^2}{3} - \frac{3x^2}{4}\right]_0^4$