Year 11 to Year 12 Transition Paper

Straight Line Graphs

Mark Scheme

Question	Scheme	Marks
1(a)	$3y = 2x + 24$	M1
	$y = \frac{2}{3}x + 8$	A1
		(2)
(b)	$y = \frac{2}{3}x + c, \qquad 3y = 2x + c$	M1
	$y = \frac{2}{3}x + 1$	A1
		(2)
		(4 marks)

Notes

(a)

M1 $3y = 2x + 24$ or $y - \frac{2}{3}x = \frac{24}{3}$

A1 cao

(b)

M1 for use of correct gradient in the equation of a straight line in any form,

eg $y = \frac{2}{3}x + c,\ 3y = 2x + c$

A1 for $y = \frac{2}{3}x + 1$ oe

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

Notes

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

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 $y=-\frac{3}{2}x+\dots$

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

Question	Scheme	Marks
3 (Way 1)	Use $y = mx + c$ with both (3, 1) and (4, -2) and attempt to find m or c	M1
	$m = -3$	A1
	$c = 10$ so $y = -3x + 10$	A1
		(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
	Gradient simplified to −3 (may be implied)	A1
	$y = -3x + 10$ oe	A1
		(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
	Obtains $a = 3b$, $k = -10b$ or $3k = -10a$	A1
	Obtains $a = 3$, $b = 1$, $k = -10$ Or writes $3x + y - 10 = 0$ oe	A1
		(3)
		(3 marks)

Notes

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

Question	Scheme	Marks
4(a)	$2x+4y-3=0 \Rightarrow y=\mp\frac{2}{4}x+...$ Gradient of perpendicular = $\pm\frac{4}{2}$	M1
	Either $m=2$ or $y=2x+7$	A1
		(2)
(b)	Combines 'their' $y=2x+7$ with $2x+4y-3=0 \Rightarrow 2x+4(2x+7)-3=0 \Rightarrow x=...$	M1
	$x=-2.5$ oe	A1
		(2)
		(4 marks)

Notes

(a)

M1: Attempts to set given equation in the form $y=ax+b$ with $a=\mp\frac{2}{4}$ oe such as $\mp\frac{1}{2}$ **AND** deduces that $m=-\frac{1}{a}$ Condone errors on the "$+b$"

An alternative method is to find both intercepts to get gradient $l_1=\pm\frac{0.75}{1.5}$ and use the perpendicular gradient rule.

A1: Correct answer. Accept **either** $m=2$ **or** $y=2x+7$

This must be simplified and not left as $m=\frac{4}{2}$ or $m=2x$ unless you see $y=2x+7$.

Watch: There may be candidates who look at $2x+4y-3=0$ and incorrectly state that the gradient is 2 and use the perpendicular rule to get $m=-\frac{1}{2}$ They will score M0 A0 in (a) and also no marks in (b) as the lines would be parallel. In a case like this don't allow an equation to be "altered"

Candidates who state $m=2$ or $y=2x+7$ **with no incorrect working** can score both marks

(b)

M1: Substitutes their $y=mx+7$ into $2x+4y-3=0$, condoning slips, in an attempt to form and solve an equation in *x*. Alternatively equates their $y=-\frac{1}{2}x+\frac{3}{4}$ with their $y=mx+7$ in an attempt to form and solve, condoning slips, an equation in *x*. Don't be too concerned by the mechanics of the candidates attempt to solve. (E.g. allow solutions from their calculators).

You may see $2x+4y-3=2x-y+7$ with y being found before the value of *x* appears

It cannot be awarded from "unsolvable" equations (e.g. lines that are parallel).

A1: $x=-2.5$

The answer alone can score both marks as long as both equations are correct and no incorrect working is seen.

Remember to isw after the correct answer and ignore any *y* coordinate

Question	Scheme	Marks
5(a)	Gradient of $\mathbf{L_1}$ is $-\frac{3}{4}$	M1
	$y = -\frac{3}{4}x + c$ $1 = -\frac{3}{4} \times 2 + c$ $c = \frac{10}{4}$	M1
	$y = -\frac{3}{4}x + \frac{5}{2}$	A1
		(3)
(b)	Gradient of $\mathbf{L_1}$ is $-\frac{3}{4}$	M1
	Gradient of $\mathbf{L_3} = \frac{4}{3}$ $y - -5 = \frac{4}{3}(x - 0)$	M1
	$4x - 3y - 15 = 0$	A1
		(3)
		(6 marks)

Notes

(a)

M1 for method to find gradient of $\mathbf{L_1}$ or sight of "$m = -\frac{3}{4}$"

M1 for method to find equation, ie use of $y - y_1 = m(x - x_1)$ or
$y = mx + c$, with attempt to find c

A1 for $y = -\frac{3}{4}x + \frac{5}{2}$

(b)

M1 for method to find gradient of $\mathbf{L_3}$, eg use of $-\frac{1}{m}$ or sight of "$m = \frac{4}{3}$"

M1 for method to find equation, ie use of $y - y_1 = m(x - x_1)$ or
$y = mx + c$, with attempt to find c

A1 for $4x - 3y - 15 = 0$ or $-4x + 3y + 15 = 0$
(accept $4x + -3y + -15 = 0$)

Question	Scheme		Marks
6(a)	$\frac{5}{4}$ oe	$\frac{5}{4}$ or exact equivalents such as 1.25 but **not** $\frac{5}{4}x$.	B1
			(1)
(b)	$y = \frac{5}{4}x + c$	Uses a line with a parallel gradient $\frac{5}{4}$ oe or their gradient from part (a). Evidence is $y = "\frac{5}{4}"x + c$ or similar.	M1
	$(12,5) \Rightarrow 5 = "\frac{5}{4}" \times 12 + c \Rightarrow c = ..$	Method of finding an equation of a line with numerical gradient and passing through $(12,5)$. Score even for the perpendicular line. Must be seen in part (a).	M1
	$y = \frac{5}{4}x - 10$	Correct equation. Allow $-\frac{40}{4}$ for -10	A1
			(3)
(c)	$(B=)(0,-10)$	$(B=)(0,-10)$ Follow through on their 'c'. Allow also if –10 is marked in the correct place on the diagram. Allow x = 0, y = -10 (the x = 0 may be seen "embedded" but not just y = -10 with no evidence that x = 0)	B1ft
	$(C=)(8,0)$	$(C=)(8,0)$ Correct coordinates. Allow also if 8 is marked in the correct place on the diagram. Allow y = 0, x = 8 (the y = 0 may be seen "embedded" but not just x = 8 with no evidence that y = 0)	B1
	Do not penalise lack of "0" twice so penalise it at the first occurrence but check the diagram if necessary.		
			(2)
(d) Way 1	Area of Parallelogram = $(3 + "10") \times "8"$	Uses area of parallelogram = $bh = (3 + "10") \times "8"$ Follow through on their 10 and their 8	M1
	= 104	cao	A1
	Correct answer only scores both marks		**(2)**
(d) Way 2	Trapezium *AOCD* + Triangle *OCB* $= \frac{1}{2}(3 + 3 + "10") \times "8" + \frac{1}{2} \times "8" \times "10"$	A correct method using their values for *AOCD* + *OCB*.	M1
	= 104	cao	A1
			(2)
(d) Way 3	2 Triangles + Rectangle $= 2 \times \frac{1}{2}("8" \times "10") + "8" \times 3$	A correct method using their values for 2x*OBC* + rectangle.	M1
	= 104	cao	A1
			(2)
(d) Way 4	Triangle *ACD* + Triangle *ACB* $= 2 \times \frac{1}{2}("10" + 3) \times "8"$	A correct method using their values for *ACD* + *ABC*.	M1
	= 104	cao	A1
			(2)

Question	Scheme	Marks
		(8 marks)

Question	Scheme		Marks
7(a)	l: passes through (5, 8) and (3,11)		
	Gradient of l is $\frac{11-8}{3-5}\left(=\frac{3}{-2}\right)$	A correct gradient in any form, simplified or unsimplified. (May be implied by subsequent work)	B1
	$y-8=-\frac{3}{2}(x-5)$ **or** $y=-\frac{3}{2}x+c$ **and** $8=-\frac{3}{2}(5)+c \Rightarrow c=\frac{31}{2}$ $y=-\frac{3}{2}x+\frac{31}{2}$	$y-11=m(x-3)$ or $y-8=m(x-5)$ with their gradient **or** uses $y=mx+c$ with $(3, 11)$ or $(5, 8)$ and their gradient and reaches as far as c = …	M1
		Correct equation of l in **any form**.	A1
	$3x+2y-31=0$ or e.g. $0=-2y-3x+31$	Correct equation in the **required form**. (Allow any integer multiple)	A1
			[4]
(b)	$AB=\sqrt{(5-3)^2+(8-11)^2}$ **or** $AB^2=(5-3)^2+(8-11)^2$	Fully correct method for the length of AB or AB^2	M1
	$=\sqrt{13}$	Cao	A1
			[2]
(c) **Way 1**	$\sqrt{(t-3)^2+(8-11)^2}=(5-t)$	Correct use of Pythagoras for BC and sets equal to $(5-t)$ (Allow $(t-5)$)	M1
	$t^2-6t+18=25-10t+t^2 \Rightarrow t=...$	Solves for t using correct processing. **Dependent on the previous mark.**	**d**M1
	$(x=\text{or}\, t=)\frac{7}{4}$	Allow equivalent answers e.g. 1.75 (allow x = .. or t = … or just the correct value)	A1
			[3]
(c) **Way 2**	Midpoint of (5, 8) and (3, 11) is (4, 9.5) $\Rightarrow y-9.5=\frac{2}{3}(x-4)$	Finds equation of perpendicular bisector using perpendicular gradient and midpoint. Must be a correct method for the midpoint and a correct straight line method using the negative reciprocal gradient from (a)	M1
	$y=8 \Rightarrow x=...$	Substitutes y = 8 into their perpendicular bisector and solves for x. **Dependent on the previous mark.**	**d**M1
	$(x=\text{or}\, t=)\frac{7}{4}$	Allow equivalent answers e.g. 1.75 (allow x = .. or t = … or just the correct value)	A1
			[3]
(d) **Way 1**	$\frac{1}{2}(5-"\frac{7}{4}")\times 3$	Fully correct method following through their non-zero value for t	M1

	$=\frac{39}{8}$	Area of triangle is $\frac{39}{8}$ or equivalent fraction e.g. $\frac{78}{16}$, $4\frac{7}{8}$, 4.875	A1
			[2]
(d) Way 2	$\frac{1}{2}\begin{vmatrix}5 & "\frac{7}{4}" & 3 & 5\\ 8 & 8 & 11 & 8\end{vmatrix}=\frac{1}{2}\left(5\times8+"\frac{7}{4}"\times11+3\times8-8\times"\frac{7}{4}"-8\times3-11\times5\right)$ Fully correct method following through their non-zero value for t		M1
	$=\frac{39}{8}$	Area of triangle is $\frac{39}{8}$ or equivalent fraction e.g. $\frac{78}{16}$, $4\frac{7}{8}$, 4.875	A1
			[2]
(d) Way 3	$\frac{1}{2}\sqrt{\left("4"-"\frac{7}{4}"\right)^2+\left("\frac{19}{2}"-8\right)^2}\times\sqrt{13}$	Fully correct method following through their non-zero value for t and their midpoint	M1
	$=\frac{39}{8}$	Area of triangle is $\frac{39}{8}$ or equivalent fraction e.g. $\frac{78}{16}$, $4\frac{7}{8}$, 4.875 or possibly $\frac{\sqrt{1521}}{8}$	A1
			[2]
			11 marks

Question	Scheme	Marks
8(a)	$\frac{-2-5}{6-2}\ (=-\frac{7}{4})$	M1
	$y-5=-\frac{7}{4}(x-2)$	M1
	$7x + 4y = 34$	A1
		(3)
(b)	**L_2** gradient found	M1
	$5 = \frac{4}{7}\times 7 + c$ or $\frac{y-5}{x-7}=\frac{4}{7}$	M1
	$y=\frac{4}{7}x+1$	A1
		(3)
(c)	No, with reason	M1
		(1)
		(7 marks)

Notes

(a)
M1 for method to find gradient of **L_1**, eg $\frac{-2-5}{6-2}\ (=-\frac{7}{4})$
M1 for a correct equation in any form,
eg $y-5=-\frac{7}{4}(x-2)$

A1 for $7x + 4y = 34$ oe with integer coefficients in the form $ax + by = c$

(b)
M1 for method to find gradient of **L_2**
M1 (dep M1) for a method to find the equation in any form eg $5 = \frac{4}{7}\times 7 + c$ or $\frac{y-5}{x-7}=\frac{4}{7}$

A1 ft from (a) for $y=\frac{4}{7}x+1$

(c)
M1 for No, with reason, eg $3\times\frac{1}{3}\neq -1$

Question	Scheme	Marks
9(a)	$y = \frac{4}{5}x + c$	M1
	$y - -1 = \frac{4}{5}(x - 2)$ or $y = \frac{4}{5}x - \frac{13}{5}$	M1
	$4x - 5y - 13 = 0$	A1
		(3)
(b)	**L₂ =** $\frac{4}{5}$	M1
	See notes	M1
	$y = \frac{4}{5}x + \frac{8}{5}$	A1
		(3)
(c)	$-\frac{3}{2}$ or $\frac{2}{3}$	M1
	Perpendicular with reason	A1
		(2)
		(8 marks)

Notes

(a)

M1 for correct use of gradient, eg $y = \frac{4}{5}x + c$

M1 for a correct equation in any form,

eg $y - -1 = \frac{4}{5}(x - 2)$ or $y = \frac{4}{5}x - \frac{13}{5}$

A1 for $4x - 5y - 13 = 0$ oe with integer coefficients

(b)

M1 for gradient of $\mathbf{L_2} = \frac{4}{5}$ ft from (a)

M1 for a complete method to find equation

A1 for $y = \frac{4}{5}x + \frac{8}{5}$ oe

(c)

M1 for at least one correct gradient , $-\frac{3}{2}$ or $\frac{2}{3}$

A1 for line is perpendicular with reason,

eg $-\frac{3}{2} \times \frac{2}{3} = -1$ oe

Question	Scheme	Marks
10(a)	Gradient = $-\frac{4}{3}$	M1
	c (= 4)	M1
	$4x + 3y - 12 = 0$	A1
		(3)
(b)	$-\frac{4}{3}$	B1
		(1)
		(4 marks)

Notes

(a)
M1 for method to find gradient of **L,** eg $-\frac{4}{3}$
M1 for complete method to find the value of c (= 4)
A1 $4x + 3y - 12 = 0$ oe in correct form

(b)
B1 ft their gradient from (a)

Question	Scheme	Marks
11(a)	$x - 2y = 2$	
		(1)
(b)	$y = \frac{1}{2}x + c$	M1
	$-6 = \frac{1}{2} \times -2 + c$	M1
	$y = \frac{1}{2}x - 5$	A1
		(3)
		(4 marks)

Notes

(a)
B1 for eg $x - 2y = 2$ or $-x + 2y = -2$

(b)
M1 for use of gradient of $\mathbf{L_2} = \frac{1}{2}$, eg $y = \frac{1}{2}x + c$
M1 for a correct method to find c, eg $-6 = \frac{1}{2} \times -2 + c$
A1for $y = \frac{1}{2}x - 5$

Question	Scheme	Marks
12	Gradient of L_1 is $-\frac{3}{2}$ $\qquad$ $y = \frac{2}{3}x + \frac{13}{3}$	M1
	Gradient of $L_2 = \frac{2}{3}$	M1
	$y - 5 = \frac{2}{3}(x - 1)$	M1
	$y = \frac{2}{3}x + \frac{13}{3}$	A1
		(4)
		(4 marks)

Notes

M1 for attempt to find gradient of L_1 or sight of $m = -\frac{3}{2}$

M1 for substitution into $-\frac{1}{m}$

M1 for attempt to use $y - y_1 = m(x - x_1)$ or $y = mx + c$, with attempt to find c

A1 for $y = \frac{2}{3}x + \frac{13}{3}$

Question	Scheme	Marks
13(a)	gradient of $-\frac{2}{5}$	M1
	find c	M1
	$y = -\frac{2}{5}x + \frac{26}{5}$	A1
		(3)
(b)	$mn = -1$	M1
	$y = \frac{5}{2}x - \frac{7}{2}$	A1
		(2)
		(5 marks)

Notes

(a)

M1 for use of the gradient of $-\frac{2}{5}$ in an equation of a straight line

M1 (dep M1) for method to find c

A1 $y = -\frac{2}{5}x + \frac{26}{5}$

(b)

M1 for using $mn = -1$ eg gradient of perpendicular line shown as $\frac{5}{2}$

A1 for $y = \frac{5}{2}x - \frac{7}{2}$ oe