Straight line graphs - Edexcel Past Exam Questions 2 MARK SCHEME

Question 1

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: $\frac{3x}{2}=4 \quad \Rightarrow \quad x=\frac{8}{3}$ [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: $\frac{1}{2}\left\|x_A\times y_B-x_C\times y_B\right\|$	

Question 2

Question Number	Scheme	Marks
	$L_1:\ 4y + 3 = 2x \Rightarrow y = \frac{1}{2}x - \frac{3}{4}$; $A(p, 4)$ lies on L_1.	
(a)	$\{p =\}\ 9\frac{1}{2}$ or $\frac{19}{2}$ or 9.5	B1
		[1]
(b)	$\{4y + 3 = 2x\} \Rightarrow y = \frac{2x - 3}{4} \Rightarrow m(L_1) = \frac{1}{2}$ or $\frac{2}{4}$	M1 A1
	So $m(L_2) = -2$	B1ft
	$L_2:\ y - 4 = -2(x - 2)$	M1
	$L_2:\ 2x + y - 8 = 0$ or $L_2:\ 2x + 1y - 8 = 0$	A1
		[5]
(c)	$\{L_1 = L_2 \Rightarrow\}\ 4(8 - 2x) + 3 = 2x$ or $-2x + 8 = \frac{1}{2}x - \frac{3}{4}$	M1
	$x = 3.5,\ y = 1$	A1, A1 cso
		[3]
(d)	$CD^2 = ("3.5" - 2)^2 + ("1" - 4)^2$	"M1"
	$CD = \sqrt{("3.5" - 2)^2 + ("1" - 4)^2}$	A1 ft
	$= \sqrt{1.5^2 + 3^2} = 1.5\sqrt{1^2 + 2^2} = 1.5\sqrt{5}$ or $\frac{3}{2}\sqrt{5}$ **(*)**	A1 **cso**
		[3]
(e)	Area = triangle ABC + triangle ABE	
	$= \frac{1}{2} \times \frac{3}{2}\sqrt{5} \times \sqrt{80} + \frac{1}{2} \times 3\sqrt{5} \times \sqrt{80}$ Finding the area of any triangle.	M1
	$= \frac{3}{4}\sqrt{5} \times 4\sqrt{5} + \frac{3}{2}\sqrt{5} \times 4\sqrt{5}$	
	$= \frac{3}{4}(20) + \frac{3}{2}(20)$	B1
	$= 45$	A1
		[3]
		15

Question 3

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		

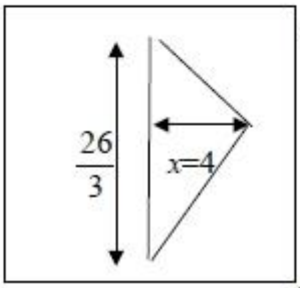
Question 4

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: $4+2\frac{\mathrm{d}y}{\mathrm{d}x}=0$	Attempt to differentiate Allow $p \pm q\frac{\mathrm{d}y}{\mathrm{d}x}=0,\ p,q \neq 0$	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 $m_N=-\frac{1}{gradient\ from\ (a)}$	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]

Question 5

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
	$y - 3 = \frac{3}{4}(x+1)$ or $y - 12 = \frac{3}{4}(x - 11)$ or $y = \frac{3}{4}x + c$ 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]

Question 6

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)**

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

Notes Continued

(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 ½×OB ×(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 9(b) using $\frac{1}{2} \times BC \times OC$

dM1 Uses the area of a triangle formula ½×BC ×OC Also finds OC ($=\sqrt{52}$) and BC= ($\frac{4}{3}\sqrt{13}$)

Method 3 in 9(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 9(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 9(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 $\int_0^4 "\frac{26}{3}" - \frac{2x}{3} - \frac{3x}{2} dx = \left[\frac{26}{3}x - \frac{x^2}{3} - \frac{3x^2}{4} \right]_0^4$

Question 7

Question Number	Scheme	Marks
(a)	Method 1: $gradient = \frac{y_1 - y_2}{x_1 - x_2} = \frac{2-(-4)}{-1-7}, = -\frac{3}{4}$ | Method 2: $\frac{y-y_1}{y_2-y_1} = \frac{x-x_1}{x_2-x_1}$, so $\frac{y-y_1}{6} = \frac{x-x_1}{-8}$	M1, A1
	$y-2 = -\frac{3}{4}(x+1)$ or $y+4 = -\frac{3}{4}(x-7)$ or $y = their\text{'}-\frac{3}{4}\text{'}x + c$	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 $-\frac{3}{4} \times \frac{p+4}{16-7} = -1$ or $\frac{p+4}{16-7} = \frac{4}{3}$ | Or $(y+4) = \frac{4}{3}(x-7)$ equation with $x =$ 16 substituted	M1
	$p + 4 = \frac{9 \times 4}{3} \Rightarrow p = ...$, $p = 8$ | 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 $gradient = \frac{y_1 - y_2}{x_1 - x_2}$ and attempt to substitute correct numbers. Formula may be implied by the correct $\frac{2-(-4)}{-1-7}$ or equivalent.

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

M1 Uses their gradient with either (-1, 2) or (7, -4) to form a linear equation

Eg $y - 2 = their\text{'}-\frac{3}{4}\text{'}(x+1)$ or $y + 4 = their\text{'}-\frac{3}{4}\text{'}(x-7)$ or $y = their\text{'}-\frac{3}{4}\text{'}x + c$ 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. $-\frac{3}{4} \times \frac{p+4}{16-7} = -1$ (allow sign errors)

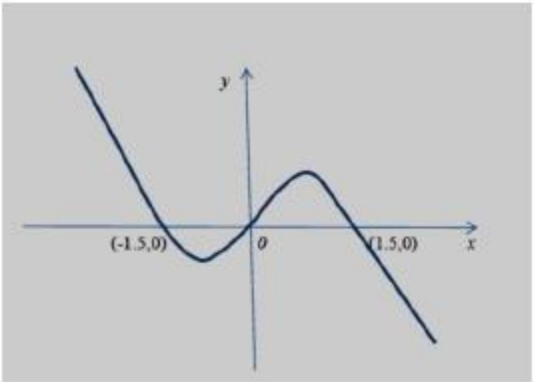
Or Attempts Pythagoras correct way round (allow sign errors)

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.

Question 8

Question Number	Scheme		Marks
(a)	$9x-4x^3=x(9-4x^2)$ or $-x(4x^2-9)$	Takes out a common factor of x or $-x$ <u>correctly.</u>	B1
	$9-4x^2=(3+2x)(3-2x)$ or $4x^2-9=(2x-3)(2x+3)$	$9-4x^2=(\pm3\pm2x)(\pm3\pm2x)$ or $4x^2-9=(\pm2x\pm3)(\pm2x\pm3)$	M1
	$9x-4x^3=x(3+2x)(3-2x)$	Cao but allow equivalents e.g. $x(-3-2x)(-3+2x)$ or $-x(2x+3)(2x-3)$	A1
Note: $4x^3-9x=x(4x^2-9)=x(2x-3)(2x+3)$ so $9x-4x^3=x(3-2x)(2x+3)$ **would score full marks**			
	Note: Correct work leading to $9x\left(1-\frac{2}{3}x\right)\left(1+\frac{2}{3}x\right)$ **would score full marks**		
	Allow ($x\pm0$) or ($-x\pm0$) instead of x and $-x$		
			(3)
(b)		 or  A cubic shape with one maximum and one minimum	M1
		Any line or curve drawn passing through (not touching) the origin	B1
		Must be the correct shape and in all four quadrants and pass through (-1.5, 0) and (1.5, 0) (Allow (0, -1.5) and (0, 1.5) or just -1.5 and 1.5 provided they are positioned correctly). **Must be on the diagram** (Allow $\sqrt{\frac{9}{4}}$ for 1.5)	A1
			(3)

(c)	$A=(-2,\,14),\quad B=(1,\,5)$	B1: $y=14$ **or** $y=5$ B1: $y=14$ **and** $y=5$	B1 B1
	These must be seen or used in (c)		
	$(AB=)\sqrt{(-2-1)^2+(14-5)^2}\left(=\sqrt{90}\right)$	Correct use of Pythagoras <u>including the square root.</u> Must be a correct expression for their A and B if a correct formula is not quoted	M1
	E.g. $AB=\sqrt{(-2+1)^2+(14-5)^2}$ **scores M0.** **However** $AB=\sqrt{(y_2-y_1)^2+(x_2-x_1)^2}=\sqrt{(-2+1)^2+(14-5)^2}$ **scores M1**		
	$(AB=)3\sqrt{10}$	cao	A1
			(4)
			(10 marks)
Special case: Use of $4x^3-9x$ **for the curve gives (-2, -14) and (1, -5) in part (c). Allow this to score a maximum of B0B0M1A1 as a special case in part (c) as the length AB comes from equivalent work.**			

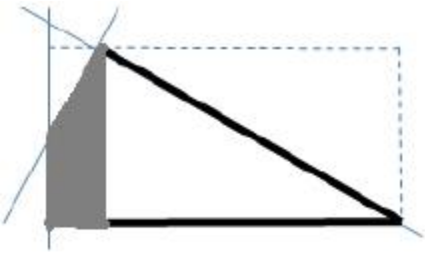
Question 9

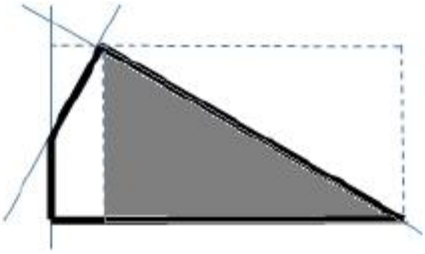
Question Number	Scheme	Notes	Marks
(a)	l_1 : passes through (0, 2) and (3, 7) l_2 : goes through (3, 7) and is perpendicular to l_1		
	Gradient of l_1 is $\frac{7-2}{3-0}\left(=\frac{5}{3}\right)$	$m(l_1)=\frac{7-2}{3-0}$. Allow un-simplified. May be implied.	B1
	$m(l_2)=-1\div their\ \frac{5}{3}$	Correct application of perpendicular gradient rule	M1
	$y-7=\text{"}-\frac{3}{5}\text{"}(x-3)$ or $y=\text{"}-\frac{3}{5}\text{"}x+c,\ 7=\text{"}-\frac{3}{5}\text{"}(3)+c \Rightarrow c=\frac{44}{5}$	M1: Uses $y-7=m(x-3)$ with their <u>changed</u> gradient or uses $y=mx+c$ with (3, 7) and their <u>changed</u> gradient to find a value for c A1ft: Correct ft equation for their perpendicular gradient **(this is dependent on both M marks)**	M1A1ft
	$3x+5y-44=0$	Any positive or negative integer multiple. Must be seen in (a) and must include "= 0".	A1
			[5]
(b)	When $y=0$ $x=\frac{44}{3}$	M1: Puts $y=0$ and finds a value for x from their equation A1: $x=\frac{44}{3}\left(\text{or } 14\frac{2}{3} \text{ or } 14.\dot{6}\right)$ or exact equivalent. ($y=0$ not needed)	M1 A1
	Condone 3x – 5y – 44 = 0 only leading to the correct answer and condone coordinates written as (0, 44/3) but allow recovery in (c)		
			[2]

(c)	GENERAL APPROACH:			
	Correct attempt at finding the area of any one of the triangles or one of the trapezia but not just one rectangle. The correct pair of 'base' and 'height' must be used for a triangle and the correct formula used for a trapezium. If Pythagoras is required, then it must be used correctly with the correct end coordinates. **Note that the first three marks apply to their calculated coordinates e.g. their $\frac{44}{3}$, $\frac{44}{5}$, $-\frac{6}{5}$ etc. But the given coordinates must be correct e.g. (0, 2) and (3, 7).**			M1
	A correct numerical **expression** for the area of one **triangle** or one **trapezium** for their coordinates.			A1ft
	Combines the correct areas together correctly for their chosen "way". Note that if correct numerical expressions for areas have been incorrectly simplified before combining them, then this M1 may still be given. **Dependent on the first method mark.**			dM1
	Correct numerical expression for the area of *ORQP*. **The expressions must be fully correct for this mark i.e. no follow through.**			A1
	Correct exact area e.g. $54\frac{1}{3}$, $\frac{163}{3}$, $\frac{326}{6}$, $54.\dot{3}$ or any exact equivalent			A1
	Shape	**Vertices**	**Numerical Expression**	**Exact Area**
	Triangle	*TRQ*	$\frac{1}{2}\times7\times\left(\frac{44}{3}-3\right)$	$\frac{245}{6}$
	Triangle	*SPO*	$\frac{1}{2}\times\frac{6}{5}\times2$	$\frac{6}{5}$
	Triangle	*PWQ*	$\frac{1}{2}\times\left(\frac{44}{5}-2\right)\times3$	$\frac{51}{5}$
	Triangle	*PVQ*	$\frac{1}{2}\times(7-2)\times3$	$\frac{15}{2}$

	Triangle	VWQ	$\frac{1}{2}\times\left(\frac{44}{5}-7\right)\times 3$	$\frac{27}{10}$	
	Triangle	QUR	$\frac{1}{2}\times\left(\frac{44}{3}-3\right)\times 7$	$\frac{245}{6}$	
	Triangle	PQR	$\frac{1}{2}\times\sqrt{34}\times\frac{7}{3}\times\sqrt{34}$	$\frac{119}{3}$	
	Triangle	PNQ	$\frac{1}{2}\times\frac{34}{3}\times 5$	$\frac{85}{3}$	
	Triangle	OPQ	$\frac{1}{2}\times 2\times 3$	3	
	Triangle	OQR	$\frac{1}{2}\times\frac{44}{3}\times 7$	$\frac{154}{3}$	
	Triangle	OWR	$\frac{1}{2}\times\frac{44}{3}\times\frac{44}{5}$	$\frac{968}{15}$	
	Triangle	SQR	$\frac{1}{2}\times\left(\frac{44}{3}+\frac{6}{5}\right)\times 7$	$\frac{833}{15}$	
	Triangle	OPR	$\frac{1}{2}\times\frac{44}{3}\times 2$	$\frac{44}{3}$	
	Trapezium	$OPQT$	$\frac{1}{2}(2+7)\times 3$	$\frac{27}{2}$	
	Trapezium	$OPNR$	$\frac{1}{2}\times\left(\frac{34}{3}+\frac{44}{3}\right)\times 2$	26	
	Trapezium	$OVQR$	$\frac{1}{2}\times\left(3+\frac{44}{3}\right)\times 7$	$\frac{371}{6}$	
	EXAMPLES				
(c)	**WAY 1**				

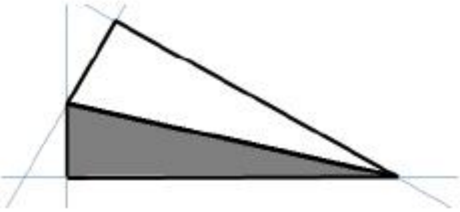
	$OPQT=\frac{1}{2}(2+7)\times 3$ or $TRQ=\frac{1}{2}\times 7\times\left(\frac{44}{3}-3\right)$	M1: Correct method for $OPQT$ or TRQ A1ft: $OPQT=\frac{1}{2}(2+7)\times 3$ or $TRQ=\frac{1}{2}\times 7\times\left(\frac{44}{3}-3\right)$	M1A1ft
	$\frac{1}{2}(2+7)\times 3+\frac{1}{2}\times 7\times\left(\frac{44}{3}-3\right)$	dM1: Correct numerical combination of areas that have been calculated correctly A1: **Fully Correct** numerical expression for the area $ORQP$	dM1A1
	$54\frac{1}{3}$	Any exact equivalent e.g. $\frac{163}{3}$, $\frac{326}{6}$, $54.\dot{3}$	A1

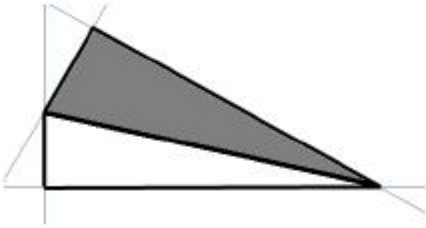




$$\frac{1}{2}\times(7+2)\times 3+\frac{1}{2}\times\frac{"35"}{3}\times 7$$
$$=\frac{27}{2}+\frac{245}{6}=\frac{326}{6}$$

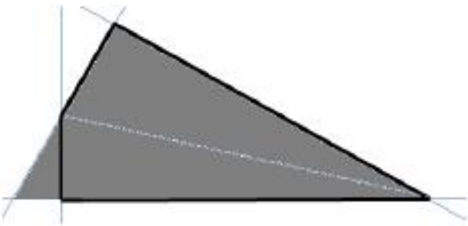
	WAY 2		
	$PQR = \frac{1}{2} \times \sqrt{34} \times \frac{7}{3} \times \sqrt{34}$ **or** $OPR = \frac{1}{2} \times \frac{44}{3} \times 2$	M1: Correct method for PQR or OPR A1ft: $PQR = \frac{1}{2} \times \sqrt{34} \times \frac{7}{3} \times \sqrt{34}$ or $OPR = \frac{1}{2} \times \frac{44}{3} \times 2$	M1A1ft
	$\frac{1}{2} \times \sqrt{34} \times \frac{7}{3} \times \sqrt{34} + \frac{1}{2} \times \frac{44}{3} \times 2$	dM1: Correct numerical combination of areas that have been calculated correctly A1: **Fully Correct** numerical expression for the area $ORQP$	dM1A1
	$54\frac{1}{3}$	Any exact equivalent e.g. $\frac{163}{3}$, $\frac{326}{6}$, $54.\dot{3}$	A1

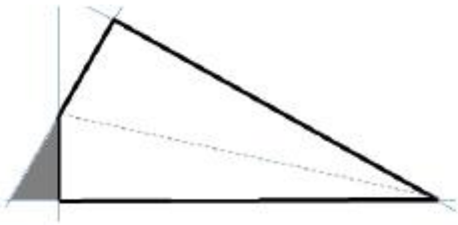




$$\frac{1}{2} \times \frac{"44"}{3} \times 2 + \frac{1}{2} \times \sqrt{34} \times "\frac{7}{3}\sqrt{34}"$$
$$= \frac{88}{6} + \frac{238}{6} = \frac{326}{6}$$

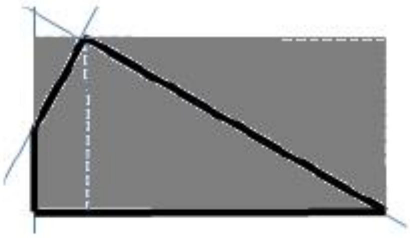
	WAY 3		
	$SQR = \frac{1}{2} \times 7 \times \frac{238}{15}$ **or** $SPO = \frac{1}{2} \times \frac{6}{5} \times 2$	M1: Correct method for SQR or SPO A1ft: $SQR = \frac{1}{2} \times 7 \times \frac{238}{15}$ or $SPO = \frac{1}{2} \times \frac{6}{5} \times 2$	M1A1ft
	$\frac{1}{2} \times 7 \times \frac{238}{15} - \frac{1}{2} \times \frac{6}{5} \times 2$	dM1: Correct numerical combination of areas that have been calculated correctly A1: **Fully Correct** numerical expression for the area $ORQP$	dM1A1
	$54\frac{1}{3}$	Any exact equivalent e.g. $\frac{163}{3}$, $\frac{326}{6}$, $54.\dot{3}$	A1

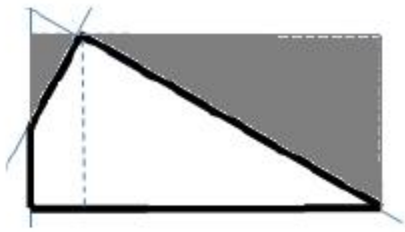




$$\frac{1}{2} \times \frac{"238"}{15} \times 7 - \frac{1}{2} \times \frac{"6"}{5} \times 2$$
$$= \frac{1666}{30} - \frac{6}{5} = \frac{1630}{30}$$

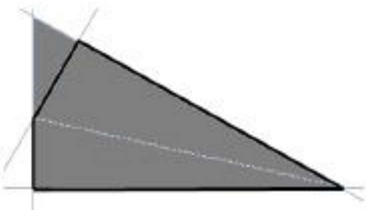
	WAY 4		
	$PVQ = \frac{1}{2}\times 5\times 3$ or $QUR = \frac{1}{2}\times 7\times \frac{35}{3}$	M1: Correct method for PVQ or QUR	M1A1ft
		A1ft: $PVQ = \frac{1}{2}\times 5\times 3$ or $QUR = \frac{1}{2}\times 7\times \frac{35}{3}$	
	$OVUR\ 7\times\frac{44}{3} - \frac{1}{2}\times 5\times 3 - \frac{1}{2}\times 7\times\frac{35}{3}$	dM1: Correct numerical combination of areas that have been calculated correctly	dM1A1
		A1: **Fully Correct** numerical expression for the area $ORQP$	
	$54\frac{1}{3}$	Any exact equivalent e.g. $\frac{163}{3}$, $\frac{326}{6}$, $54.\dot{3}$	A1

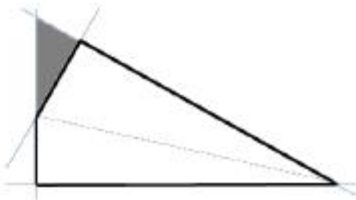




$$7\times\frac{"44"}{3} - \frac{1}{2}\times 5\times 3 - \frac{1}{2}\times\frac{"35"}{3}\times 7$$
$$= \frac{308}{3} - \frac{15}{2} - \frac{245}{6} = \frac{326}{6}$$

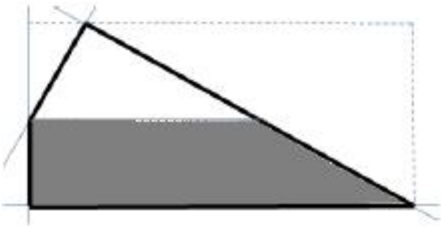
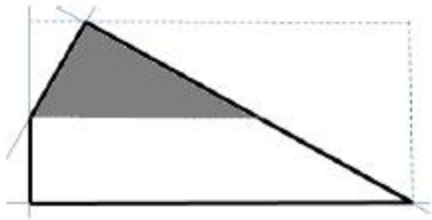
	WAY 5		
	$OWR = \frac{1}{2}\times\frac{44}{3}\times\frac{44}{5}$ or $PWQ = \frac{1}{2}\times\left(\frac{44}{5}-2\right)\times 3$	M1: Correct method for OWR or PWQ	M1A1ft
		A1ft: $OWR = \frac{1}{2}\times\frac{44}{3}\times\frac{44}{5}$ or $PWQ = \frac{1}{2}\times\left(\frac{44}{5}-2\right)\times 3$	
	$\frac{1}{2}\times\frac{44}{3}\times\frac{44}{5} - \frac{1}{2}\times\left(\frac{44}{5}-2\right)\times 3$	dM1: Correct numerical combination of areas that have been calculated correctly	dM1A1
		A1: **Fully Correct** numerical expression for the area $ORQP$	
	$54\frac{1}{3}$	Any exact equivalent e.g. $\frac{163}{3}$, $\frac{326}{6}$, $54.\dot{3}$	A1





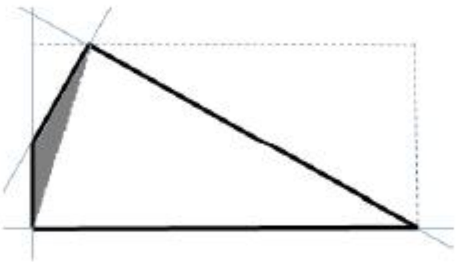
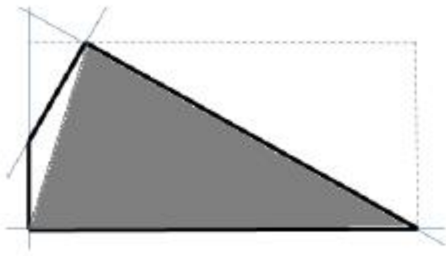
$$\frac{1}{2}\times\frac{"44"}{5}\times\frac{"44"}{3} - \frac{1}{2}\times\left(\frac{44}{5}-2\right)\times 3$$
$$= \frac{968}{15} - \frac{51}{5} = \frac{163}{3}$$

	WAY 6		
	$OPNR=\frac{1}{2}\times\left(\frac{34}{3}+\frac{44}{3}\right)\times 2$ **or** $PNQ=\frac{1}{2}\times\frac{34}{3}\times 5$	M1: Correct method for *OPNR* or *PNQ* A1ft: $OPNR=\frac{1}{2}\times\left(\frac{34}{3}+\frac{44}{3}\right)\times 2$ **or** $PNQ=\frac{1}{2}\times\frac{34}{3}\times 5$	M1A1ft
	$\frac{1}{2}\times\left(\frac{34}{3}+\frac{44}{3}\right)\times 2+\frac{1}{2}\times\frac{34}{3}\times 5$	dM1: Correct numerical combination of areas that have been calculated correctly A1: **Fully Correct** numerical expression for the area *ORQP*	dM1A1
	$54\frac{1}{3}$	Any exact equivalent e.g. $\frac{163}{3}$, $\frac{326}{6}$, $54.\dot{3}$	A1

$$\frac{1}{2}\times\left(\frac{"34"}{3}+\frac{"44"}{3}\right)\times 2+\frac{1}{2}\times\frac{"34"}{3}\times 5$$
$$=\frac{156}{6}+\frac{170}{6}=\frac{326}{6}$$

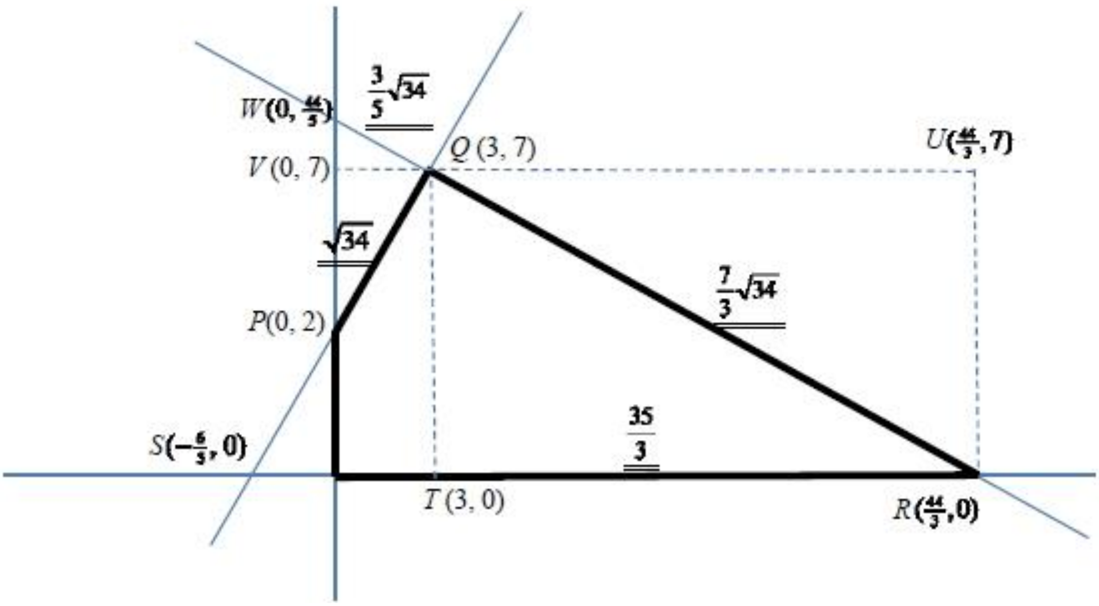
	WAY 7		
	$OPQ=\frac{1}{2}\times 3\times 2$ **or** $OQR=\frac{1}{2}\times\frac{44}{3}\times 7$	M1: Correct method for *OPQ* or *OQR* A1ft: $OPQ=\frac{1}{2}\times 3\times 2$ **or** $OQR=\frac{1}{2}\times\frac{44}{3}\times 7$	M1A1ft
	$\frac{1}{2}\times 3\times 2+\frac{1}{2}\times\frac{44}{3}\times 7$	dM1: Correct numerical combination of areas that have been calculated correctly A1: **Fully Correct** numerical expression for the area *ORQP*	dM1A1
	$54\frac{1}{3}$	Any exact equivalent e.g. $\frac{163}{3}$, $\frac{326}{6}$, $54.\dot{3}$	A1

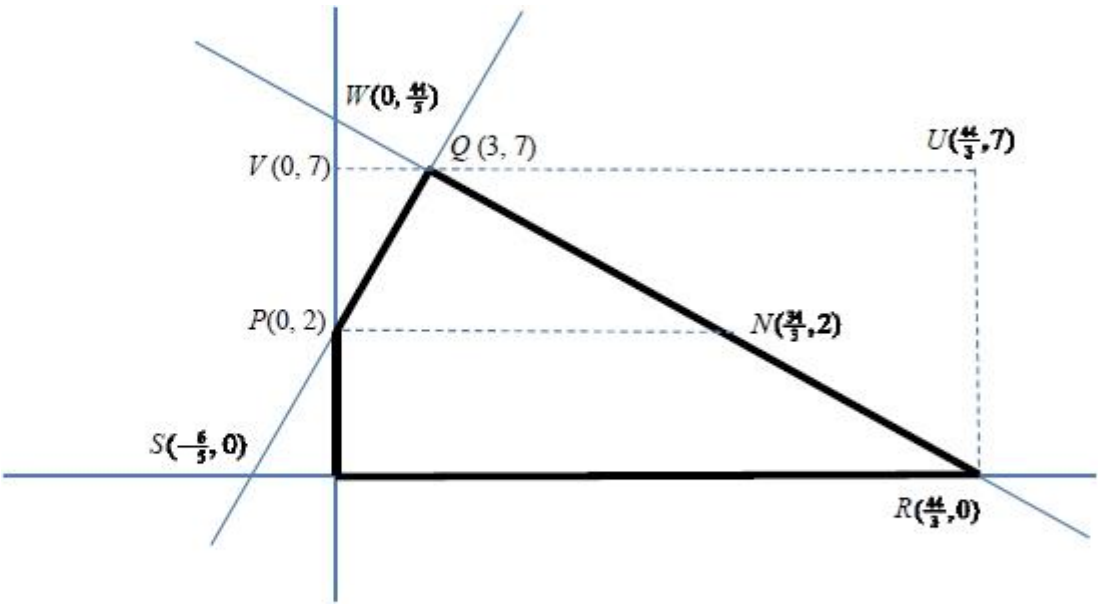



$$\frac{1}{2}\times 3\times 2+\frac{1}{2}\times\frac{"44"}{3}\times 7$$
$$=3+\frac{308}{6}=\frac{326}{6}$$

	WAY 8		
	$\frac{1}{2}\begin{vmatrix} 0 & \frac{44}{3} & 3 & 0 & 0 \\ 0 & 0 & 7 & 2 & 0 \end{vmatrix}$	M1: Uses the vertices of the quadrilateral to form a determinant $\begin{vmatrix} 0 & \frac{44}{3} & 3 & 0 & 0 \\ 0 & 0 & 7 & 2 & 0 \end{vmatrix}$	M1A1ft
		A1ft: $\frac{1}{2}\begin{vmatrix} 0 & \frac{44}{3} & 3 & 0 & 0 \\ 0 & 0 & 7 & 2 & 0 \end{vmatrix}$	
	$\frac{1}{2}\left(\frac{44}{3} \times 7 + 3 \times 2\right)$	dM1: Fully correct determinant method with no errors	dM1A1
		A1: **Fully Correct** numerical expression for the area *ORQP*	
	$54\frac{1}{3}$	Any exact equivalent e.g. $\frac{163}{3}$, $\frac{326}{6}$, $54.\dot{3}$	A1

There will be other ways but the same approach to marking should be applied.





Question 10

Question Number	Scheme		Marks
(a)	Gradient of $l_1 = \frac{4}{5}$ oe	States or implies that the gradient of $l_1 = \frac{4}{5}$. E.g. may be implied by a perpendicular gradient of $-\frac{5}{4}$. Do not award this mark for just rearranging to $y = \frac{4}{5}x + ...$ unless they then state e.g. $\frac{dy}{dx} = \frac{4}{5}$	B1
	Point $P = (5, 6)$	States or implies that P has coordinates (5, 6). $y = 6$ is sufficient. **May be seen on the diagram.**	B1
	$-\frac{5}{4} = \frac{y - "6"}{x - 5}$ or $y - "6" = -\frac{5}{4}(x-5)$ or $"6" = -\frac{5}{4}(5) + c \Rightarrow c = ...$	Correct straight line method using P(5, "6") and gradient of $-\frac{1}{\text{grad } l_1}$. Unless $-\frac{5}{4}$ or $-\frac{1}{4}$ is being used as the gradient here, the gradient of l_1 clearly needs to have been identified and its negative reciprocal attempted to score this mark.	M1
	$5x + 4y - 49 = 0$	Accept any integer multiple of this equation including "= 0"	A1
			(4)
(b)	$y = 0 \Rightarrow 5x + 4(0) - 49 = 0 \Rightarrow x = ...$ **or** $y = 0 \Rightarrow 5(0) = 4x + 10 \Rightarrow x = ...$	Substitutes $y = 0$ into their l_2 to find a value for x **or** substitutes $y = 0$ into l_1 or their rearrangement of l_1 to find a value for x. **This may be implied by a correct value on the diagram.**	M1
	$y = 0 \Rightarrow 5x + 4(0) - 49 = 0 \Rightarrow x = ...$ **and** $y = 0 \Rightarrow 5(0) = 4x + 10 \Rightarrow x = ...$	Substitutes $y = 0$ into their l_2 to find a value for x **and** substitutes $y = 0$ into l_1 or their rearrangement of l_1 to find a value for x. **This may be implied by correct values on the diagram.**	M1
	(Note that at T, $x = 9.8$ and at S, $x = -2.5$)		

	Fully correct method using their values to find the area of triangle SPT with vertices at points of the form (5, "6"), $(p, 0)$ and $(q, 0)$ where $p \neq q$ **Attempts to use integration should be sent to your team leader**		ddM1
	Method 1: $\frac{1}{2}ST\times"6"$ $\frac{1}{2}\times('9.8'-'-2.5')\times'6'=...$		
	Method 2: $\frac{1}{2}SP\times PT$ $\frac{1}{2}\times\sqrt{(5-'-2.5')^2+('6')^2}\times\sqrt{('9.8'-5)^2+('6')^2}=...$ $\left(=\frac{1}{2}\times\frac{3\sqrt{41}}{2}\times\frac{6\sqrt{41}}{5}\right)$ **Note that if the method is correct but slips are made when simplifying any of the calculations, the method mark can still be awarded**		
	Method 3: 2 Triangles $\frac{1}{2}\times(5+'2.5')\times'6'+\frac{1}{2}\times('9.8'-5)\times'6'=...$		
	Method 4: Shoelace method $\frac{1}{2}\begin{vmatrix}5 & 9.8 & -2.5 & 5\\ 6 & 0 & 0 & 6\end{vmatrix}=\frac{1}{2}\left\|(0+0-15)-(58.8+0+0)\right\|=\frac{1}{2}\left\|-73.8\right\|=...$ **(must see a correct calculation i.e. the middle expression for this determinant method)**		
	Method 5: Trapezium + 2 triangles $\frac{1}{2}\times('2.5')\times'2'+\frac{1}{2}("2"+"6")\times5+\frac{1}{2}\times("9.8"-5')\times'6'=...$		
	$=36.9$	36.9 cso oe e.g $\frac{369}{10}$, $36\frac{9}{10}$, $\frac{738}{20}$ but not e.g. $\frac{73.8}{2}$	A1
	Note that the final mark is cso so beware of any errors that have fortuitously resulted in a correct area.		
			(4)
			(8 marks)