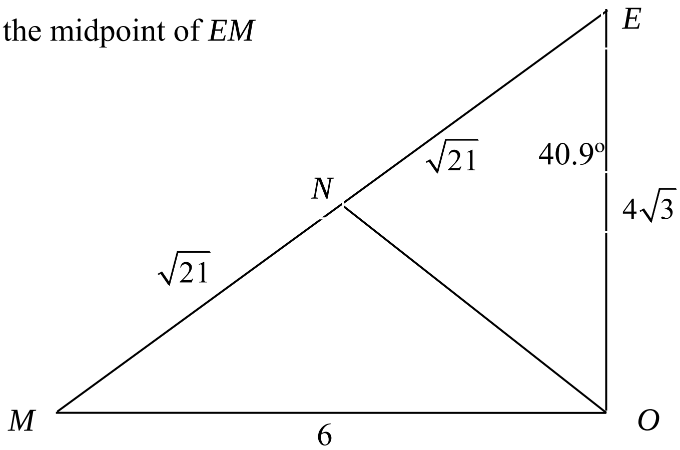
Question Number	Scheme	Marks
10(a)	$\frac{y--4}{-4-1}=\frac{x--6}{-6-4}\Rightarrow y+4=\frac{1}{2}(x+6)$ oe eg $y=\frac{1}{2}x-1$	M1A1 (2)
(b)	$\left(\frac{3\times 4+2\times -6}{5},\frac{3\times 1+2\times -4}{5}\right)\Rightarrow(0,-1)$	M1A1 (2)
(c)	Gradient of perpendicular $=-2$	B1
	Allow all following work if x, y used instead of m, n	
	$-2=\frac{n--1}{m-0}$ $(\Rightarrow -2m=n+1)$	B1ft
	$\left(3\sqrt{5}\right)^2=(m-0)^2+(n--1)^2\Rightarrow 45=m^2+(n+1)^2$	
	$45=m^2+4m^2\Rightarrow 45=5m^2\Rightarrow m=\pm 3$ negative required $m=-3$	M1A1
	$\Rightarrow n=-2m-1\Rightarrow n=-2\times -3-1=5$ coordinates are $(-3,\ 5)$	A1 (5)
(d)(i)	$RQ=\sqrt{(-13--3)^2+(0-5)^2}=5\sqrt{5}$	M1
	$AB=\sqrt{(4--6)^2+(1--4)^2}=5\sqrt{5}$	
	With conclusion	A1cso
(ii)	$\left(\text{Gradient of } AB=\frac{1}{2}\right)$ Gradient of $RQ=\frac{5-0}{-3--13}=\frac{1}{2}$	M1
	With conclusion *	A1cso (4)
ALT	By vectors – combines both parts:	
	$\overrightarrow{AB}=10\mathbf{i}+5\mathbf{j}$ or equivalent column vector	M1
	$\overrightarrow{RQ}=10\mathbf{i}+5\mathbf{j}$ or equivalent column vector	M1
	So same length and parallel (provided both vectors are correct)	A1A1
(e)	Area is base × height $A=3\sqrt{5}\times 5\sqrt{5}=75$ (units)^2	M1A1 (2) [15]
ALT:	$A=\frac{1}{2}\begin{vmatrix}-3 & 4 & -6 & -13 & -3\\ 5 & 1 & -4 & 0 & 5\end{vmatrix}$ M1	
	$=\frac{1}{2}\left[(-3-20)+(-16+6)+(0-52)-(65-0)\right]=-75\Rightarrow 75$ A1	

Question Number	Scheme	Marks
(a)		
M1	Any complete method for obtaining an equation of *l*	
A1	Correct equation in any form inc unsimplified	
(b)		
M1	Obtaining at least one of the coords of *P*. Must be correct. Can be by formula or diagram.	
A1	Both coords correct.	
	NB: If both coords are just written down, award M1A1 if both correct; M0A0 otherwise	
(c)		
B1	Correct gradient of the perpendicular	
B1ft	Correct equation connecting *m* and *n* from equating their gradient to -2 Can be unsimplified. Follow through their gradient of the perpendicular but must be negative reciprocal of gradient of *l*	
M1	Use Pythagoras (with + sign as shown oe)to find the length of *PQ*, equate this to $3\sqrt{5}$ and solve to $m = ...$	
A1	Correct value for *m* ± 3 allowed here	
A1	Correct value for *n* Values do not have to be written in coordinate brackets. Only **one** final answer or this mark is lost.	
(d)		
(i)M1	Use Pythagoras to find the length of *RQ* or *AB*	
A1cso	Lengths of both lines correct with working for each and a conclusion shown	
(ii)M1	Find the gradient of *RQ* Must show working	
A1cso	Correct gradient of both lines and a conclusion shown	
ALT	M1M1 one M mark for each vector correct or working shown but slip made A1A1 one A mark for each conclusion **provided** the vectors are correct.	
(e)		
M1	Obtaining the area of *ABPQ* by using the formula for the area of a parallelogram	
A1	Correct area	
ALT:	Use the "determinant" method.	
M1	Formula must be correct ie $\frac{1}{2}$ needed, 5 pairs of coordinates with first and last the same, coordinates to be in order round the quadrilateral (clockwise or anticlockwise). An attempt to evaluate also needed.	
A1	Correct area - must be positive.	

Question Number	Scheme	Marks
11(a)	$AC = \sqrt{12^2 + 8^2} \quad \left(= \sqrt{208} = 4\sqrt{13}\right)$ or AO or $OC = \sqrt{6^2 + 4^2} \quad \left(= 2\sqrt{13}\right)$	M1
	$h = \sqrt{10^2 - 52} = \sqrt{48} = 4\sqrt{3} \qquad *$	M1A1cso (3)
(b)	$\angle OCE = \cos^{-1}\left(\dfrac{2\sqrt{13}}{10}\right) = 43.8537... \approx 43.9^\circ$ or $\sin^{-1}\left(\dfrac{4\sqrt{3}}{10}\right)$ or $\tan^{-1}\left(\dfrac{4\sqrt{3}}{2\sqrt{13}}\right)$	M1A1 (2)
(c)	Let M be the midpoint of BC.	
	$EM = \sqrt{10^2 - 4^2} = 2\sqrt{21}$	M1
	$\cos\theta^\circ = \dfrac{4\sqrt{3}}{2\sqrt{21}} = \dfrac{2\sqrt{7}}{7} \qquad *$ or cosine rule $\cos\theta^\circ = \dfrac{\left(4\sqrt{3}\right)^2 + \left(2\sqrt{21}\right)^2 - 6^2}{2 \times 4\sqrt{3} \times 2\sqrt{21}} = \dfrac{2\sqrt{7}}{7}$	M1A1cso (3)
(d)	Let N be the midpoint of EM 	
	$NO = \sqrt{\left(\sqrt{21}\right)^2 + \left(4\sqrt{3}\right)^2 - 2 \times \sqrt{21} \times 4\sqrt{3} \times \dfrac{2\sqrt{7}}{7}..} = \sqrt{21}$	M1A1ftA1
	hence triangle NEO is isoceles, so required angle ($\angle ENO$) $\angle ENO = 180 - 2 \times 40.8933... = 98.2134... \approx 98.2^\circ$	B1 (4) [12]
ALT	Based on symmetry:	
	$\tan\dfrac{\theta}{2} = \dfrac{\left(\dfrac{h}{2}\right)}{3} = \dfrac{2\sqrt{3}}{3}$	M1A1
	$\dfrac{\theta}{2} = 49.1066...$	A1
	$\theta = 98.2^\circ$	A1(B1 on e-PEN)

Question Number	Scheme	Marks
(a)		
M1	Use Pythagoras with a + sign to find *AC* or *AO* or*OC*	
M1	Use Pythagoras with a $-$ sign to find the height	
A1cso	**Given** height obtained from correct working. No decimals used but allow $2\sqrt{13} = 7.2...$ followed by $7.2...^2 = 52$	
(b)		
M1	Use any trig function to obtain angle *OCE*	
A1	Correct size of angle *OCE* Must be 1 dp	
(c)		
M1	Use Pythagoras with a $-$ sign to obtain the length of *EM* (need not be correct)	
M1	$\cos\theta^{\circ} = \frac{4\sqrt{3}}{EM}$ with their *EM* or cosine rule as shown. Must reach $\cos\theta = ...$ if other form used at start. (NB not dependent)	
A1cso	Correct completion to the **given** answer	
(d)		
M1	Use of cosine rule in ΔEON to obtain ON	
A1ft	Correct numbers follow through their *EM*	
A1	Correct length *ON*, exact or awrt 4.58	
B1	**Correct** size of angle, must be 1 dp unless already penalised in (b). (Can be obtained by the isos triangle as shown or by cosine or sine rule in ΔEON)	
	NB: No A1ft in alt method as *h* is given in (a)	