

Question	Scheme	Mark	Notes
8	(a) (i)	$\overrightarrow{AB} = 8\mathbf{b} - 4\mathbf{a}$	1 B1
	(ii)	$\overrightarrow{PO} = -\mathbf{a}$	1 B1
	(b)	$\overrightarrow{PQ} = \alpha(8\mathbf{b} - 4\mathbf{a}) = -\mathbf{a} + \frac{8}{m}\mathbf{b} \quad (= \overrightarrow{PO} + \overrightarrow{OQ})$	3 M1 A1 A1
	(c)	$\overrightarrow{PR} = \overrightarrow{PA} + \overrightarrow{AR} = 3\mathbf{a} + \frac{1}{n}(8\mathbf{b} - 4\mathbf{a})$ $\overrightarrow{PR} = \left(3 - \frac{4}{n}\right)\mathbf{a} + \frac{8}{n}\mathbf{b}, \quad 3\mathbf{a} - \frac{4}{n}\mathbf{a} + \frac{8}{n}\mathbf{b}, \quad \frac{3n\mathbf{a} - 4\mathbf{a} + 8\mathbf{b}}{n}$	2 M1 A1
	(d)	PR parallel to OB means “comp of \mathbf{a} ” in \overrightarrow{PR} above is zero (OR since triangles AOB and ARB are similar, $\frac{AP}{AO} = \frac{3}{4} = \frac{PR}{OB}$, Comp of \mathbf{b} in (c) means that $\therefore \overrightarrow{PR} = 6\mathbf{b} = \frac{8}{n}\mathbf{b}$ (M1))	2 M1 A1
	(e)	Triangles OAB and OPQ are similar (oe) $\therefore \Delta OAB = 4^2 \times \Delta OPQ $ $APQB = 150 = \text{Triangle } OAB - \text{Triangle } OPQ$ $\therefore 150 = 4^2 \Delta OPQ - \Delta OPQ $ (oe) $\therefore \Delta OPQ = 10(\text{cm}^2)$	3 M1 M1 (DEP) A1

Question		Scheme	Mark	Notes
9	(a)	Triangle S drawn and labelled	1	B1
	(b)	Triangle T drawn and labelled $\left(\Delta T = \begin{pmatrix} 2 & 3 & 3 \\ 4 & 4 & 6 \end{pmatrix}\right)$	2	B2 (-1ee)
	(c)	Either point $(-2,2)$ indicated OR At least two construction lines through $(-2,2)$ Triangle U $\left(\Delta U = \begin{pmatrix} -6 & -7 & -7 \\ 0 & 0 & -2 \end{pmatrix}\right)$ NB: Award M1 A2 if $(-2,2)$ not indicated and no construction lines but ΔU drawn correctly Award M1 A1 A0 if ΔU drawn correctly except for one Vertice.	3	M1 A2 (-1ee)
	(d)	Triangle V drawn and labelled $\left(\Delta V = \begin{pmatrix} -1 & -2 & -2 \\ -1 & -1 & -3 \end{pmatrix}\right)$ NB: ft on “triangle U ”	2	B2) ft (-1ee
	(e)	$\begin{pmatrix} -3 & 1 \\ 1 & 1 \end{pmatrix} \begin{pmatrix} -1 & -2 & -2 \\ -1 & -1 & -3 \end{pmatrix}$ Triangle W drawn and labelled $\left(\Delta W = \begin{pmatrix} 2 & 5 & 3 \\ -2 & -3 & -5 \end{pmatrix}\right)$		M1 A2 (-1ee)
	(f)	-4	1	B1
	(g)	1 : 4	1	B1

Question		Scheme	Mark	Notes
10	(a)	$\sin 25 = \frac{20}{AB}$ $47.3240 \rightarrow \mathbf{47.3}$ (cm)	2	M1 A1
	(b)	$\cos 20 = \frac{FC}{15}$ $14.0954 \rightarrow \mathbf{14.1}$ (cm)	2	M1 A1
	(c)	$AC^2 = AB^2 + 15^2 - 2 \times AB \times 15 \times \cos 95$ $AC = \sqrt{(AB^2 + 15^2) - (2 \times AB \times 15 \times \cos 95)}$ $\mathbf{50.9}$ (cm)	3	M1 M1 A1 (DEP)
	(d)	<p><u>Method 1:</u> $ABCD = \Delta ABC + \Delta ACD$</p> <p>Scheme: ΔABC: M1 (angle for area formula), M1 (area formula)</p> <p>ΔACD: M1 (angle or side for area formula), M1 (area formula)</p> <p>$ABCD$: M1 (adding areas) A1</p> <p>$\angle ABC = 25 + (180 - 90 - 20) (= 95)$</p> <p>NB: $\angle ABC$ must be evaluated to 95</p> <p> $\Delta ABC = \frac{1}{2} \times 15 \times AB \times \sin \angle ABC$ $\left(= \begin{cases} 353.6 & \text{using 4sf} \\ 353.4 & \text{using 3sf} \end{cases} \right)$ </p>	6	M1 (DEP) M1 M1 M1 (DEP))

	<p>(Point X is st AD is perpendicular to CX</p> <p>$\therefore AX = 20 + "FC")$</p> <p>$\therefore \cos \angle CAD = \frac{"AX"}{"AC"} \quad \left(\angle CAD = \begin{cases} 47.94^\circ \text{ using 3sf answers} \\ 47.92^\circ \text{ using 4sf answers} \end{cases} \right)$</p> <p>$\therefore \Delta ACD = \frac{1}{2} \times 40 \times "AC" \times \sin " \angle CAD" \quad \left(= \begin{cases} 755.2 & \text{using 4sf} \\ 755.8 & \text{using 3sf} \end{cases} \right)$</p> <p>$\left[\text{OR} \quad \therefore CX = \sqrt{"AC"^2 - "AX"^2} \right.$</p> <p>$\therefore \Delta ACD = \frac{1}{2} \times 40 \times "CX" \quad \left. \right]$</p> <p>$\left(\text{OR} \quad \angle ABC = 25 + (180 - 90 - 20) \quad (= 95) \right)$</p> <p>NB: $\angle ABC$ must be evaluated to 95</p> <p>$\angle BAC = \sin^{-1} \left(\frac{15 \times \sin 95}{"50.9"} \right) \quad (= 17.07)$</p> <p>$\Delta ABC = \frac{1}{2} \times "47.324" \times "50.9" \times \sin " \angle BAC"$</p>	<p>(M1)</p> <p>(M1</p> <p>M1) (DEP))</p> <p>(M1 (DEP))</p> <p>(M1 (DEP))</p> <p>(M1</p>
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	$\angle CAD = 65 - 17.07^\circ \quad (= 47.93^\circ)$ $\therefore \Delta ACD = \frac{1}{2} \times 40 \times 50.9 \times \sin(47.93^\circ)$ <p>Finally:</p> $\therefore ABCD = \Delta ABC + \Delta ACD = \begin{cases} 1108.8 & \text{using 4sf} \\ 1109.2 & \text{using 3sf} \end{cases}$ $ABCD = \mathbf{1110} \text{ (cm}^2\text{)}$		M1 A1 (DEP)
	<p>Method 2: $ABCD = (\Delta ABE + \Delta BCF) + CFED$</p> <p>Scheme: $\Delta ABE + \Delta BCF$: M1(full method for area)</p> <p>CFED: M1(side or angle need to find CX), M1(full method for CX), M1(area formula for CFED)</p> <p>ABCD: M1(adding areas), A1</p> <p>$ABCD = (\Delta ABE + \Delta BCF) + CFED$</p> $(\Delta ABE + \Delta BCF) = \left(\frac{1}{2} \times AB \times 20 \times \sin 65^\circ \right) + \left(\frac{1}{2} \times FC \times 15 \times \sin 20^\circ \right) \quad \text{M1}$		M1 M1 M1 (DEP) M1 (DEP) M1 (DEP) A1

	$\left(= \begin{cases} 464.852 & \text{using 3sf} \\ 465.06 & \text{using 4sf} \end{cases} \right)$ <p>Point X is st AD is perpendicular to CX</p> $\therefore AX = 20 + "FC"$ <p>M1</p> $\therefore CX = \sqrt{"AC"{}^2 - "AX"{}^2} \quad \left(= \begin{cases} 37.79 & \text{using 3sf} \\ 37.76 & \text{using 4sf} \end{cases} \right)$ <p>M1 (DEP)</p> $\left(\text{OR } \tan 25 = \frac{20}{BE} \text{ (BE = 42.89)} \right) \quad \text{(M1)}$ $FE = CX = "BE" - 15 \sin 20 \quad \text{(M1(DEP))}$ $\therefore CFED = \frac{1}{2} \times "CX" \times ("FC" + 20) \quad \left(= \begin{cases} 644.32 & \text{using 3sf} \\ 643.71 & \text{using 4sf} \end{cases} \right) \quad \text{M1 (DEP)}$ $\therefore ABCD = "(\Delta BCF + \Delta ABE)" + "CFED" \quad \left(= \begin{cases} 1108.8 & \text{using 4sf} \\ 1109.2 & \text{using 3sf} \end{cases} \right) \text{M1 (DEP)}$ $ABCD = \mathbf{1110} \text{ (cm}^2\text{)}$		
	<p><u>Method 3:</u> $\Delta ABC + \Delta ACX + \Delta CXD$</p> <p><u>Scheme:</u> ΔABC: M1 (angle for area formula), M1 (area formula)</p>	6	M1 (DEP) M1 M1 M1 (DEP)

	<p>ΔACX: M1(full method for area formula)</p> <p>ΔCXD: M1(full method for area formula)</p> <p>$ABCD$: M1 (Adding areas) A1</p> <p><u>$ABCD = \Delta ABC + \Delta ACX + \Delta CXD$</u></p> <p>$\angle ABC = 25 + (180 - 90 - 20) \quad (= 95)$</p> <p>NB: $\angle ABC$ must be evaluated to 95</p> <p>$\Delta ABC = \frac{1}{2} \times 15 \times "AB" \times \sin " \angle ABC "$ $\left(= \begin{cases} 353.6 & \text{using 4sf} \\ 353.4 & \text{using 3sf} \end{cases} \right)$</p> <p>M1(DEP)</p> <p>(Point X is st AD is perpendicular to CX</p> <p>$\therefore AX = 20 + "FC")$</p> <p>$(BE = 20 \tan 65 = 42.89 \quad \text{and} \quad BF = 15 \sin 20 = 5.130 \quad \therefore FE = 37.7598)$</p> <p>$\Delta ACX = \frac{1}{2} \times "34.095" \times "37.76" \quad (= 643.718)$</p> <p>$(DX = 20 - "14.095" = 5.905)$</p> <p>$\Delta CXD = \frac{1}{2} \times 37.76 \times 5.905 \quad (= 111.479)$</p>		<p>M1</p> <p>A1</p>
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<p>$\therefore ABCD = 353.4 + 643.718 + 111.479 \quad (=111.479)$ M1(DEP)</p> <p>$ABCD = 1108.6 \rightarrow \mathbf{1110}$ A1</p> <p>Method 4: <u>$\Delta ABE + \Delta BED + \Delta BCD$</u></p> <p>Scheme: $\Delta ABE + \Delta BED$: M1(area formula for ΔABE), M1($\Delta ABE = \Delta BED$)</p> <p>ΔBCD: M1(full method for $\angle DBC$), M1(area formula)</p> <p>$ABCD$: M1 (Adding areas), A1</p> <p><u><u>$\Delta ABE + \Delta BED + \Delta BCD$</u></u></p> <hr/> <p>$(BE = 20 \tan 65 = 42.89)$</p> <p>$\Delta ABE = \frac{1}{2} \times 20 \times "42.89" \quad (= 428.9)$ M1</p> <p>and $\Delta ABE = \Delta BED \quad (\text{Congruence})$ M1</p> <p>$\angle DBE = 25 \therefore \angle DBC = 70 - 25 = 45$ M1</p> <p>$\Delta BCD = \frac{1}{2} \times 15 \times "47.324" \times \sin "45" \quad (= 250.97)$ M1(DEP)</p> <p>$ABCD = "428.9" + "428.9" + "250.97"$ M1(DEP)</p> <p>$ABCD = 1108.77 \rightarrow \mathbf{1110}$</p> <hr/>	6	M1 M1 M1 M1 (DEP) M1 (DEP) A1
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Question		Scheme	Mark	Notes
11	(a)	$3x^4 - 11x^3 + 6x^2 + 9x - 6$ (Expanding, allow 1 slip) $\left(\text{OR } 3\left(\frac{2}{3}\right)^4 + a\left(\frac{2}{3}\right)^3 + 6\left(\frac{2}{3}\right)^2 + 9\left(\frac{2}{3}\right) - 6 = 0 \quad (\text{M1}) \right)$	2	M1 A1
	(b)	cc $\frac{dy}{dx} = 3x^2 - 6x$ (differentiating, one term correct) "3x ² - 6x" = 0 $3x(x - 2)$ (solving 2 term quadratic) (0, 3) and (2, -1) NB: Working must be seen	4	M1 M1 (DEP) M1 (DEP) A1
	(c)	(3), [Accept -0.38, -0.375, -0.37, $-\frac{3}{8}$], (-1), [Accept -0.13, -0.125, -0.12, $-\frac{1}{8}$], 1.11 [Accept $\frac{71}{64}$] NB : (1) Do not award respective A1 for (b) in (c). (2) 2dp answers required, penalise ONCE	3	B3 (-1eeoo)