

| Question | Scheme | Mark | Notes |
|-------------------|--|--------|---|
| 8 (a) (i) (ii) | $\vec{AB} = 8\mathbf{b} - 4\mathbf{a}$ $\vec{PO} = -\mathbf{a}$ | 1 1 | B1 B1 |
| (b) | $\vec{PQ} = \alpha(8\mathbf{b} - 4\mathbf{a}) = -\mathbf{a} + \frac{8}{m}\mathbf{b} \quad (= \vec{PO} + \vec{OQ})$ | 3 | M1 A1 A1 |
| (c) | $\vec{PR} = \vec{PA} + \vec{AR} = 3\mathbf{a} + \frac{1}{n}(8\mathbf{b} - 4\mathbf{a})$ $\vec{PR} = \left(3 - \frac{4}{n}\right)\mathbf{a} + \frac{8}{n}\mathbf{b}, \quad 3\mathbf{a} - \frac{4}{n}\mathbf{a} + \frac{8}{n}\mathbf{b}, \quad \frac{3n\mathbf{a} - 4\mathbf{a} + 8\mathbf{b}}{n}$ | 2 | M1 A1 NB: Cand. must use vectors as required by question. |
| (d) | PR parallel to OB means “comp of \mathbf{a} ” in \vec{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 $\therefore \vec{PR} = 6\mathbf{b} = \frac{8}{n}\mathbf{b}$ (M1)) | 2 | M1 A1 NB: So \mathbf{a} and \mathbf{b} terms separated |
| (e) | Triangles OAB and OPQ are similar (oe) $\therefore \Delta OAB = 4^2 \times \Delta OPQ $ $APQB = 150 = \text{Triangle } OAB \square \square \text{Triangle } OPQ$ $\therefore 150 = 4^2 \Delta OPQ - \Delta OPQ \quad (\text{oe})$ $\therefore \Delta OPQ = 10 \text{ cm}^2$ | 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) | $\begin{pmatrix} -3 & 1 \\ 1 & 1 \end{pmatrix} \text{ or } \begin{pmatrix} -1 & -2 & -2 \\ -1 & -1 & -3 \end{pmatrix}$ | | M1 A2 (-1ee) |
| (f) | Triangle W drawn and labelled $\left(\Delta W = \begin{pmatrix} 2 & 5 & 3 \\ -2 & -3 & -5 \end{pmatrix} \right)$ -4 | 1 | B1 |
| (g) | 1 : 4 | 1 | B1 |

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

(Point X is st AD is perpendicular to CX

$$\therefore AX = 20 + "FC"$$

$$\therefore \cos \angle CAD = \frac{"AX"} {"AC"} \quad \left(\begin{array}{l} \angle CAD = \begin{cases} 47.94^\circ & \text{using 3sf answers} \\ 47.92^\circ & \text{using 4sf answers} \end{cases} \end{array} \right)$$

$$\therefore |\Delta ACD| = \frac{1}{2} \times 40 \times "AC" \times \sin "\angle CAD" \quad \left(= \begin{cases} 755.2 & \text{using 4sf} \\ 755.8 & \text{using 3sf} \end{cases} \right)$$

$$\left[\text{OR} \quad \therefore CX = \sqrt{"AC"^2 - "AX"^2} \right]$$

$$\therefore |\Delta ACD| = \frac{1}{2} \times 40 \times "CX"$$

$$\left(\text{OR} \quad \angle ABC = 25 + (180 - 90 - 20) \quad (= 95) \right)$$

NB: $\angle ABC$ must be evaluated to **95**

$$\angle BAC = \sin^{-1} \left(\frac{15 \times \sin 95}{"50.9"} \right) \quad (= 17.07)$$

$$|\Delta ABC| = \frac{1}{2} \times "47.324" \times "50.9" \times \sin "\angle BAC"$$

(M1)

(M1)

M1) (DEP))

(M1) (DEP))

(M1) (DEP))

(M1)

$$\angle CAD = 65 - "17.07" \quad (= 47.93)$$

$$\therefore |\Delta ACD| = \frac{1}{2} \times 40 \times "50.9" \times \sin"(65 - 17.07)"$$

)

Finally:

$$\therefore ABCD = |\Delta ABC| + |\Delta ACD| \quad \left(= \begin{cases} 1108.8 & \text{using 4sf} \\ 1109.2 & \text{using 3sf} \end{cases} \right)$$

$$ABCD = 1110 \text{ (cm}^2\text{)}$$

M1 (DEP)
A1

Method 2: $ABCD = (\Delta ABE + \Delta BCF) + CFED$

Scheme: $\Delta ABE + \Delta BCF$: M1(full method for area)

CFED: M1(side or angle need to find CX), M1(full method for CX),
M1(area formula for CFED)

ABCD: M1(adding areas), A1

$ABCD = (\Delta ABE + \Delta BCF) + CFED$

$$(\Delta ABE + \Delta BCF) = \left(\frac{1}{2} \times "AB" \times 20 \times \sin 65 \right) + \left(\frac{1}{2} \times "FC" \times 15 \times \sin 20 \right) \quad \text{M1}$$

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> $\therefore AX = 20 + "FC"$ $\therefore CX = \sqrt{"AC"^2 - "AX"^2} \quad \left(= \begin{cases} 37.79 & \text{using 3sf} \\ 37.76 & \text{using 4sf} \end{cases} \right)$ <p>(OR $\tan 25 = \frac{20}{BE}$ ($BE = 42.89$) (M1))</p> $FE = CX = "BE" - 15 \sin 20 \quad (\text{M1(DEP)})$ $\therefore CFED = \frac{1}{2} \times "CX" \times ("FC" + 20) \quad \left(= \begin{cases} 644.32 & \text{using 3sf} \\ 643.71 & \text{using 4sf} \end{cases} \right) \quad \text{M1 (DEP)}$ $\therefore ABCD = ("BCF + \Delta ABE") + "CFED" \quad \left(= \begin{cases} 1108.8 & \text{using 4sf} \\ 1109.2 & \text{using 3sf} \end{cases} \right) \quad \text{M1 (DEP)}$ $ABCD = \mathbf{1110} \text{ (cm}^2\text{)}$ | M1 | |
| | <p><u>Method 3: $\Delta ABC + \Delta ACX + \Delta CXD$</u></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> $\underline{ABCD = \Delta ABC + \Delta ACX + \Delta CXD }$ $\angle ABC = 25 + (180 - 90 - 20) \quad (= 95)$ <p>NB: $\angle ABC$ must be evaluated to 95</p> $ \Delta ABC = \frac{1}{2} \times 15 \times "AB" \times \sin "\angle ABC" \quad \left(= \begin{cases} 353.6 & \text{using 4sf} \\ 353.4 & \text{using 3sf} \end{cases} \right)$ <p>M1(DEP)</p> <p>(Point X is st AD is perpendicular to CX $\therefore AX = 20 + "FC"$)</p> $(BE = 20 \tan 65 = 42.89 \quad \text{and} \quad BF = 15 \sin 20 = 5.130 \quad \therefore FE = 37.7598)$ $ \Delta ACX = \frac{1}{2} \times "34.095" \times "37.76" \quad (= 643.718)$ $(DX = 20 - "14.095" = 5.905)$ $ \Delta CXD = \frac{1}{2} \times 37.76 \times 5.905 \quad (= 111.479)$ | M1 | A1 |
|--|--|----|----|

| | | | | | |
|--|--|---------|----|---|--|
| | $\therefore ABCD = 353.4 + 643.718 + 111.479 \quad (=111.479)$ $ABCD = 1108.6 \rightarrow 1110$ <u>Method 4: $\Delta ABE + \Delta BED + \Delta BCD$</u> <u>Scheme: $\Delta ABE + \Delta BED$</u> : M1(area formula for ΔABE), M1($\Delta ABE = \Delta BED$) <u>ΔBCD</u> : M1(full method for $\angle DBC$), M1(area formula) $ABCD$: M1 (Adding areas), A1 <hr/> <u>$\Delta ABE + \Delta BED + \Delta BCD$</u> $(BE = 20\tan 65^\circ = 42.89)$ $ \Delta ABE = \frac{1}{2} \times 20 \times "42.89" \quad (= 428.9)$ and $ \Delta ABE = \Delta BED $ (Congruence) $\angle DBE = 25^\circ \therefore \angle DBC = 70^\circ - 25^\circ = 45^\circ$ $ \Delta BCD = \frac{1}{2} \times 15 \times "47.324" \times \sin "45" \quad (= 250.97)$ $ABCD = "428.9" + "428.9" + "250.97"$ $ABCD = 1108.77 \rightarrow 1110$ <hr/> | M1(DEP) | A1 | 6 | M1 M1 M1 M1 (DEP) M1 (DEP) A1 |
|--|--|---------|----|---|--|

| 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) | $\frac{dy}{dx} = 3x^2 - 6x$ (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) | $(3), \quad [\text{Accept } -0.38, -0.375, -0.37, -\frac{3}{8}], \quad (-1),$ $[\text{Accept } -0.13, -0.125, -0.12, -\frac{1}{8}], \quad 1.11 \quad [\text{Accept } \frac{71}{64}]$ NB : (1) Do not award respective A1 for (b) in (c). (2) 2dp answers required, penalise ONCE | 3 | B3 (-1eeoo) |