

Question	Scheme	Mark	Notes
1 (a)	$348 \times \frac{100}{60}$ oe (\$) 580	2	M1 A1
(b)	"\$580" $\times \frac{75}{100}$ - \$348 OR $(0.40 - 0.25) \times "580"$ OR $(0.75 - 0.60) \times "580"$	2	M1 A1
2	$x = -14$ $y = 10$	4	M1 Rearranging st coef of x or y is the same in both eqns OR isolating x or y M1 (DEP) Substituting expression (or value correctly obtained) for x or y to obtain y or x NB: Allow a total of 1 slip in both M marks. A1 A1

Question	Scheme	Mark	Notes
3 (a)	$576 = \frac{\alpha}{\left(\frac{1}{2}\right)^3}$ $\alpha = 72 \quad \therefore f = \frac{72}{r^3}$	3	M1 A1 A1
(b)	$f = 5 + \frac{1}{t} = \frac{"72"}{2^3} \quad (= 9) \quad (\text{oe})$	2	M1 A1

Question	Scheme	Mark	Notes	
4	One of (1,1): $-7 + 2x^2 = 1$ (ie 1 st column) (2,1): $-21 - 4x^2 = -37$ (3,1): $35 - 6x^2 = 11$ One of (1,2): $1 + 2(x + 2y) = 1$ (ie 2 nd column) (2,2): $3 - 4(x + 2y) = 3$ (3,2): $-5 - 6(x + 2y) = -5$ One of (1,3): $-xz - 2y = -4$ (ie 3 rd column) (2,3): $-3xz + 4y = -22$ (3,3): $5xz + 6y = 24$	$x = 2$ $y = -1$ $z = 3$	6	M1 A1 M1 (DEP) A1 M1 (DEP) A1

Question	Scheme	Mark	Notes
5 (a)		4	B1 25 correctly positioned B1 5, 10 and 15 correctly positioned B1 45 and 20 correctly positioned B1 4x correctly positioned in T and x correctly positioned in H
(b)	$150 = 25 + "45" + "5" + x + "10" + 20 + "15" + 4x \text{ (oe)}$ <p>(ie $150 = \text{their } 8 \text{ values}$)</p>	1	B1 ft
(c)	(eg $150 = "120" + 5x \text{ (oe)}$) (cao)	2	M1 Collecting "their" two x terms and equating them to "their" 7 constant values A1 B1 Ft
(d)	$\left(\frac{"10" + "20"}{"45" + "5" + "10" + "20"} = \right) \frac{"30"}{"80} \text{ (oe), "0.375", "37.5\%}$	1	NB: ft on their diagram

Question	Scheme	Mark	Notes
6 (a)		1	B1
(b)	$\frac{3}{5}, 0.6$ $\frac{3}{2}$ OR 1.5 OR not 3/2	1	B1
(c)	$y(2x-3)=6$ (oe) OR $x(2y-3)=6$ (oe) $h^{-1}: x \mapsto \frac{6+3x}{2x}, \frac{3(2+x)}{2x}, \frac{3}{x} + \frac{3}{2}, h^{-1} = \frac{6+3x}{2x}$ (oe)	2	M1 A1
(d)	$18x - x(2x-3) = 3(2x-3)$ (removing denominators, oe, allow 1 minor slip) $2x^2 - 15x - 9 (= 0)$ (oe) $x = \frac{-(-15) \pm \sqrt{((-15)^2 - 4 \times 2 \times (-9))}}{2 \times 2}$ NB: on their trinomial quadratic. -0.558 8.06		M1 A1 M1 (INDEP) A1 A1

Question	Scheme	Mark	Notes
7 (a)	$65 < t \leq 70 \quad fd = 4 \text{ (8 x 1cm squares) units}$ $70 < t \leq 80 \quad freq = 50 \text{ runners}$ $80 < t \leq 95 \quad fd = 4 \text{ units}$ $95 < t \leq 115 \quad fd = 4.5 \text{ units}$ $115 < t \leq 140 \quad freq = 75 \quad \text{and} \quad fd = 3 \text{ units}$	5	B1 B1 B1 B1 B1 ft
(b)		95 < t ≤ 115	1 B1 Ft NB: ft on "50" for $70 < t \leq 80$
(c)	Using a correct mid-pt At least 3 correct products $\frac{10 \times 62.5 + 20 \times 67.5 + "50" \times 75 + 60 \times 87.5 + 90 \times 105 + "75" \times 127.5}{305}$ $\left(= \frac{625 + 1350 + "3750" + 5250 + 9450 + 9562.5}{305} = \frac{29987.5}{305} \right)$	98 (minutes)	4 M1 M1 (DEP) M1 (DEP) A1 (cao)

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)

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(M1)

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

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

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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
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	$\therefore ABCD = 353.4 + 643.718 + 111.479 \quad (=111.479)$ $ABCD = 1108.6 \rightarrow 1110$ <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
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Question	Scheme	Mark	Notes
11 (a)	$3x^4 - 11x^3 + 6x^2 + 9x - 6$ (Expanding, allow 1 slip) (OR $3\left(\frac{2}{3}\right)^4 + a\left(\frac{2}{3}\right)^3 + 6\left(\frac{2}{3}\right)^2 + 9\left(\frac{2}{3}\right) - 6 = 0$ (M1))	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)	$(3), [Accept -0.38, -0.375, -0.37, -\frac{3}{8}], (-1),$ $[Accept -0.13, -0.125, -0.12, -\frac{1}{8}], 1.11$ [Accept $\frac{71}{64}$] NB : (1) Do not award respective A1 for (b) in (c). (2) 2dp answers required, penalise ONCE	3	B3 (-1eeoo)