1	$(AX =)\ (17.6 - 8.4) \div 2\ (= 4.6)$		6	M1	where X is the foot of the perpendicular from B to AD
	$0.5 \times (8.4 + 17.6) \times h = 179.4$ **or** $0.5 \times$ '4.6' $\times h + 0.5 \times$ '4.6' $\times h + 8.4 \times h = 179.4$ **or** $13 \times h = 179.4$			M1	
	$(h =)\ 179.4 \div$ '13' (=13.8) **or** $(h =)\ 358.8 \div$ '26' (=13.8) oe			M1	
	$\tan ABX = \frac{'4.6'}{'13.8'}$ **or** $\tan BAX = \frac{'13.8'}{'4.6'}$			M1	ft their h dep on second M1 $(AB =)\sqrt{'4.6'^2 + '13.8'^2} = \sqrt{211.6}$ = (14.546…) **and** one from $\sin ABX = \frac{'4.6'}{'\sqrt{211.6}'}$ or $\sin BAX = \frac{'13.8'}{'\sqrt{211.6}'}$ or $\cos ABX = \frac{'13.8'}{'\sqrt{211.6}'}$ or $\cos BAX = \frac{'4.6'}{'\sqrt{211.6}'}$ or $\sin ABX = \frac{'4.6' \times \sin 90}{'\sqrt{211.6}'}$ or $\cos ABX = \frac{'\sqrt{211.6}' + '13.8'^2 - '4.6'^2}{2 \times '\sqrt{211.6}' \times '13.8'}$
	$(ABX =)\ \tan^{-1}\left(\frac{'4.6'}{'13.8'}\right)(= 18.4)$ **or** $(BAX =)\ \tan^{-1}\left(\frac{'13.8'}{'4.6'}\right)(= 71.6)$			M1	
		108.4		A1	awrt 108.4
					Total 6 marks

2	$8.5^2 - (8 \div 2)^2$ (= 56.25) **or** $\cos x = \frac{4}{8.5}$ oe			M1	**or** eg $\cos A = \frac{8^2 + 8.5^2 - 8.5^2}{2 \times 8 \times 8.5}$
	$\sqrt{"56.25"}$ (= 7.5) **or** $x = \cos^{-1}\left(\frac{4}{8.5}\right)$ (= 61.927…) oe			M1	**or** eg $(A =)\cos^{-1}\left(\frac{8^2 + 8.5^2 - 8.5^2}{2 \times 8 \times 8.5}\right)$(61.927…) (other angle = 56.144…)
	8 × "7.5" ÷ 2 oe **or** 0.5 × 8 × 8.5 × sin "61.927…"			M1	**or** eg 0.5 × 8.5 × 8 × sin"61.927…" oe
		30	4	A1	
					Total 4 marks

3	$\pi \times 7.2^2 \div 2$ (= 81.4….)			M1	allow 81.3 – 81.5 for area of semi circle
	"81.4" ÷ 6 (= 13.5...) **or** 12 × 6 (= 72) **or** "81.4" ÷ 12 (= 6.7...)			M1	(dep) allow 13.5 – 13.6 for the number of boxes needed (NB: 12 × 6 = 72 alone is 0 marks)
		No with correct figures	3	A1	
					Total 3 marks

4	$CB = 13\sin 40$ (= 8.3562...)			M1	
	$\frac{1}{2} \times 6 \times "8.35..." \times \sin ACB = 22$			M1	
	Acute version of $ACB = \sin^{-1}\left(\frac{22}{\frac{1}{2} \times 6 \times "8.35..."}\right)$ (= 61.35…)			M1	
	$ACB = 180 -$ "61.353…" (= 118.647...)			M1	
	$AB^2 = 6^2 + "8.35..."^2 - 2 \times 6 \times "8.35..." \times \cos "118.64"$ (= 153.98...)			M1	
		12.4	6	A1	accept 12.3 – 12.5
					Total 6 marks

5	$30 = \frac{27}{1.2x}$		3	M1	Or for $\frac{27}{30}$ (= 0.9)
	$1.2x = \frac{27}{30}$ or $36x = 27$ or $22.5 \div 30$			M1	
		0.75 oe		A1	
					Total 3 marks

6	Gradient of $\mathbf{L_2} = -10 \div -5)\ (= 2)$		5	M1	Method to find gradient of $\mathbf{L_2}$
	$6 = 2 \times 8 + c \rightarrow c = -10$ $y = 2x - 10$ oe			A1	Equation for $\mathbf{L_2}$
	$0 = 2x - 10 \rightarrow x = 5$ or $(5, 0)$ $y = 2 \times -3 - 10 \rightarrow y = -16$ or $(-3, -16)$			A1	Finding point A and point B
	(Area =) $0.5 \times 5 \times 16$ or $(0.5 \times 5 \times 10) + (0.5 \times 10 \times 3)$ or $0.5 \times 5 \times \sqrt{265} \times \sin 100.6°$ or $0.5 \times \sqrt{320} \times \sqrt{265} \times \sin 15.9°$			M1	Method to find area of triangle
		40		A1 cao	Dep on M2
					Total 5 marks

7	$\dfrac{18}{\sqrt{7}+1} \times \dfrac{\sqrt{7}-1}{\sqrt{7}-1}$		3	M1	for $\dfrac{18}{\sqrt{7}+1} \times \dfrac{\sqrt{7}-1}{\sqrt{7}-1}$
	eg $\dfrac{18(\sqrt{7}-1)}{7-1}$			M1	Dep on M1 for a correct numerator **and** multiplying out the denominator to $7 - 1$ or 6
	$3\sqrt{7}-3$	$3\sqrt{7}-3$		A1	Dep on M2 Allow $3\left(\sqrt{7}-1\right)$
					Total 3 marks

8	$0.5 \times \pi \times 6^2\ (= 56.54\ldots)$ **or** $12 \times 6\ (= 72)$ **or** $\pi \times 6^2$ oe		3	M1	
	"72" – "56.54…"			M1	dep M1 for a complete method
		15.5		A1	15.4 to 15.5
					Total 3 marks

9	$\dfrac{1}{2} \times 6 \times 11 \times \sin 118 (= 29.1\ldots)$		3	M1	for the area of half of the kite
	eg $2 \times \dfrac{1}{2} \times 6 \times 11 \times \sin 118$			M1	for a complete method
		58.3		A1	accept 58.2 – 58.3
					Total 3 marks

10	$17.5^2 - 14^2\ (= 110.25)$		4	M1	or for use of cosine rule to find one of the angles eg $28^2 = 17.5^2 + 17.5^2 - 2 \times 17.5 \times 17.5 \times \cos A$ **or** eg $\cos B = \dfrac{14}{17.5}$
	$\sqrt{17.5^2 - 14^2}\ (=10.5)$			M1	**or** for rearranging the cosine rule to eg $\cos A = \dfrac{17.5^2 + 17.5^2 - 28^2}{2 \times 17.5 \times 17.5}$ $(A = 106.26\ldots)$ **or** eg $B = \cos^{-1}(\dfrac{14}{17.5})\ (= 36.86\ldots)$
	$0.5 \times 28 \times$ "10.5" oe			M1	**or** for $0.5 \times 17.5 \times 17.5 \times \sin 106.26\ldots$ oe eg $0.5 \times 17.5 \times 28 \times \sin 36.86\ldots$ [clear use of Heron's formula: M1 for $S = 0.5(17.5 + 17.5 + 28) (= 31.5)$ M2 for $\sqrt{\text{"31.5"}(\text{"31.5"} - 17.5)^2(\text{"31.5"} - 28)}$ oe]
		147		A1	accept awrt 147
					Total 4 marks

11	eg $\dfrac{55}{360} \times \pi \times d = 5$ **or** $\dfrac{55}{360} \times \pi \times 2 \times r = 5$ oe **OR** $\dfrac{360}{55} \times 5 (= 32.7\ldots)$ oe		4	M1	for a correct equation for the diameter **or** radius **OR** for a method to find the circumference of the circle
	eg $d = \dfrac{5 \times 360}{55\pi} (= 10.4\ldots)$ **or** $r = \dfrac{5 \times 360}{55 \times 2 \times \pi} (= 5.2\ldots)$ **OR** $d = \dfrac{32.7\ldots}{\pi}\ (= 10.4\ldots)$ **or** $r = \dfrac{32.7\ldots}{2 \times \pi}\ (= 5.2\ldots)$			M1	for a method to work out the diameter **or** radius
	(area =) eg $\pi \times \left(\dfrac{\text{"10.4..."}}{2}\right)^2$ **or** $\pi \times$ "5.2…"^{2}			M1	
		85.2		A1	allow 84.9 – 85.4
					Total 4 marks

12	$\frac{\sin Q}{4.2}=\frac{\sin 18}{1.6}$ oe or $1.6^2 = 4.2^2 + RQ^2 - 2\times 4.2\times RQ\times\cos 18$ oe		6	M1	correct sine ratio - could be rearranged or correct substitution into the cosine rule using angle R
	$\sin^{-1}\left(4.2\times\frac{\sin 18}{1.6}\right)$ (= 54.2) **or** $\sin^{-1}(0.811...)$ $\frac{2\times 4.2\times\cos 18\pm\sqrt{(2\times 4.2\times\cos 18)^2-4\times 1\times 15.08}}{2}$			M1	
	180 – "54.2" (=125.8) or RQ = 3.0585.. and 4.933…			M1	This can be implied by the correct value(s) (125.8 or 3.0585…) used later
	(P =) 180 –"125.8" – 18 (=36.2) **or** $RQ=\sqrt{4.2^2+1.6^2-2\times 4.2\times 1.6\times\cos\text{"36.2"}}$ (= 3.0585…) or 3.0585 chosen as value from cosine rule above **or** perpendicular height = 4.2sin"36.2" (= 2.4805…) (where "36.2" comes from correct working)			M1	
	(Area =) $\frac{1}{2}\times 4.2\times 1.6\times\sin(\text{"36.2"})$ **or** (Area =) $\frac{1}{2}\times 4.2\times\text{"3.0585..."}\times\sin 18$ **or** (Area =) $\frac{1}{2}\times 1.6\times\text{"2.4805..."}$			M1	
		1.98		A1	awrt 1.98
					Total 6 marks

13	$\frac{1}{2}\times 7\times h = 42$ oe or $(h =)\frac{42\times 2}{7}$ (= 12) oe or $3.5^2 + h^2 = y^2$ or $h=\sqrt{y^2-3.5^2}$ oe		4	M1	A correct equation involving the height or a correct expression for height – could be in terms of y
	$y^2=\left(\frac{7}{2}\right)^2+(\text{"12"})^2$ oe or $\frac{1}{2}\times 7\times\text{"}\sqrt{y^2-3.5^2}\text{"}=42$ oe			M1	(indep) use of *their* height (any found value that they have called 'height')
	$y=\sqrt{\left(\frac{7}{2}\right)^2+(\text{"12"})^2}$ oe			M1	**all values must come from a correct method**
	Correct answer scores full marks (unless from obvious incorrect working)	12.5		A1	oe eg $\frac{25}{2}$
					Total 4 marks

14	$\sin 52=\frac{12\div 2}{r}$ oe **or** $\frac{r}{\sin 90}=\frac{6}{\sin 52}$ oe **or** $\cos(90-52)=\frac{12\div 2}{r}$ oe **or** $(r^2 =)(12\div 2)^2+\left(\frac{12\div 2}{\tan 52}\right)^2$ oe $\left[r^2=6^2+4.687...^2\right]$ **or** $\frac{r}{\sin 38}=\frac{12}{\sin 104}$ oe		4	M1	A correct trig statement for the radius use of tan must also include a correct Pythagoras statement.
	$r=\frac{6}{\sin 52}$ (=7.614) oe **or** $r=\frac{6}{\cos 38}$ oe **or** $(r =)\sqrt{(12\div 2)^2+\left(\frac{12\div 2}{\tan 52}\right)^2}$ $\left[r=\sqrt{6^2+4.687...^2}\right]$ oe **or** $\frac{12\sin 38}{\sin 104}$ oe			M1	A correct method to find the radius of the circle use of tan must also use Pythagoras to find an expression for r
	(Area =) $\pi\times(\text{"7.61..."})^2$			M1	the radius must come from a completely correct method
	Correct answer scores full marks (unless from obvious incorrect working)	182		A1	Accept 181 - 183
					Total 4 marks

15	$12 = \frac{1}{2} \times 4.6 \times 8.3 \times \sin ABC$ or $\frac{4.6h}{2} = 12$ $(h = 5.217....)$		5	M1	a correct equation for the area to find angle *ABC* or to find the perpendicular height of the triangle.
	$ABC = \sin^{-1}\left(\frac{12}{\frac{1}{2} \times 4.6 \times 8.3}\right)$ (= 38.947…) oe or $ABC = \sin^{-1}(0.6286)$ (= 38.947...) or $ABC = \sin^{-1}\left(\frac{"5.217..."}{8.3}\right)(= 38.947...)$ or $BM^2 = 8.3^2 - "5.217..."^2$			M1	A correct method to find angle *ABC* or a correct method to find BM^2 where *CMB* is 90º
	$AC^2 = 4.6^2 + 8.3^2 - 2 \times 4.6 \times 8.3 \times \cos("38.947")$ [allow cos39º] or $AC^2 = 30.6(627...)$ $BM = \sqrt{8.3^2 - "5.217..."^2}$ (=6.455…)			M1	a correct start to the cosine rule to find length AC or a fully correct method for *BM*
	or $AC = \sqrt{"30.6(6...)"}$ **or** 5.5(3739…)			A1	A correct value for *AC* which can be the square root of 30.6(6…)
	Correct answer scores full marks (unless from obvious incorrect working)	18.4		A1	Allow answers in range 18.4 to 18.45
					Total 5 marks

16	(54 – 24) ÷ 2 (=15) [may be marked on diagram]		5	M1	
	$"15"^2 - (24 \div 2)^2 (= 81)$			M1	ft their "15" (if > 12)
	[height =] $\sqrt{"15"^2 - (24 \div 2)^2}$ (= 9)			M1	ft their "15" (if > 12)
	$(24 \times "9") \div 2$ oe			M1	figures must be from correct working
	Correct answer scores full marks (unless from obvious incorrect working)	108		A1	allow 107.9 – 108.1
	ALTERNATIVES BELOW				**Total 5 marks**
16	(54 – 24) ÷ 2 (=15) [may be marked on diagram]		5	M1	
	or $x = \cos^{-1}\left(\frac{"12"}{"15"}\right)(= 36.86...)$ **or** $y = \sin^{-1}\left(\frac{24 \div 2}{"15"}\right)(= 53.13...)$ **or** $A = \cos^{-1}\left(\frac{15^2 + 15^2 - 24^2}{2 \times 15 \times 15}\right)(= 106.2...)$ **or** $B = \cos^{-1}\left(\frac{15^2 + 24^2 - 15^2}{2 \times 15 \times 24}\right)(= 36.8....)$			M1	ft their "15" (if > 12) [using Hero's formula S = 0.5 × 54 (= 27) and] 27 × (27 – 24) × (27 – "15") × (27 – "15")
	or "12"tan"36.86…" (= 9) (allow 8.9… for these) "12" ÷ tan"53.13…" (= 9) **or** "15" × sin "36.86…" (= 9) **or** "15" × cos "53.13…" (= 9)			M1	ft their "15" (if > 12) M2 for 0.5 × 24 × "15" × sin"36.86…" or 0.5 × "15" × "15" × sin(2 × "53.13…") or $0.5 \times "15" \times "15" \times \sin("106.2...")$ **or** $\sqrt{"27"("27"-24)("27"-"15")("27"-"15")}$
	$(24 \times "9") \div 2$ oe			M1	
	Correct answer scores full marks (unless from obvious incorrect working)	108		A1	allow 107.9 – 108.1
					Total 5 marks

17	$\frac{1}{2}(330+170)\times 240$ (= 60 000) oe or $\left(\frac{80\times 240}{2}\right)+(170\times 240)+\left(\frac{80\times 240}{2}\right)$(= 60 000) oe or (2 × 9600) + 40 800 (= 60 000) oe		4	M1 for working out the area of the trapezium
	[60 000] ÷ 10 000 (= 6) or 10 000 × 6 (= 60 000)			M1 ft their area (must come from a two dimensional area) Allow $\frac{\text{their area}}{10\ 000}$
	49 650 ÷ [6]			M1 dep on either previous M1 ft their number of hectares Allow $\frac{49\ 650}{\text{their number of hectares}}$
	Correct answer scores full marks (unless from obvious incorrect working)	8275		A1
				Total 4 marks