



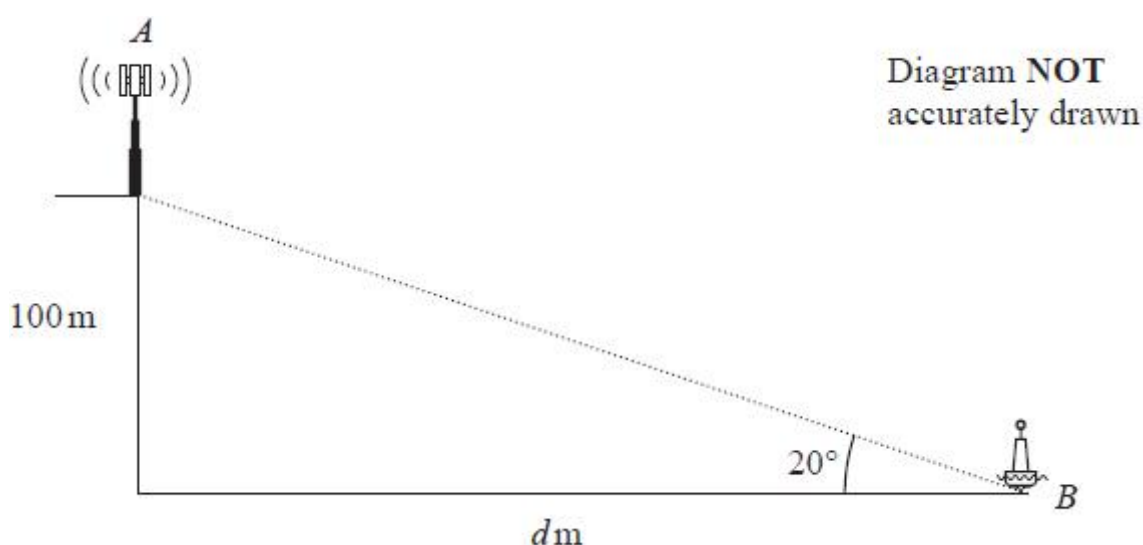
Unit 1 Revision Sheet E Pythagoras and Trig Higher

Note: Higher tier students must also revise using the foundation tier revision worksheets as this content can also be assessed on higher tier papers.

Questions

Q1.

The diagram shows a vertical cliff with a vertical radio mast on top of the cliff and a buoy in the sea.



The height of the cliff is 100 metres.

The buoy is at the point B that is d metres from the base of the cliff.

The angle of elevation from B to the top of the cliff is 20°

(a) Calculate the value of d .

Give your answer correct to 3 significant figures.

(3)

The point A at the top of the radio mast is vertically above the top of the cliff.

The angle of elevation from B to A is 25°

(b) Calculate the height of the radio mast.

Give your answer correct to 3 significant figures.

(3)

(Total for question = 6 marks)



Q2.

A , B and C are points on a circle with centre O .

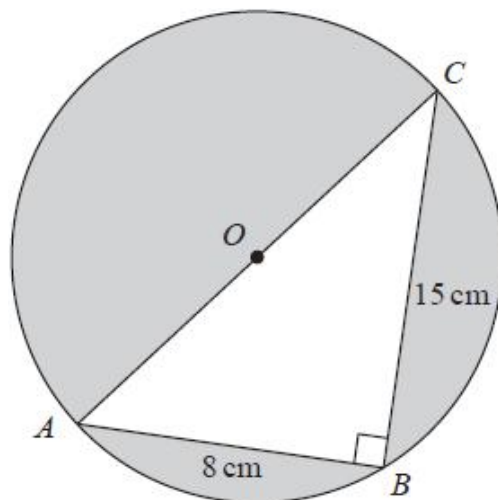


Diagram NOT
accurately drawn

AOC is a diameter of the circle.

$AB = 8 \text{ cm}$ $BC = 15 \text{ cm}$

Angle $ABC = 90^\circ$

Work out the total area of the regions shown shaded in the diagram.
Give your answer correct to 3 significant figures.

(Total for question = 5 marks)

Q3.

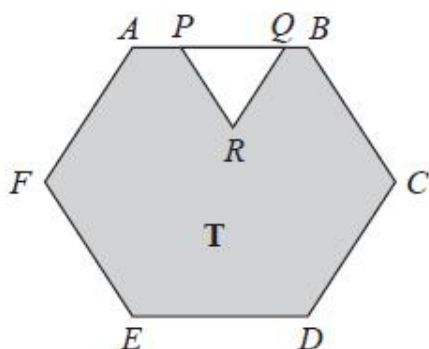


Diagram NOT
accurately drawn

The diagram shows a shaded region **T** formed by removing an equilateral triangle PQR from a regular hexagon $ABCDEF$.

The points P and Q lie on AB such that $AB = 1.5 \times PQ$

Given that the area of region **T** is $72\sqrt{3} \text{ cm}^2$

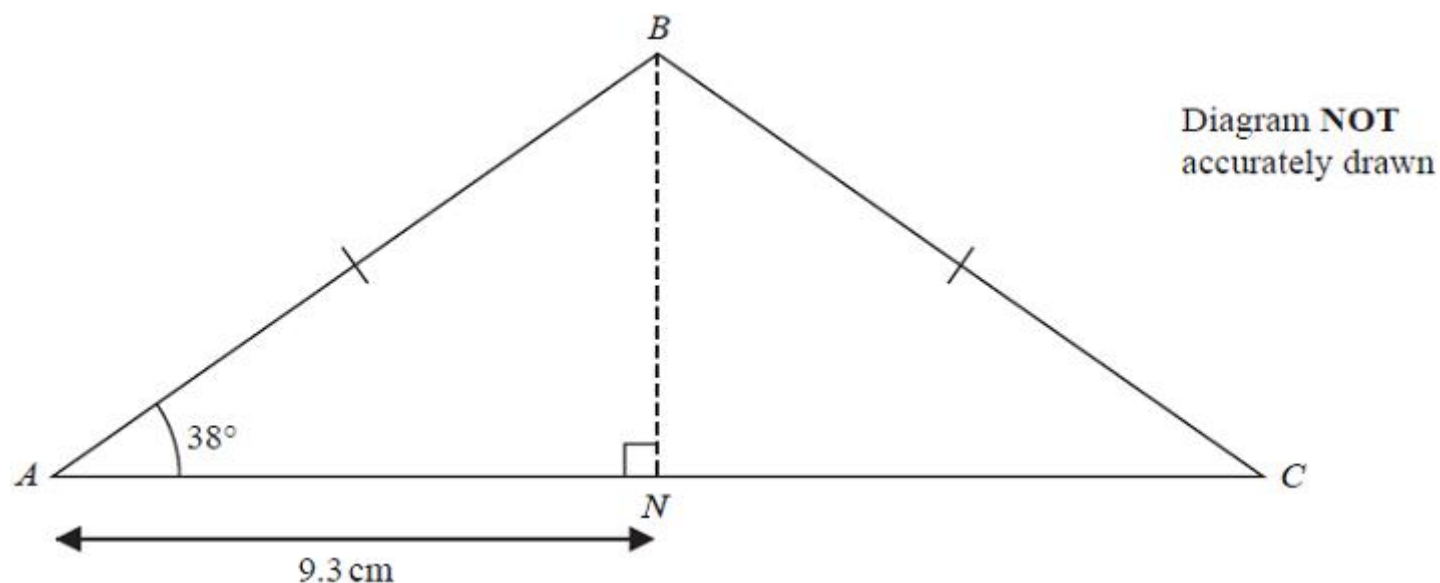
work out the length of PQ .

(Total for question = 4 marks)



Q4.

ABC is an isosceles triangle with $BA = BC$.



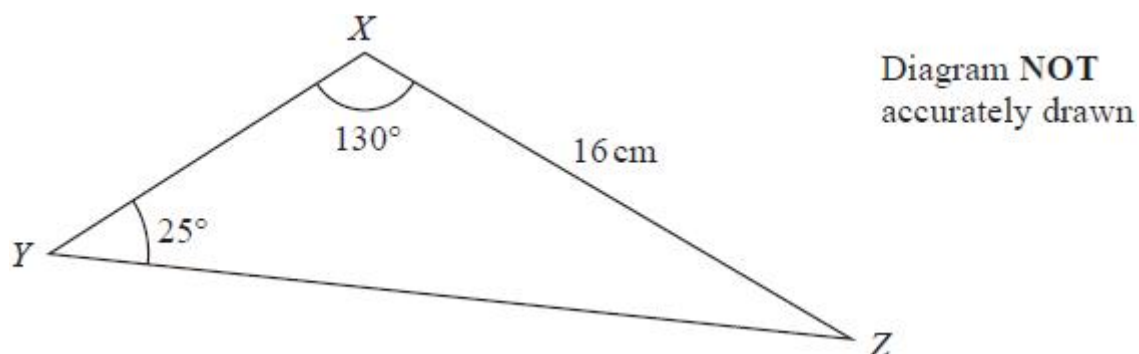
N is the point on AC such that $AN = 9.3$ cm and BN is perpendicular to AC .

Work out the perimeter of triangle ABC .
Give your answer correct to 3 significant figures.

(Total for question = 4 marks)

Q5.

Here is a triangle XYZ .



The length XZ and the angles YXZ and XYZ are each given correct to 2 significant figures.

Calculate the upper bound for the length YZ .
Give your answer correct to one decimal place.
Show your working clearly.

(Total for question = 3 marks)



Q6.

The diagram shows a triangular prism $ABCDEF$ with a horizontal base $ABEF$.

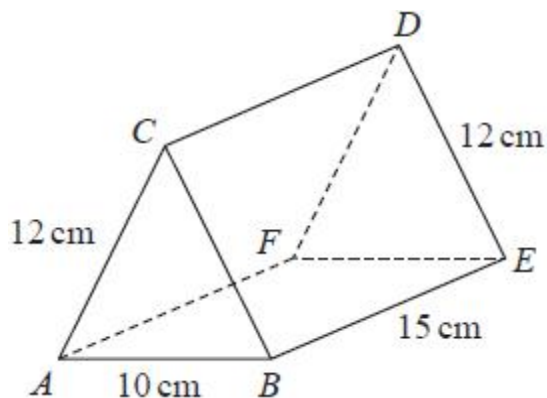


Diagram **NOT**
accurately drawn

$$AC = BC = FD = ED = 12 \text{ cm} \quad AB = 10 \text{ cm} \quad BE = 15 \text{ cm}$$

Calculate the size of the angle between AD and the base $ABEF$.
Give your answer correct to 3 significant figures.

(Total for question = 4 marks)

Q7.

Here is a quadrilateral $ABCD$.

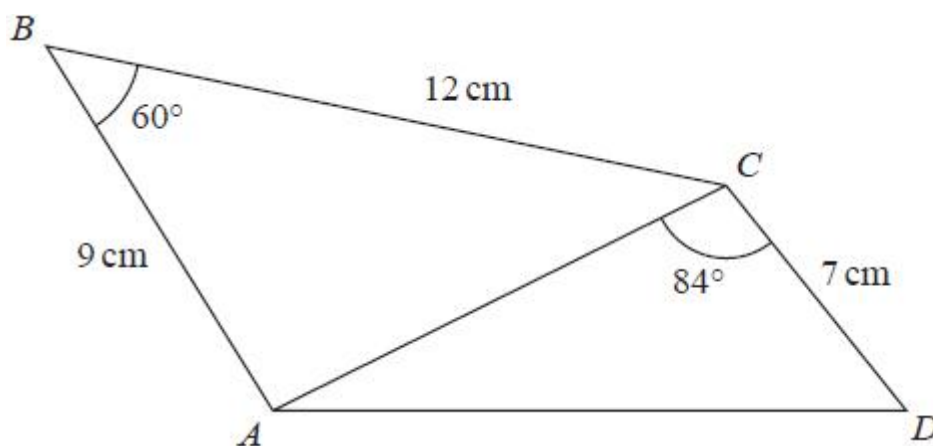


Diagram **NOT**
accurately drawn

Calculate the area of quadrilateral $ABCD$.
Give your answer correct to 3 significant figures.
Show your working clearly.

(Total for question = 5 marks)



Q8.

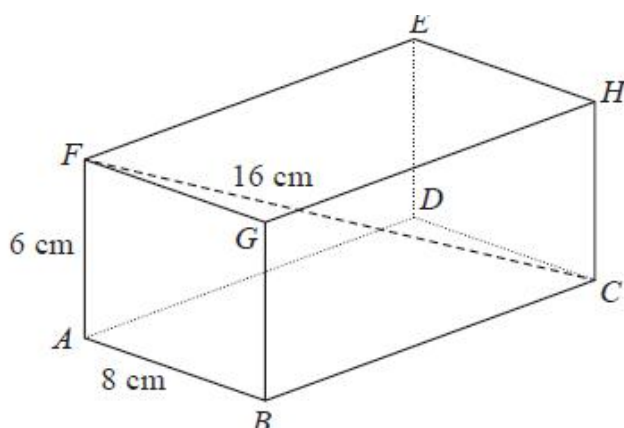


Diagram NOT
accurately drawn

The diagram shows a cuboid $ABCDEFGH$.

$AB = 8$ cm, $AF = 6$ cm and $FC = 16$ cm.

(a) Find the length of BC .

Give your answer correct to 3 significant figures.

(3)

(b) Find the size of the angle between the line FC and the plane $ABGF$.

Give your answer correct to 1 decimal place.

(2)

(Total for question = 5 marks)

Q9.

The diagram shows a pyramid with a horizontal rectangular base $PQRS$.

$PQ = 16$ cm.

$QR = 10$ cm.

M is the midpoint of the line PR .

The vertex, T , is vertically above M .

$MT = 15$ cm.

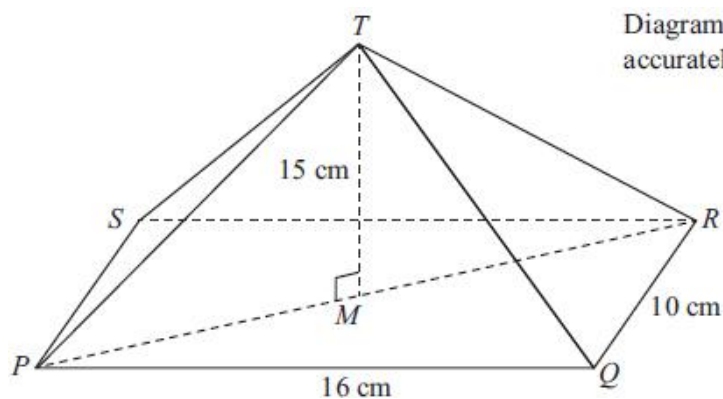


Diagram NOT
accurately drawn

Calculate the size of the angle between TP and the base $PQRS$.

Give your answer correct to 1 decimal place.

(Total for question = 4 marks)



Q10.

The diagram shows a kite $ABCD$

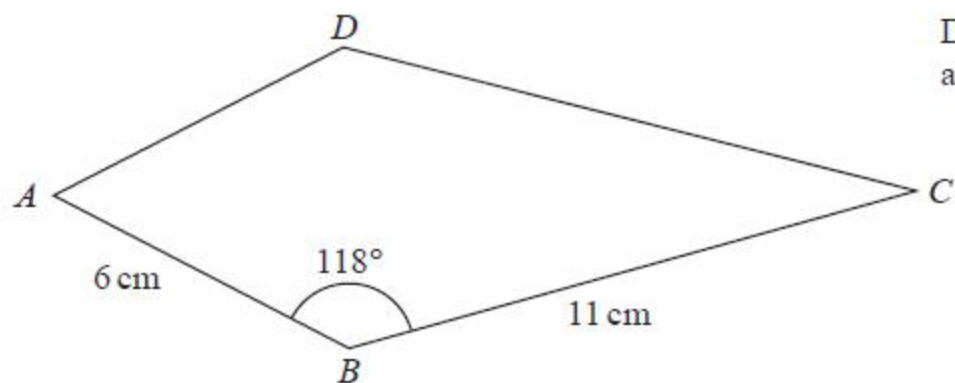


Diagram **NOT**
accurately drawn

$$AB = 6 \text{ cm}$$

$$BC = 11 \text{ cm}$$

$$\text{Angle } ABC = 118^\circ$$

Calculate the area of the kite.
Give your answer correct to 3 significant figures.

(Total for question = 3 marks)

Q11.

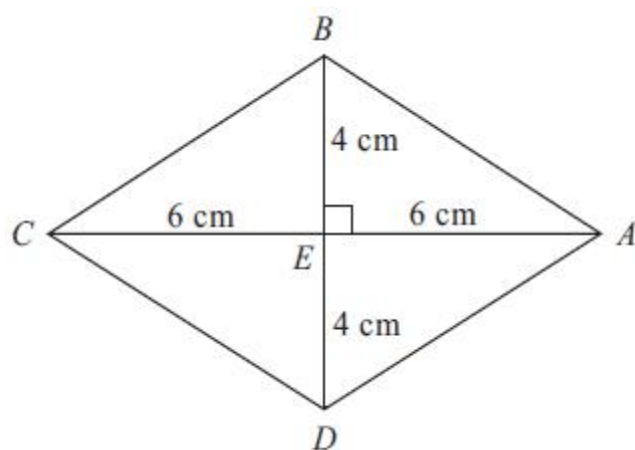


Diagram **NOT**
accurately drawn

$ABCD$ is a rhombus.
The diagonals AC and BD cross at the point E .
 $AE = CE = 6\text{cm}$.
 $BE = DE = 4\text{cm}$
Angle $AEB = 90^\circ$

(a) Work out the area of the rhombus.

(3)



(b) Work out the length of AB .
Give your answer correct to 3 significant figures.

(3)

(Total for question is 6 marks)

Q12.

Two circles, C_1 and C_2 , are drawn on a centimetre grid, with a scale of 1 cm for 1 unit on each axis.

The centre of circle C_1 is at the point with coordinates $(-1, 3)$ and the radius of C_1 is 13 cm.

The centre of circle C_2 is at the point with coordinates $(7, 18)$ and the radius of C_2 is 6 cm.

(a) Work out the distance between the centre of C_1 and the centre of C_2

(3)

(b) Explain why circle C_1 intersects circle C_2

(1)

(Total for question = 4 marks)

Q13.

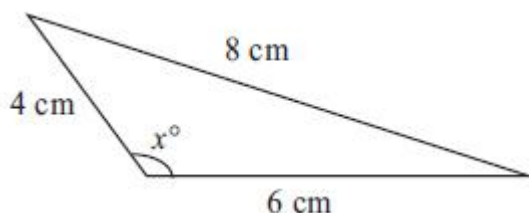


Diagram NOT
accurately drawn

Calculate the value of x .
Give your answer correct to 1 decimal place.

$x = \dots\dots\dots$

(Total for question = 3 marks)



Q14.

The diagram shows triangle PQR .

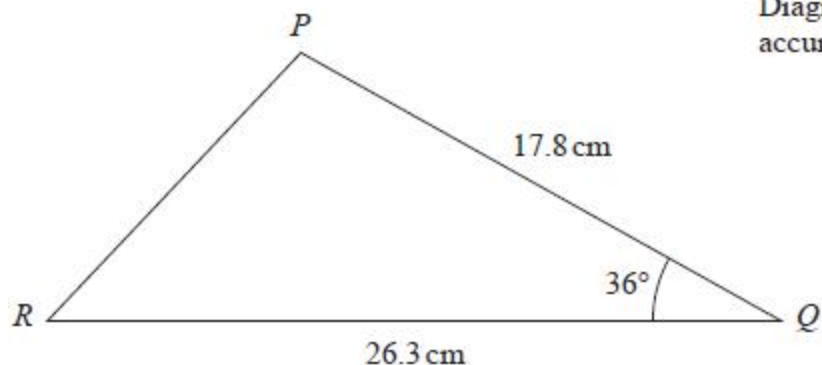


Diagram NOT
accurately drawn

Calculate the length of PR .
Give your answer correct to 3 significant figures.

(Total for question = 3 marks)

Q15.

$ABCD$ is a kite.

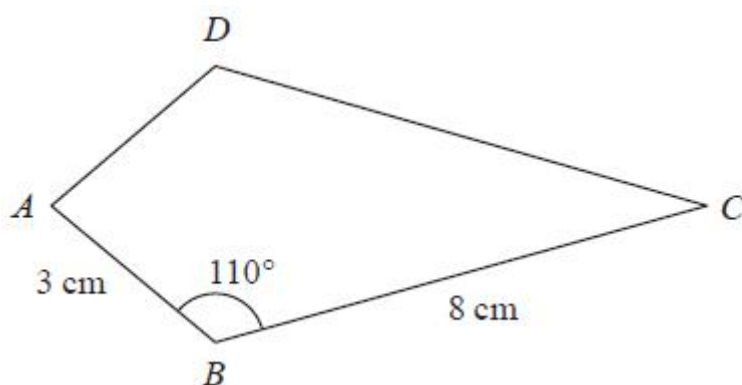


Diagram NOT
accurately drawn

$AB = 3\text{ cm}$
 $BC = 8\text{ cm}$
Angle $ABC = 110^\circ$

Calculate the area of the kite $ABCD$.
Give your answer correct to 3 significant figures.

(Total for question = 3 marks)



Q16.

Here is triangle LMN , where angle LMN is an obtuse angle.

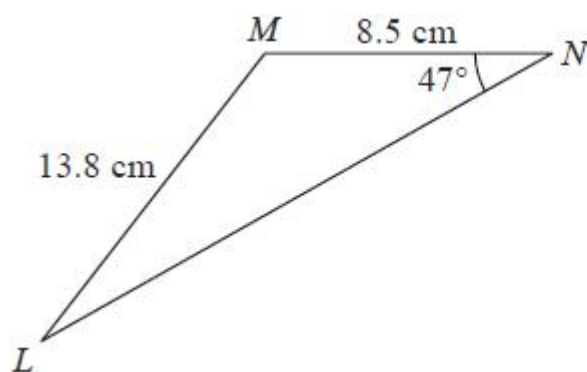


Diagram **NOT**
accurately drawn

$$ML = 13.8 \text{ cm}$$

$$MN = 8.5 \text{ cm}$$

$$\text{Angle } MNL = 47^\circ$$

Work out the area of triangle LMN .

Give your answer correct to 3 significant figures.

(Total for question = 6 marks)



Mark Scheme

Q1.

Q	Working	Answer	Mark	Notes
(a)	$\tan 20 = \frac{100}{d}$ oe or $\tan(90 - 20) = \frac{d}{100}$ oe or $\frac{d}{\sin(90 - 20)} = \frac{100}{\sin 20}$ oe		3	M1
	$(d =) \frac{100}{\tan 20} (= 274.747\dots)$ or $(d =) 100 \times \tan(90 - 20)$ $(= 274.747\dots)$ or $(d =) \frac{100}{\sin 20} \times \sin(90 - 20) (= 274.747\dots)$			M1
	Correct answer scores full marks (unless from obvious incorrect working)	275		A1 awrt 275
(b)	$\tan 25 = \frac{100 + h}{275}$ oe or $\tan 25 = \frac{y}{275}$ oe or $275 \times \tan 25 (= 128\dots)$ or $\tan(90 - 25) = \frac{275}{100 + h}$ oe or $\tan(90 - 25) = \frac{275}{y}$ oe or $\frac{100 + h}{\sin 25} = \frac{275}{\sin(90 - 25)}$ or 128.1 – 128.2 (y is the height of cliff and radio mast)		3	M1 ft part (a) Allow $(hyp =) \sqrt{100^2 + 275^2}$ $(= \sqrt{85486.321} = 292.380)$ or $(hyp =) \frac{100}{\sin 20} \times \sin 90$ $(= 292.380)$
	$(h =) 275 \times \tan 25 - 100 = 28.1169\dots$ or $(h =) \frac{275}{\tan 90 - 25} - 100 (= 28.1169\dots)$ or $(h =) \frac{275}{\sin(90 - 25)} \times \sin 25 - 100 (= 28.1169\dots)$			M1 ft part (a) $(h =) \frac{292.380}{\sin(90 - 25)} \times \sin(25 - 20)$ $(= 28.1169\dots)$
	Correct answer scores full marks (unless from obvious incorrect working)	28.1		A1 Accept answers in the range 28 – 28.2
				Total 5 marks



Q2.

Q	Working	Answer	Mark	Notes
	$8^2 + 15^2 (= 289)$	167	5	M1
	$\sqrt{8^2 + 15^2} (= 17)$			M1
	$\pi \times "8.5" ^2 (226.98\dots)$ or $0.5 \times 15 \times 8 (= 60)$			M1
	$\pi \times "8.5" ^2 - 0.5 \times 15 \times 8$ (“226.98” – “60”)			M1
				A1 Accept answers which round to 167
				Total 5 marks



Q3.

Q	Working	Answer	Mark	Notes
	eg $0.5 \times x \times x \times \sin 60 \left(= \frac{\sqrt{3}}{4} x^2 = 0.433...x^2 \right)$ oe where $x = PQ$ eg $0.5 \times 2n \times 2n \times \sin 60 \left(= \sqrt{3} n^2 = 1.732...n^2 \right)$ oe where $2n = PQ$ or use $0.5 \times b \times h$ where $h = \sqrt{x^2 - (0.5x)^2} \left(= \frac{\sqrt{3}}{2} x \right)$ oe		4	M1 For expression for area of triangle [using $AB = x$ and $PQ = \frac{2}{3}x$ gives $\frac{\sqrt{3}}{9} x^2 = 0.192...x^2$] (correct expression in 1 variable eg PQ)
	eg $6 \times 0.5 \times 1.5x \times 1.5x \times \sin 60 \left(= \frac{27\sqrt{3}}{8} x^2 = 5.845...x^2 \right)$ oe eg $6 \times 0.5 \times 3n \times 3n \times \sin 60 \left(= \frac{27\sqrt{3}}{2} n^2 = 23.382...n^2 \right)$ oe or eg $2 \left(\frac{1}{2} \times 1.5x \times 1.5x \times \sin 120 \right) + 1.5x \times AE$ where $AE = \sqrt{(1.5x)^2 + (1.5x)^2 - 2 \times 1.5x \times 1.5x \times \cos 120}$ $\left(= \frac{27\sqrt{3}}{8} x^2 = 5.845...x^2 \right)$ or use of $6 \times 0.5 \times b \times h$, finding h by Pythagoras			M1 for expression for area of hexagon [using $AB = x$ and $PQ = \frac{2}{3}x$ gives $\frac{3\sqrt{3}}{2} x^2 = 2.598...x^2$] (correct expression in 1 variable eg AB)
	eg $6 \times 0.5 \times 1.5x \times 1.5x \times \sin 60 - 0.5 \times x \times x \times \sin 60 = 72\sqrt{3}$ oe or $\left(\frac{27\sqrt{3}}{8} - \frac{\sqrt{3}}{4} \right) x^2 = 72\sqrt{3}$ or $(5.845... - 0.433...)x^2 = 124.7...$ or eg $6 \times 0.5 \times 3n \times 3n \times \sin 60 - 0.5 \times 2n \times 2n \times \sin 60 = 72\sqrt{3}$ oe $\left(\frac{27\sqrt{3}}{2} - \sqrt{3} \right) n^2 = 72\sqrt{3}$ or $(23.382... - 1.732...)n^2 = 124.7...$			M1 for a correct equation for shaded area (correct equation in 1 variable, eg PQ or x etc)
		4.8	A1	



Q4.

Q	Working	Answer	Mark	Notes
	eg $\cos 38 = \frac{9.3}{(AB)}$ oe or $\sin'52' = \frac{9.3}{(AB)}$ oe or $\frac{(BC)}{\sin 38} = \frac{2 \times 9.3}{\sin'104'}$ oe or $\frac{\sin'52'}{9.3} = \frac{\sin 90}{(BC)}$ oe		4	M1 or $BN = \frac{9.3 \sin 38}{\sin'52'}$ or $9.3 \tan 38 (= 7.2659...)$ and $(AB^2) = 9.3^2 + '7.2659...'^2$
	eg $(AB) = \frac{9.3}{\cos 38} (= 11.80...)$ or $(AB) = \frac{9.3}{\sin'52'}$ (= 11.80...) or $(BC) = \frac{2 \times 9.3 \times \sin 38}{\sin'104'}$ (= 11.80...) oe			M1 or $(AB) = \sqrt{9.3^2 + '7.2659...'^2} (= 11.80...)$
	'11.8' + '11.8' + 9.3 + 9.3 or '11.8' \times 2 + 9.3 \times 2 oe			M1
	<i>Correct answer scores full marks (unless from obvious incorrect working)</i>	42.2		A1 awrt 42.2
				Total 4 marks

Q5.

Q	Working	Answer	Mark	Notes
	15.5 or 16.5 or 24.5 or 25.5 or 125 or 135		3	B1 Accept 16.49 for 16.5 25.49 for 25.5 134.9 for 135
	$\frac{(YZ)}{\sin(125)} = \frac{16.5}{\sin(24.5)}$ oe			M1 for substitution into sine rule $\frac{(YZ)}{\sin(LB_2)} = \frac{UB_1}{\sin(LB_3)}$ oe where 16 < $UB_1 \leq 16.5$ and 125 $\leq LB_2 < 130$ and 24.5 $\leq LB_3 < 25$
	<i>Working required</i>	32.6		A1 Accept 32.5 to 32.6 from correct working
				Total 3 marks



Q6.

Q	Working	Answer	Mark	Notes
	$[AM =]\sqrt{5^2 + 15^2} (= \sqrt{250} = 15.8\dots)$ where M is midpoint of EF , oe other correct method to find AM $[AD =]\sqrt{12^2 + 15^2} (= \sqrt{369} = 19.2\dots)$ $[DM =]\sqrt{12^2 - 5^2} (= \sqrt{119} = 10.9\dots)$		4	M2 for a complete method to find two of AM, AD, DM (where M is the midpoint of EF) Other longer ways to find AM, AD, DM may be used but must be a complete method eg $\angle DEM = \cos^{-1}\left(\frac{5}{12}\right) (= 65.37\dots)$ and $DM = 12 \sin 65.37\dots$ $\angle DEM = \cos^{-1}\left(\frac{5}{12}\right) (= 65.37\dots)$ and $DM = 5 \tan 65.37\dots$ Use $10 \div 2$ as 5 throughout (M1 For a complete method to find one of AM, AD, DM (where M is the midpoint of EF))
	eg $\tan DAM = \frac{\sqrt{119}}{\sqrt{250}} \left(= \frac{10.9\dots}{15.8\dots} \right)$ oe or $\sin DAM = \frac{\sqrt{119}}{\sqrt{369}} \left(= \frac{10.9\dots}{19.2\dots} \right)$ oe or $\cos DAM = \frac{\sqrt{250}}{\sqrt{369}} \left(= \frac{15.8\dots}{19.2\dots} \right)$ oe			M1 a correct method to find the required angle –other longer methods may be used but they must get to the stage of an equation for the required angle eg $\sin DAM = \frac{10.9\dots}{\sqrt{15.8\dots^2 + 10.9\dots^2}}$ NB: “10.9...” and “15.8...” must come from correct working
	Working not required, so correct answer scores full marks (unless from obvious incorrect working)	34.6		A1 any answer which rounds to 34.6
				Total 4 marks



Q7.

Q	Working	Answer	Mark	Notes
	$(AC^2 =) 9^2 + 12^2 - 2 \times 9 \times 12 \times \cos 60 (= 117)$ or $(AC^2 =) 81 + 144 - 108 (= 117)$ oe		5	M1 oe eg $BM = 9 \cos 60 (= 4.5)$ and $AM = 9 \sin 60 (= \frac{9\sqrt{3}}{2})$ and $AC^2 = (\frac{9\sqrt{3}}{2})^2 + (12 - 4.5)^2$ (where AM is perpendicular to BC)
	$(AC =) \sqrt{117}$ or $3\sqrt{13}$ or 10.8(16653...)			A1 oe
	$(\text{area } ABC =) 0.5 \times 9 \times 12 \times \sin 60 (= 27\sqrt{3})$ or 46.7(653....)			M1 indep or $\frac{1}{2} \times (\frac{9\sqrt{3}}{2}) \times 12 (= 27\sqrt{3})$ oe
	$(\text{area } ACD =) 0.5 \times 7 \times \sqrt{117} \times \sin 84 (= 37.6(50896...))$			M1 dep on 1st M1
	<i>Working required</i>	84.4		A1 dep on M3 awrt 84.4
				Total 5 marks



Q8.

Question	Working	Answer	Mark	Notes
(a)	$6^2 + 8^2 + BC^2 = 16^2$ or $BC^2 = 16^2 - 6^2 - 8^2$ or $36 + 64 + BC^2 = 256$ or $BC^2 = 256 - 36 - 64$ or $FB^2 = 100$ oe or $FB = \sqrt{100}$ oe or $AC^2 = 220$ oe or $AC = \sqrt{220}$ oe or $GC^2 = 192$ oe or $GC = \sqrt{192}$ oe		3	M1 for use of Pythagoras in 3D shape or a correct value for FB or FB^2 or AC or AC^2
	$BC = \sqrt{16^2 - 6^2 - 8^2}$ or $BC = \sqrt{256 - 36 - 64}$ or $BC = \sqrt{156}$ or $BC = \sqrt{16^2 - 10^2}$ or $BC = \sqrt{256 - 100}$ or $BC = \sqrt{220 - 8^2}$ oe or $BC = \sqrt{192 - 6^2}$ oe			M1 For a correct method to find BC. (Condone $2\sqrt{55}^2$ rather than $(2\sqrt{55})^2$ for 220 for method mark)
	12.4899...	12.5		A1 for answer which rounds to 12.5
(b)	$\cos BFC = \frac{10}{16}$ or $\sin BFC = \frac{12.5}{16}$ or $\tan BFC = \frac{12.5}{10}$		2	M1 A correct equation for the correct angle.
		51.3		A1 for awrt 51.3 or 51.4
Total 5 marks				

Q9.

Q	Working	Answer	Mark	Notes
	$\sqrt{16^2 + 10^2}$ (=18.9 or better) "18.867" $\div 2$ (=9.433) $\tan "x" = 15/$ "9.433"	57.8	4	M1 or M2 for $\sqrt{8^2 + 5^2}$ (=9.43 or better) M1 dep on previous M1 M1 dep on M2 A1 57.832..... awrt 57.8
Total 4 marks				



Q10.

Q	Working	Answer	Mark	Notes
	$\frac{1}{2} \times 6 \times 11 \times \sin 118 (= 29.1\dots)$		3	M1 for the area of half of the kite
	eg $2 \times \frac{1}{2} \times 6 \times 11 \times \sin 118$			M1 for a complete method
		58.3		A1 accept 58.2 – 58.3
				Total 3 marks

Q11.

Question	Working	Answer	Mark	Notes
(a)	Complete, correct expression which, if correctly evaluated, gives 48 eg $4 \times \frac{1}{2} \times 6 \times 4, 2 \times \frac{1}{2} \times 12 \times 4, \frac{1}{2} \times 12 \times 8$		3	M2 M1 for correct expression for area of one relevant triangle $\frac{1}{2} \times 6 \times 4, \frac{1}{2} \times 6 \times 4 \sin 90^\circ$ $\frac{1}{2} \times 8 \times 6, \frac{1}{2} \times 12 \times 4$
		48		A1 cao
(b)	$4^2 + 6^2 = 16 + 36 = 52$		3	M1 for squaring and adding
	$\sqrt{4^2 + 6^2}$			M1 (dep) for square root
		7.21		A1 for answer which rounds to 7.21 (7.211102...)
				Total 6 marks



Q12.

Q	Working	Answer	Mark	Notes
(a)	$(18-3)^2 + (7-(-1))^2$ oe or $15^2 + 8^2 (= 289)$ oe		3	M1
	$\sqrt{(18-3)^2 + (7-(-1))^2} (= \sqrt{289})$			M1
		17		A1
(b)	$13 + 6 > "17"$	correct reason	1	A1ft dep M1 Acceptable examples "They overlap by 2cm" "The distance between the centres is less than the sum of the radii" "17 is less than the distance than the total of the radii" "19 is bigger than the distance between the centres" Not acceptable examples "19 is greater than the distance between the circles" oe "The circumference of each circle overlaps"
				Total 4 marks

Q13.

Question	Working	Answer	Mark	Notes
	$(\cos x^\circ) = \frac{4^2 + 6^2 - 8^2}{2 \times 4 \times 6}$ or $8^2 = 4^2 + 6^2 - 2 \times 4 \times 6 \cos x^\circ$		3	M1 for correct substitution in Cosine Rule
	$(\cos x^\circ) = -0.25$ oe			A1
		104.5		A1 for value rounding to 104.5 (104.4775...)
				Total 3 marks



Q14.

Question	Working	Answer	Mark	Notes
	$17.8^2 + 26.3^2 - 2 \times 17.8 \times 26.3 \times \cos 36$		3	M1
	e.g. 1008.5... - 757.... or 251(.06...)			M1 for correct order of operations
		15.8		A1 for ans in range 15.8 - 15.9
				Total 3 marks

Q15.

The correct answer, unless clearly obtained by an incorrect method, should be taken to imply a correct method.

Question	Working	Answer	Mark	Notes
	$0.5 \times 3 \times 8 \times \sin 110 (= 11.2...)$ oe or 11.3		3	M1
	$2 \times 0.5 \times 3 \times 8 \times \sin 110$ oe or $2 \times "11.2.."$			M1 dep
		22.6		A1 awrt 22.6
				Total 3 marks



Q16.

Q	Working	Answer	Mark	Notes
	$\frac{\sin 47}{13.8} = \frac{\sin MLN}{8.5}$		6	M1 Or method using a right angled triangle to find length MX (MX is perpendicular to LN) $\sin 47 = \frac{MX}{8.5}$
	$MLN = \sin^{-1}\left(\frac{\sin 47 \times 8.5}{13.8}\right)$			M1 Or $\cos^{-1}\left(\frac{8.5 \sin 47}{13.8}\right)$
	$MLN = 26.7(73\dots)$			A1 $LMX = 63.232\dots$
	$LMN = 180 - 47 - "26.7\dots"$ or $106(.2260622\dots)$			M1 $LMN = 63.232 + (180 - (90+47))\dots$ or $106(.2260622\dots)$
	$\frac{1}{2} \times 8.5 \times 13.8 \times \sin("106")$			M1
		56.3		A1 Accept an answer that rounds to 56.3 or 56.4 unless clearly obtained from incorrect working.
				Total 6 marks