

1	$4.3^2 + 6.4^2$ or 59.45		4	M1	for squaring and adding
	$\sqrt{4.3^2 + 6.4^2}$ or $\sqrt{59.45}$ or 7.71(038...) or 7.7			M1	dep 1st M1 for square rooting
	e.g. ('7.71' + 4.3 + 6.4) \times 22 or '18.4' \times 22 (=404.8) or ('8' + 4.3 + 6.4) \times 22 or '18.7' \times 22 or '19' \times 22 or '20' \times 22			M1	dep M2 for a non-rounded perimeter \times 22 or 19 \times 22 accept 20 \times 22 oe
		\$418		A1	cao
Total 4 marks					

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

3	e.g. ($EF \Rightarrow$) $12\cos 40 (= 9.19...)$ or ($FD \Rightarrow$) $12\sin 40 (= 7.71...)$ and ($EF \Rightarrow$) $\sqrt{12^2 - "7.71"^2} (= 9.19...)$			M2	complete method to find EF (if not M2 then M1 for a correct statement involving EF e.g. $\frac{EF}{12} = \cos 40$)
	e.g. $\frac{"9.19"}{EG} = \tan 28$ or $\tan 62 = \frac{EG}{"9.19"}$ or $\frac{"9.19"}{FG} = \sin 28 (= 19.5...)$ and $"19.5"^2 - "9.19"^2 (= 298.9...)$			M1	(dep on M2) for a correct trig statement involving EG or complete method to find FG and a correct start to Pythagoras process
		17.3	4	A1	accept 17.2 – 17.3
Total 4 marks					

4	$8.5^2 + 5.6^2 (= 103.61)$		3	M1	
	$\sqrt{8.5^2 + 5.6^2}$			M1	
		10.2		A1	Accept 10.1 to 10.2 or better
Total 3 marks					

5	$(AC^2 \Rightarrow) 17^2 - 15^2$		5	M1	
	$(AC \Rightarrow) \sqrt{17^2 - 15^2} (= \sqrt{64} = 8)$			M1	
	$\frac{\pi \times '8'}{2} (= 4\pi = 12.566...)$			M1	dep on M2 for $\frac{\pi \times '8'}{2}$ oe or 4π 12.5663...
	'12.566...' + 15 + 17			M1	for '12.566' + 15 + 17 and no additional values
		44.6		A1	for awrt 44.6
Total 5 marks					

Alternative mark scheme for 5

	$\cos^{-1}\left(\frac{15}{17}\right) (= 28.0724)$ or $\sin^{-1}\left(\frac{15}{17}\right) (= 61.9275)$		5	M1	for a correct method to find one of the angles
	$15 \times \tan ('28.0724') (= 8)$ or $15 \div \tan ('61.9275') (= 8)$			M1	
	$\frac{\pi \times '8'}{2} (= 4\pi = 12.566...)$			M1	dep on M2 for $\frac{\pi \times '8'}{2}$ or 12.5663... or 4π
	"12.566" + 15 + 17			M1	for "12.566" + 15 + 17 and no additional values
		44.6		A1	for awrt 44.6
Total 5 marks					

6	$(AB^2 =) 7.5^2 - 6^2 (= 20.25)$ or eg $(BAC =) \sin^{-1}\left(\frac{6}{7.5}\right) (= 53.1...)$ or $\cos(BCA) = \frac{6}{7.5} (= 0.8)$		6	M1	for a correct first step to find AB or a complete method to find angle BAC or a correct first step to find angle BCA
	$(AB =) \sqrt{7.5^2 - 6^2} (= 4.5)$ or $(AB =) \frac{6}{\tan "53.1"} (= 4.5...)$ or $(AB =) 7.5 \cos "53.1" (= 4.5...)$ or $(BCA =) \cos^{-1}\left(\frac{6}{7.5}\right) (= 36.8...)$			M1	for a complete method to find AB or angle BCA
	$(\text{Area } ABC =) \frac{1}{2} \times 6 \times "4.5" (= 13.5)$ or $(\text{Area } ABC =) \frac{1}{2} \times 6 \times 7.5 \times \sin("36.8") (= 13.47... \text{ or } 13.5)$			M1	ft [their labelled AB] or [their labelled BCA] eg for $\frac{1}{2} \times 6 \times$ [their labelled AB] or $\frac{1}{2} \times 6 \times 7.5 \times \sin$ [their labelled BCA]
	$(\text{Area } DAC =) 31.5 - "13.5" (= 18)$ or $"13.5" + 0.5 \times 7.5 \times AD = 31.5$ oe $(AD =) ("18" \div 7.5) \div 0.5$ oe			M1	ft (dep on previous M1) allow $31.5 -$ [their area]
		4.8		M1	for a complete method to find AD , dependent on correct working
				A1	accept $4.78 - 4.81$
Total 6 marks					

7	$(\text{area } PQS =) \frac{1}{2} \times 6.1 \times 3.8 \times \sin P = 9$ or $(\text{area } PQRS =) 6.1 \times 3.8 \times \sin P = 18$	$\frac{1}{2} \times 6.1 \times SX = 9$ or $(SX =) \frac{9}{\frac{1}{2} \times 6.1} (= 2.95...)$ or $6.1 \times SX = 18$ or $(SX =) 18 \div 6.1 (= 2.95...)$		5	M1	correct equation for the area of the triangle or parallelogram or a calculation to find the height of the parallelogram (where X is the point vertically below S on PQ)
	eg $(\sin P =) \frac{9}{\frac{1}{2} \times 6.1 \times 3.8} (= 0.776... \text{ or } \frac{900}{1159})$ or $(\sin P =) \frac{18}{6.1 \times 3.8} (= 0.776... \text{ or } \frac{900}{1159})$	$(PX^2 =) 3.8^2 - "2.95..."^2 (= 5.73...)$ or $(PX =) \sqrt{3.8^2 - "2.95..."^2} (= 2.39...)$			M1	correct expression for $\sin P$ OR for start of Pythagoras method to find length of PX (where X is the point vertically below S on PQ)
	$(P =) \sin^{-1} 0.776... (= 50.9...)$	$(QX =) 6.1 - \sqrt{5.73} (= 3.70...)$ or $(QX =) 6.1 - "2.39" (= 3.70...)$			M1	for complete method to find angle P OR for method to find length of QX
	$(QS^2 =) 3.8^2 + 6.1^2 - 2 \times 3.8 \times 6.1 \times \cos("50.9") (= 22.4...)$ or $(QS =) \sqrt{3.8^2 + 6.1^2 - 2 \times 3.8 \times 6.1 \times \cos("50.9")}$	$(QS^2 =) "2.95..."^2 + "3.70..."^2 (= 22.4...)$ or $(QS =) \sqrt{"2.95..."^2 + "3.70..."^2}$			M1	correct expression for QS^2 (or QS)
			4.74		A1	accept $4.73 - 4.74$
Total 5 marks						

8	$12.8^2 + x^2 = 16^2$ oe or $163.84 + x^2 = 256$ or $(x^2 =) 16^2 - 12.8^2 (= 92.16)$ or $(x^2 =) 256 - 163.84 (= 92.16)$		4	M1 for applying Pythagoras theorem correctly Allow $\cos^{-1}\left(\frac{12.8}{16}\right)(= 36.9\dots)$ and $\frac{x}{\sin(36.9\dots)} = \frac{16}{(\sin 90)}$
	$(x =) \sqrt{16^2 - 12.8^2} (= \sqrt{92.16}) (= 9.6)$ or $(x =) \sqrt{256 - 163.84} (= \sqrt{92.16}) (= 9.6)$			M1 for square rooting Allow $x = \frac{16}{(\sin 90)} \times \sin(36.9\dots)$
	$(12.8 - "9.6") + "9.6" + "9.6" + 16 + 16 + 16$ oe			M1 (dep on M1) for a complete method to find the perimeter
		70.4		A1 oe e.g. $\frac{352}{5}$
				Total 4 marks

9	$17.5^2 - 14^2 (= 110.25)$		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 $\cos B = \frac{14}{17.5}$
	$\sqrt{17.5^2 - 14^2} (= 10.5)$			M1	or for rearranging the cosine rule to eg $\cos A = \frac{17.5^2 + 17.5^2 - 28^2}{2 \times 17.5 \times 17.5}$ ($A = 106.26\dots$) or eg $B = \cos^{-1}\left(\frac{14}{17.5}\right)$ ($= 36.86\dots$)
	$0.5 \times 28 \times "10.5"$ oe			M1	or for $0.5 \times 17.5 \times 17.5 \times \sin 106.26\dots$ oe eg $0.5 \times 17.5 \times 28 \times \sin 36.86\dots$ [clear use of Heron's formula: M1 for $S = 0.5(17.5 + 17.5 + 28)(=31.5)$ M2 for $\sqrt{31.5("31.5" - 17.5)}^2 ("31.5" - 28)$ oe]
		147		A1	accept awrt 147
Total 4 marks					

10	$(54 - 24) \div 2 (=15)$ [may be marked on diagram]		5	M1	
	$"15" - (24 \div 2)^2 (= 81)$			M1	ft their "15" (if > 12)
	[height =] $\sqrt{"15" - (24 \div 2)^2} (= 9)$			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					
10	$(54 - 24) \div 2 (=15)$ [may be marked on diagram]		5	M1	
	or $x = \cos^{-1}\left(\frac{"12"}{"15"}\right) (= 36.86\dots)$ or $y = \sin^{-1}\left(\frac{24 \div 2}{"15"}\right) (= 53.13\dots)$ or $A = \cos^{-1}\left(\frac{15^2 + 15^2 - 24^2}{2 \times 15 \times 15}\right) (= 106.2\dots)$ or $B = \cos^{-1}\left(\frac{15^2 + 24^2 - 15^2}{2 \times 15 \times 24}\right) (= 36.8\dots)$			M1	ft their "15" (if > 12) [using Hero's formula $S = 0.5 \times 54 (= 27)$ and] $27 \times (27 - 24) \times (27 - "15") \times (27 - "15")$
	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 $0.5 \times 24 \times "15" \times \sin "36.86\dots"$ or $0.5 \times "15" \times "15" \times \sin(2 \times "53.13\dots")$ or $0.5 \times "15" \times "15" \times \sin("106.2\dots")$ 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					

12	(a)	$\sqrt{4^2 + 9^2 + 15^2} (= \sqrt{322} = 17.9(443...))$ or $\sqrt{15^2 + 4^2} (= \sqrt{241} = 15.5(241...))$ and $\sqrt{9^2 + (" \sqrt{241} ")^2} (= \sqrt{322} = 17.9(443...))$	2	M1
			17.9	A1 awrt 17.9

13	$7.2^2 + 5.4^2 (= 81)$		4	M1 for correct first step using Pythagoras	M1 for reaching one step from the length of AB if using trig eg $(EAB =) \tan^{-1}\left(\frac{5.4}{7.2}\right) (= 36.8\dots)$ and $\sin("36.8\dots") = \frac{5.4}{AB}$
	$\sqrt{7.2^2 + 5.4^2} (= 9)$			M1 for complete Pythagoras method to find length of AB/DC check the diagram for sight of 9, DC marked as 9 implies M2	M1 for complete method to find the length of AB/DC eg $\frac{5.4}{\sin("36.8\dots")} (= 9)$
	$7.2 + 5.4 + 6 + "9" + 6$ oe			M1 for a complete method to find the perimeter	
	<i>Correct answer scores full marks (unless from obvious incorrect working)</i>	33.6		A1 oe	
					Total 4 marks