

1	$2 \times \pi \times 18$ or $\pi \times 36$		2	M1
		113		A1 for 113 – 113.15
Total 2 marks				

2	$(AC^2 =) 17^2 - 15^2$		5	M1
	$(AC =) \sqrt{17^2 - 15^2} (= \sqrt{64} = 8)$			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 2

	$\cos^{-1}\left(\frac{15}{17}\right) (= 28.0724)$ 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				

3	$\pi \times (18 \div 2)^2 (= 254.469...)$			M1
		254	2	A1 accept 254 – 255
Total 2 marks				

4	$2 \times \pi \times 7 (= 43.982... \text{ or } 14\pi)$ or $(2 \times \pi \times 7) \div 2 (= 21.991... \text{ or } 7\pi)$ or $2 \times \pi \times 9 (= 56.548... \text{ or } 18\pi)$ or $(2 \times \pi \times 9) \div 2 (= 28.274... \text{ or } 9\pi)$		3	M1 for finding the circumference of either the full circle or the length of the arc for either semicircle
	e.g. "21.991" + "28.274" (= 50.26...) or "7 π " + "9 π " (= 16 π) or "21.991" + "28.274" + 2 (= 52.26...) or "7 π " + "9 π " + 2 (= 52.26...) or "21.991" + "28.274" + 2 + 2 or "7 π " + "9 π " + 2 + 2			M1 for a method to find the length of the two arcs with intention to add
		54.3		A1 accept 54.2 – 54.3
Total 3 marks				

5		$8^2 + 15^2 (= 289)$	167	5	M1
		$\sqrt{8^2 + 15^2} (= 17)$		M1	
		$\pi \times "8.5"^{n2} (226.98\dots)$ or $0.5 \times 15 \times 8 (= 60)$		M1	
		$\pi \times "8.5"^{n2} - 0.5 \times 15 \times 8$ (“226.98” – “60”)		M1	
				A1 Accept answers which round to 167	
					Total 5 marks

6	$\sqrt{36} (=6)$ or 6 or 6×6		4	M1	for method to find the length of the square – may be seen in later working
	eg $\pi \times \left(\frac{[\text{their } 6]}{2}\right)^2 \div 2 (=14.1... \text{ or } 4.5\pi \text{ or } \frac{9}{2}\pi)$ or $\pi \times \left(\frac{[\text{their } 6]}{2}\right)^2 (=28.2... \text{ or } 9\pi)$			M1	for method to find the area of one semicircle or circle or the incorrect number of semicircles or circles provided correct area of circle formula is seen for [their 6] allow any value if there is a clear implication this is their side length of square.
	eg $4 \times "14.1" (=56.5... \text{ or } 18\pi)$ or $2 \times "28.2" (=56.5... \text{ or } 18\pi)$			M1	for a complete method to find the total area of the semicircles fit from previous M1 [if the pupil multiplies again and uses the incorrect number of circles or semicircles this mark is not awarded]
		92.5		A1	accept 92.4 – 92.6 (not in terms of π)
Total 4 marks					

7	$2 \times \pi \times 6.5$ or $\pi \times 13$ oe		2	M1	Allow use of π as 3.14(2...) or $\frac{22}{7}$
		40.8		A1	40.8 – 40.9
Total 2 marks					

8	$\cos 30 = \frac{24}{(AC)}$ or $\sin' 60' = \frac{24}{(AC)}$ or $\frac{\sin' 60'}{24} = \frac{\sin 90}{(AC)}$ oe		5	M1 for correct trig ratio involving AC	M2 for use of tan and Pythagoras to obtain AC (AB =) $24 \tan 30 (=13.856...)$ and $\sqrt{13.856...^2 + 24^2} (=27.712...)$
	$(AC =) \frac{24}{\cos 30} (=16\sqrt{3} = 27.712...)$ or $(AC =) \frac{24}{\sin' 60'} (=16\sqrt{3} = 27.712...)$ or $(AC =) \frac{24 \times \sin 90}{\sin' 60'}$			M1 for a correct trig ratio for AC	If not M2, then M1 for use of tan and Pythagoras to obtain AC ² (AB =) $24 \tan 30 (=13.856...)$ and $13.856...^2 + 24^2 (=768)$
	$\frac{1}{2} \times 2 \times \pi \times 3 (=3\pi = 9.424...)$			M1	for using $\pi \times 2 \times 3$ or $2\pi \times 3$ correctly to find the arc length of the semicircle, or circumference of a circle with radius 3.
	'27.712...' + '9.424...' – 2×3			M1	for a complete correct method to find the length AFEDC
		31		A1	accept answers in range from 31 to 31.15
Total 5 marks					

9	$\sin 52 = \frac{12 \div 2}{r}$ 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 $[r^2 = 6^2 + 4.687...^2]$ 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 $(r =) \sqrt{(12 \div 2)^2 + \left(\frac{12 \div 2}{\tan 52}\right)^2} [r = \sqrt{6^2 + 4.687...^2}]$ 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 =) $\pi \times ("7.61...")^2$			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					

10	(c)		Chord drawn	1	B1
11		$\cos 50 = \frac{18}{(AB)}$ or $\sin 40 = \frac{18}{(AB)}$ or $\frac{(AB)}{\sin 90} = \frac{18}{\sin 40}$		5	M1 M2 for $(AB =) \sqrt{18^2 + (18 \tan 50)^2}$ oe $(= 28.0030\dots)$ or 28
		$(AB =) \frac{18}{\cos 50}$ ($= 28.0030\dots$) oe or 28 or $(AB =) \frac{18}{\sin 40}$ ($= 28.0030\dots$) oe or 28			M1
		$\frac{1}{2} \times \pi \times "28.0030\dots" (= 43.9\dots)$ oe or 44 $\pi \times "28.0030\dots" (= 87.9\dots)$ oe or 88			M1 for use of πd or $\frac{1}{2} \pi d$ oe Allow any value of $AB > 18$ if M2 not scored
		"28..." + "43.9..." ($= 71.9900\dots$) or "28" + "44"			M1ft from previous M1 Allow <i>their</i> d + <i>their</i> $\frac{1}{2} \pi d$
		<i>Correct answer scores full marks (unless from obvious incorrect working)</i>	72		A1 awrt 72
					Total 5 marks
12		$2 \times \pi \times 8.5$ oe <i>Correct answer scores full marks (unless from obvious incorrect working)</i>	53.4	2	M1 A1 allow answers in range 53.3 – 53.43
					Total 2 marks