Circular Measure 2 MS

Q1.

2	(i)	$\frac{1}{2}.3^2\pi = \frac{1}{2}9^2\theta - \frac{1}{2}3^2\theta$ $\rightarrow \theta = \frac{1}{4}\pi$	M1 A1 A1	[3]	M1 needs $\frac{1}{2}r^2\theta$ once. A1 all correct. Answer given
	(ii)	$P = 6+6+3\times\frac{1}{4}\pi + 9\times\frac{1}{4}\pi = 21.4$ cm. or $12 + 3\pi$	M1 A1	[2]	M1 is for use of $s=r\theta$ once.

Q2.

6	(i)	$r(2\pi - \alpha) + 2r\alpha + 2r$ $2\pi r + r\alpha + 2r$	B1B1 B1√ [3]	ft for $r\alpha$ instead of $2r\alpha$ or omission $2r$ SC1 for $2r\alpha + 4r$. (Plate = shaded part)
	(ii)	$\frac{1}{2}(2r)^2\alpha + \pi r^2 - \frac{1}{2}r^2\alpha$ $\frac{3r^2\alpha}{2} + \pi r^2$	B1B1 B1 [3]	Either B1 can be scored in (iii)
	(iii)	$\pi r^2 - \frac{1}{2}r^2\alpha = 2r^2\alpha$ $\alpha = \frac{2}{5}\pi$	M1 A1 [2]	For equating *their* 2 parts from (ii)

Q3.

2	(i)	slant length = 10 cm. circumference of base = 12π arc length = 10θ (= 12π) $\rightarrow \theta = 1.2\pi$ or 3.77 radians.	B1 B1 B1√ B1 [4]	Use of $r\theta$, θ calculated, not 6 or 8.
	(ii)	$\frac{1}{2}r^2\theta = 188.5$ cm ^{2} or 60π.	M1 A1√ [2]	Use of $\frac{1}{2}r^2\theta$ with radians and r = calculated '10', not 6 or 8.

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Q4.

6 **(i)**	area $\Delta = \frac{1}{2} \times 4 \times 4\tan\alpha$ oe soi	**B1**	$4\tan\alpha = \sqrt{16/\cos^2\alpha - 16}$. (Can also score in answer) Accept θ throughout
	Area sector $= \frac{1}{2} \times 2^2\alpha$ oe soi	**B1**	
	Shaded area $= 8\tan\alpha - 2\alpha$ cao	**B1** [3]	Little/no working – accept terms in answer
(ii)	$DC = \frac{4}{\cos\alpha} - 2$ oe soi	**B1**	
	Arc $DE = 2\alpha$ soi anywhere provided clear	**B1**	$\frac{4}{\cos\alpha} = \sqrt{16 + 16\tan^2\alpha}$. Can score in answer
	Perimeter $= \frac{4}{\cos\alpha} + 4\tan\alpha + 2\alpha$ cao	**B1** [3]	Little/no working – accept terms in answer

Q5.

2	Radius of semicircle $= \frac{1}{2}AB = r\sin\theta$	B1	aef
	Area of semicircle $= \frac{1}{2}\pi r^2\sin^2\theta = A_1$	B1√	Uses $\frac{1}{2}\pi r^2$ with $r = f(\theta)$
	Shaded area = semicircle – segment $= A_1 - \frac{1}{2}r^2 2\theta + \frac{1}{2}r^2\sin 2\theta$	B1B1 [4]	B1 (–sector), B1 for + (triangle)

Q6.

7	**(i)**	$BC^2 = r^2 + r^2 = 2r^2 \rightarrow BC = r\sqrt{2}$	**B1** [1]	**AG**
	(ii)	Area sector $BCFD = \frac{1}{4}\pi(r\sqrt{2})^2$ soi	**M1**	Expect $\frac{1}{2}\pi r^2$
		Area $\Delta BCAD = \frac{1}{2}(2r)r$	**M1**	Expect r^2 (could be embedded)
		Area segment $CFDA = \frac{1}{2}\pi r^2 - r^2$ .oe	**A1**	
		Area semi-circle $CADE = \frac{1}{2}\pi r^2$	**B1**	
		Shaded area $\frac{1}{2}\pi r^2 - \left(\frac{1}{2}\pi r^2 - r^2\right)$		
		or $\pi r^2 - \left(\frac{1}{2}\pi r^2 + \left(\frac{1}{2}\pi r^2 - r^2\right)\right)$	**DM1**	Depends on the area ΔBCD
		$= r^2$	**A1** [6]	

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Q7.

4	(i)	Sector $OCD = \frac{1}{2}(2r)^2\theta \ (= 2r^2\theta)$	B1	$2r^2\theta$ seen somewhere
		Sector(s) $OAB/OEF = (2)\frac{1}{2}r^2(\pi - \theta)$	B1	Accept with/without factor (2)
		Total $= r^2(\pi + \theta)$	B1 [3]	AG www
	(ii)	Arc $CD = 2r\theta$	B1	Accept with/without factor (2)
		Arc(s) AB/EF $(2)r(\pi - \theta)$	B1	
		Straight edges $= 4r$	B1	Must be simplified
		Total $2\pi r + 4r$ (which is independent of θ)	B1 [4]	

Q8.

6	(i)	$PT = r\tan\alpha$	B1	
		$QT = OT - OQ = \frac{r}{\cos\alpha} - r$		
		or $\sqrt{r^2 + r^2\tan^2\alpha} - r$	B1	
		Perimeter = sum of the 3 parts including $r\alpha$	B1 [3]	
	(ii)	Area of triangle = $\frac{1}{2} \times 10 \times 10\tan\frac{\pi}{3}$	M1	Correct formula used, $50\sqrt{3}$,86.6
		Area of sector = $\frac{1}{2} \times 10^2 \times \frac{1}{3}\pi$	M1	Correct formula used, $\frac{50\pi}{3}$, 52.36
		Shaded region has area 34 (2sf)	A1 [3]	

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Q9.

6	$BAC = \sin^{-1}(3/5)$ or $\cos^{-1}(4/5)$ or $\tan^{-1}(3/4)$ $ABC = \sin^{-1}(4/5)$ or $\cos^{-1}(3/5)$ or $\tan^{-1}(4/3)$ $ACB = \pi/2$ (Allow 90°) Shaded area = ΔABC – sectors ($AEF + BEG + CFG$) $\Delta ABC = \frac{1}{2} \times 4 \times 3$ oe Sum sectors $= \frac{1}{2}\left[3^2 0.6435\right) +$ $2^2 0.9273 + 1^2 1.5708]$ **OR** $\frac{\pi}{360}\left[3^2 36.8(7) + 2^2 53.1(3) + 1^2 90\right]$ $6 - 5.536 = 0.464$	**B1** **B1** **B1** **M1** **B1** **M1** **A1** [7]	Accept 36.8(7)° Accept 53.1(3)°