4722 Core Mathematics 2

			Mark	Total	
1		area of sector = ½ x 11^2 x 0.7	M1		Attempt sector area using (½) $r^2\theta$
		= 42.35	A1		Obtain 42.35, or unsimplified equiv, soi
		area of triangle = ½ x 11^2 x sin0.7 = 38.98	M1		Attempt triangle area using ½*ab*sin*C* or equiv, and
		hence area of segment = 42.35 – 38.98			subtract from attempt at sector
		= 3.37	A1	**4**	Obtain 3.37, or better
				$\boxed{4}$	
2		area $\approx \frac{1}{2}\times 2\times\left\{2+2\left(\sqrt{12}+\sqrt{28}\right)+\sqrt{52}\right\}$	M1		Attempt *y*-values at *x* = 1, 3, 5, 7 only
			M1		Correct trapezium rule, any *h*, for their *y* values to find area between *x* = 1 and *x* = 7
			M1		Correct *h* (soi) for their *y* values
		≈ 26.7	A1	**4**	Obtain 26.7 or better (correct working only)
				$\boxed{4}$	
3	**(i)**	$\log_a 6$	B1	**1**	State $\log_a 6$ cwo
	(ii)	$2\log_{10} x - 3\log_{10} y = \log_{10} x^2 - \log_{10} y^3$	M1*		Use *b* log *a* = log a^b at least once
		$= \log_{10} \frac{x^2}{y^3}$	M1dep*		Use log *a* - log *b* = log $^a/_b$
			A1	**3**	Obtain $\log_{10}\frac{x^2}{y^3}$ cwo
				$\boxed{4}$	
4	**(i)**	$\frac{BD}{\sin 62} = \frac{16}{\sin 50}$	M1		Attempt to use correct sine rule in Δ*BCD*, or equiv.
		BD = 18.4 cm	A1	**2**	Obtain 18.4 cm
	(ii)	$18.4^2 = 10^2 + 20^2 - 2$ x 10 x 20 x cos θ	M1		Attempt to use correct cosine rule in Δ*ABD*
		cos θ = 0.3998	M1		Attempt to rearrange equation to find cos *BAD* (from $a^2 = b^2 + c^2 \pm (2)bc\cos A$)
		θ = 66.4^0	A1	**3**	Obtain 66.4^0
				$\boxed{5}$	
5		$\int 12x^{\frac{1}{2}}\,dx = 8x^{\frac{3}{2}}$	M1		Attempt to integrate
			A1√		Obtain correct, unsimplified, integral following their f(*x*)
			A1		Obtain $8x^{\frac{3}{2}}$, with or without + *c*
		$y = 8x^{\frac{3}{2}} + c \Rightarrow 50 = 8\times 4^{\frac{3}{2}} + c$	M1		Use (4, 50) to find *c*
		$\Rightarrow c = -14$	A1√		Obtain *c* = -14, following $kx^{\frac{3}{2}}$ only
		Hence $y = 8x^{\frac{3}{2}} - 14$	A1	**6**	State $y = 8x^{\frac{3}{2}} - 14$ aef, as long as single power of *x*
				$\boxed{6}$	

			Mark	Total	
6	(i)	$u_1 = 7$	B1		Correct u_1
		$u_2 = 9$, $u_3 = 11$	B1	2	Correct u_2 and u_3
	(ii)	Arithmetic Progression	B1	1	Any mention of arithmetic
	(iii)	$\frac{1}{2} N (14 + (N-1) \times 2) = 2200$	B1		Correct interpretation of sigma notation
			M1		Attempt sum of AP, and equate to 2200
		$N^2 + 6N - 2200 = 0$	A1		Correct (unsimplified) equation
		$(N-44)(N+50) = 0$	M1		Attempt to solve 3 term quadratic in N
		hence $N = 44$	A1	5	Obtain $N = 44$ only ($N = 44$ www is full marks)
				$\boxed{8}$	
7	(i)	Some of the area is below the x-axis	B1	1	Refer to area / curve below x-axis or 'negative area'…
	(ii)		M1		Attempt integration with any one term correct
			A1		Obtain $\frac{1}{3}x^3 - \frac{3}{2}x^2$
		$\left[\frac{1}{3}x^3 - \frac{3}{2}x^2\right]_0^3 = \left(9 - \frac{27}{2}\right) - (0 - 0)$	M1		Use limits 3 (and 0) – correct order / subtraction
		$= -4\frac{1}{2}$	A1		Obtain (-)4½
		$\left[\frac{1}{3}x^3 - \frac{3}{2}x^2\right]_3^5 = \left(\frac{125}{3} - \frac{75}{2}\right) - \left(9 - \frac{27}{2}\right)$	M1		Use limits 5 and 3 – correct order / subtraction
		$= 8\frac{2}{3}$	A1		Obtain $8\frac{2}{3}$ (allow 8.7 or better)
		Hence total area is $13\frac{1}{6}$	A1	7	Obtain total area as $13\frac{1}{6}$, or exact equiv
					SR: if no longer $\int f(x)dx$, then B1 for using [0, 3] and [3, 5]
				$\boxed{8}$	
8	(i)	$u_4 = 10 \times 0.8^3$	M1		Attempt u_4 using ar^{n-1}
		$= 5.12$	A1	2	Obtain 5.12 aef
	(ii)	$S_{20} = \dfrac{10(1-0.8^{20})}{1-0.8}$	M1		Attempt use of correct sum formula for a GP
		$= 49.4$	A1	2	Obtain 49.4
	(iii)	$\dfrac{10}{1-0.8} - \dfrac{10(1-0.8^N)}{(1-0.8)} < 0.01$	M1		Attempt S_∞ using $\dfrac{a}{1-r}$
			A1		Obtain $S_\infty = 50$, or unsimplified equiv
		$50 - 50(1 - 0.8^N) < 0.01$	M1		Link $S_\infty - S_N$ to 0.01 and attempt to rearrange
		$0.8^N < 0.0002$ **A.G.**	A1		Show given inequality convincingly
		$\log 0.8^N < \log 0.0002$	M1		Introduce logarithms on both sides
		$N \log 0.8 < \log 0.0002$	M1		Use $\log a^b = b \log a$, and attempt to find N
		$N > 38.169$, hence $N = 39$	A1	7	Obtain $N = 39$ only
				$\boxed{11}$	

			Mark	Total	
9	**(i)**	$(90^o, 2), (-90^o, -2)$	B1		State at least 2 correct values
			B1	**2**	State all 4 correct values (radians is B1 B0)
	(ii)	**(a)** $180 - \alpha$	B1	**1**	State $180 - \alpha$
		(b) $-\alpha$ or $\alpha - 180$	B1	**1**	State $-\alpha$ or $\alpha - 180$ (radians or unsimplified is B1B0)
	(iii)	$2\sin x = 2 - 3\cos^2 x$			
		$2\sin x = 2 - 3(1 - \sin^2 x)$	M1		Attempt use of $\cos^2 x = 1 - \sin^2 x$
		$3\sin^2 x - 2\sin x - 1 = 0$	A1		Obtain $3\sin^2 x - 2\sin x - 1 = 0$ aef with no brackets
		$(3\sin x + 1)(\sin x - 1) = 0$	M1		Attempt to solve 3 term quadratic in $\sin x$
		$\sin x = -{}^1/_3$, $\sin x = 1$	A1		Obtain $x = -19.5^o$
		$x = -19.5^o, -161^o, 90^o$	A1√		Obtain second correct answer in range, following their x
			A1	**6**	Obtain 90^o (radians or extra answers is max 5 out of 6) SR: answer only (and no extras) is B1 B1√ B1
				$\boxed{10}$	
10	**(i)**	$(2x + 5)^4 = (2x)^4 + 4(2x)^3 5 + 6(2x)^2 5^2 + 4(2x)5^3 + 5^4$	M1*		Attempt expansion involving powers of $2x$ and 5 (at least 4 terms)
		$= 16x^4 + 160x^3 + 600x^2 + 1000x + 625$	M1*		Attempt coefficients of 1, 4, 6, 4, 1
			A1dep*		Obtain two correct terms
			A1	**4**	Obtain a fully correct expansion
	(ii)	$(2x + 5)^4 - (2x - 5)^4 = 320x^3 + 2000x$	M1		Identify relevant terms (and no others) by sign change oe
			A1	**2**	Obtain $320x^3 + 2000x$ cwo
	(iii)	$9^4 - (-1)^4 = 6560$ and $7360 - 800 = 6560$ **A.G.**	B1		Confirm root, at any point
		$320x^3 - 1680x + 800 = 0$	M1		Attempt complete division by $(x - 2)$ or equiv
		$4x^3 - 21x + 10 = 0$	A1√		Obtain quotient of $ax^2 + 2ax + k$, where a is their coeff of x^3
		$(x - 2)(4x^2 + 8x - 5) = 0$	A1		Obtain $(4x^2 + 8x - 5)$ (or multiple thereof)
		$(x - 2)(2x - 1)(2x + 5) = 0$	M1		Attempt to solve quadratic
		Hence $x = ½$, $x = -2½$	A1	**6**	Obtain $x = ½$, $x = -2½$ SR: answer only is B1 B1
				$\boxed{12}$	