Mark Scheme 4722
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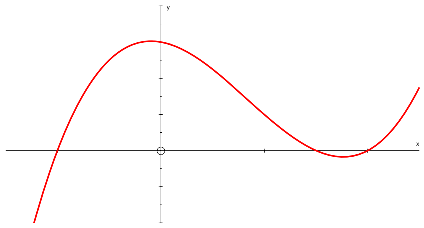
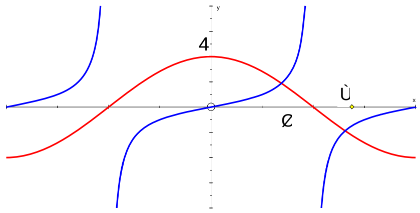
1	(i)	$a+19d=10, \quad a+49d=70$	M1		Attempt to find d from simultaneous equations involving $a+(n-1)d$ or equiv method
		Hence $30d=60 \Rightarrow d=2$	A1		Obtain $d = 2$
		a + (19 x 2) = 10 or a + (49 x 2) = 70	M1		Attempt to find a from $a+(n-1)d$ or equiv
		Hence $a = -28$	A1	**4**	Obtain $a = -28$
	(ii)	$S=\frac{29}{2}\left(2\times -28+(29-1)\times 2\right)=0$	M1		For relevant use of $\frac{1}{2}n\left(2a+(n-1)d\right)$
			A1	**2**	For showing the given result correctly **AG**
				6	
2	(i)	$\Delta=\frac{1}{2}\times 10\times 7\times \sin 80=34.5\text{cm}^2$	M1		For use of $\frac{1}{2}ca\sin B$ or complete equiv.
			A1	**2**	For correct value 34.5
	(ii)	$b^2=10^2+7^2-2\times 10\times 7\times \cos 80$	M1		For attempted use of the correct cosine formula
		Hence length of CA is 11.2 cm	A1	**2**	For correct value 11.2
	(iii)	$\sin C=\frac{10\sin 80}{11.166...}=0.8819...$	M1		For use of the sine rule to find C, or equivalent
		Hence angle C is 61.9°	A1	**2**	For correct value 61.9
				6	
3	(i)	$(1-2x)^{12}=1-24x+264x^2$	B1		Obtain 1 and $-24x$ …
			M1		Attempt x^2 term, including attempt at binomial coeff.
			A1	**3**	Obtain …$264x^2$
	(ii)	$(1\times 264)+(3\times -24)=192$	M1		Attempt coefficient of x^2 from two pairs of terms
			A1√		Obtain correct unsimplified expression
			A1	**3**	Obtain 192
				6	
4	(i)	$\text{perimeter}=(15\times 1.8)+(20\times 1.8)+5+5$	M1		Use $r\theta$ at least once
			A1		Obtain at least one of 27cm or 36cm
		$=73\text{cm}$	A1	**3**	Obtain 73
	(ii)	$\text{area}=\left(\frac{1}{2}\times 20^2\times 1.8\right)-\left(\frac{1}{2}\times 15^2\times 1.8\right)$	M1		Attempt area of sector using $kr^2\theta$
			M1		Find difference between attempts at two sectors
		$=157.5\text{cm}^2$	A1	**3**	Obtain 157.5 / 158
				6	

5	(i)	$r=\frac{4.8}{5}=0.96 \Rightarrow S_\infty=\frac{5}{0.04}=125$	B1* B1 dep*	 **2**	For correct value of r used For correct use of $\frac{a}{1-r}$ to show given answer **AG**
	(ii)	$S_n = \frac{5(1-0.96^n)}{1-0.96}$ Hence $1-0.96^n > 0.992 \Rightarrow 0.96^n < 0.008$ n log0.96<log 0.008 Hence $n > \frac{\log 0.008}{\log 0.96} \approx 118.3$ Least value of n is 119	B1 M1 A1 B1 M1 A1	 **6** **8**	For correct, unsimplified, S_n For linking S_n to 124 (> or =) and multiplying through by 0.04, or equiv. For showing the given result correctly, with correct inequality throughout **AG** For correct log statement seen or implied (ignore sign) For dividing both sides by log 0.96 For correct (integer) value 119
6	(a)	$\frac{2}{3}x^{\frac{3}{2}}+4x+c$	M1 A1 B1 B1	 **4**	For $kx^{\frac{3}{2}}$ For correct first term $\frac{2}{3}x^{\frac{3}{2}}$, or equiv For correct second term $4x$ For $+c$
	(b)(i)	$\int_1^a 4x^{-2}dx = \left[-4x^{-1}\right]_1^a$ $=4-\frac{4}{a}$	M1 M1 A1	 **3**	Obtain integral of the form kx^{-1} Use limits $x = a$ and $x = 1$ Obtain $=4-\frac{4}{a}$, or equivalent
	(ii)	4	B1√	**1** **8**	State 4, or legitimate conclusion from their (b)(i)
7	(i)(a)	$\log_{10}x - \log_{10}y$	B1	**1**	For the correct answer
	(b)	$1 + 2\log_{10}x + \log_{10}y$	M1 A1 A1	 **3**	Sum of three log terms involving 10, x^2, y For correct term $2\log_{10}x$ For both correct terms 1 and $\log_{10}y$
	(ii)	$2\log_{10}x - 2\log_{10}y = 2 + 2\log_{10}x + \log_{10}y$ Hence $3\log_{10}y = -2$ So $y=10^{-\frac{2}{3}} \approx 0.215$	M1 A1 M1 A1	 **4** **8**	For relevant use of results from (i) For a correct, unsimplified, equation in $\log_{10}y$ only For correct use of $a=\log_{10}c \Leftrightarrow c=10^a$ For the correct value 0.215

8	(i)	$-2+k+1+6=0 \Rightarrow k=-5$	M1 A1		For attempting f(–1) For equating f(-1) to 0 and deducing the correct value of *k* **AG**
		OR	M1 A1		Match coefficients and attempt *k* Show *k* = -5
		OR	B2		Following division, state remainder is 0, hence (x + 1) **is** a factor, hence *k* = -5
		EITHER: $(x+1)(2x^2-7x+6)$	B1 M1 A1		For correct leading term $2x^2$ For attempt at complete division by f(x) by (x + 1) or equiv. For completely correct quadratic factor
		$=(x+1)(x-2)(2x-3)$	A1		For all three factors correct
		OR: f(2) = 16 – 20 – 2 + 6 = 0 Hence (x – 2) is a factor Third factor is (2x – 3) Hence f(x) $=(x+1)(x-2)(2x-3)$	M1 A1 M1 A1	6	For further relevant use of the factor theorem For correct identification of factor (x – 2) For any method for the remaining factor For all three factors correct
	(ii)	$\int_{-1}^{2} f(x)dx = \left[\frac{1}{2}x^4-\frac{5}{3}x^3-\frac{1}{2}x^2+6x\right]_{-1}^{2}$	B1√ B1√		For any two terms integrated correctly For all four terms integrated correctly
		$=\left(8-\frac{40}{3}-2+12\right)-\left(\frac{1}{2}+\frac{5}{3}-\frac{1}{2}-6\right)$	M1		For evaluation of F(2) – F(–1)
		= 9	A1	4	For correct value 9
	(iii)		B1 B1	2	For sketch of positive cubic, with three distinct, non-zero, roots For correct explanation that some of the area is below the axis
				12	
9	(i)		B1 B1 B1	3	For correct sketch of one curve For correct shape and location of second curve, on same diagram For intercept 4 on *y*-axis
	(ii)	(See diagram above) $\beta = 180 - \alpha$	B1 M1 A1	3	For correct identification of intersections – in correct order For attempt to use symmetry of the graphs For the correct (explicit) answer for β
	(iii)	$\sin x = 4\cos^2 x = 4(1-\sin^2 x)$	M1 M1		For use of $\tan x = \frac{\sin x}{\cos x}$ For use of $\cos^2 x = 1-\sin^2 x$
		Hence $4\sin^2 x + \sin x - 4 = 0$	A1		For showing the given equation correctly
		$\sin x = \frac{-1\pm\sqrt{65}}{8}$	B1		For correct solution of quadratic
		Hence $\beta - \alpha = 118.02... - 61.97... \approx 56^\circ$	M1 A1	6	Attempt value for x from their solutions For the correct value 56
				1	

				2