Mark Scheme 4722
June 2006

1		$(3x-2)^4 = 81x^4 - 216x^3 + 216x^2 - 96x + 16$	M1 A1 A1 A1	4 **4**	Attempt binomial expansion, including attempt at coeffs. Obtain one correct, simplified, term Obtain a further two, simplified, terms Obtain a completely correct expansion
2	(i)	$u_2 = -1, u_3 = 2, u_4 = -1$	B1 B1	2	For correct value –1 for u_2 For correct values for both u_3 and u_4
	(ii)	Sum is $(2+(-1))+(2+(-1))+...+(2+(-1))$ i.e. $50\times(2+(-1))=50$	M1 M1 A1	3 **5**	For correct interpretation of Σ notation For pairing, or $50\times2-50\times1$ For correct answer 50
3		$y = 4x^{\frac{1}{2}} + c$ Hence $5 = 4\times4^{\frac{1}{2}} + c \Rightarrow c = -3$ So equation of the curve is $y = 4x^{\frac{1}{2}} - 3$	M1 A1 A1 M1 A1√ A1	6 **6**	For attempt to integrate For integral of the form $kx^{\frac{1}{2}}$ For $4x^{\frac{1}{2}}$, with or without +*c* For relevant use of (4, 5) to evaluate *c* For correct value –3 (or follow through on integral of form $kx^{\frac{1}{2}}$) For correct statement of the equation in full (aef)
4	(i)	Intersect where $x^2 + x - 2 = 0 \Rightarrow x = -2, 1$	M1 A1	2	For finding *x* at both intersections For both values correct
	(ii)	Area under curve is $\left[4x - \frac{1}{3}x^3\right]_{-2}^{1}$ i.e. $\left(4-\frac{1}{3}\right)-\left(-8+\frac{8}{3}\right)=9$ Area of triangle is 4½ Hence shaded area is 9 – 4½ = 4½	M1 M1 A1 M1 A1 A1	6	For integration attempt with any one term correct For use of limits – subtraction and correct order For correct area of 9 Attempt area of triangle (½*bh* or integration) Obtain area of triangle as 4 ½ Obtain correct final area of 4 ½
		OR Area under curve is $\int_{-2}^{1}(2-x-x^2)\,dx$ $= \left[-\frac{1}{3}x^3 - \frac{1}{2}x^2 + 2x\right]_{-2}^{1}$ $= \left(-\frac{1}{3}-\frac{1}{2}+2\right)-\left(\frac{8}{3}-2-4\right)$ $= 4\frac{1}{2}$	M1 M1 A1 M1 A1 A1	**8**	Attempt subtraction – either order For integration attempt with any one term correct Obtain $\pm\left[-\frac{1}{3}x^3 - \frac{1}{2}x^2 + 2x\right]$ For use of limits – subtraction and correct order Obtain ± 4 ½ - consistent with their order of subtraction Obtain 4 ½ only, following correct method only

5	(i)	$\sin^2 x = 1 - \cos^2 x \Rightarrow 2\cos^2 x + \cos x - 1 = 0$ Hence $(2\cos x - 1)(\cos x + 1) = 0$ $\cos x = \frac{1}{2} \Rightarrow x = 60^\circ$ $\cos x = -1 \Rightarrow x = 180^\circ$	M1 M1 A1 A1	4	For transforming to a quadratic in cos x For solution of a quadratic in cos x For correct answer 60^{o} For correct answer 180^{o} [Max 3 out of 4 if any extra answers present in range, or in radians] **SR** answer only is B1, B1 justification – ie graph or substitution is B2, B2
	(ii)	$\tan 2x = -1 \Rightarrow 2x = 135 \text{ or } 315$ Hence $x = 67.5^\circ \text{ or } 157.5^\circ$	M1 M1 A1 A1	4	For transforming to an equation of form tan2x = k For correct solution method, i.e. inverse tan followed by division by 2 For correct value 67.5 For correct value 157.5
		OR $\sin^2 2x = \cos^2 2x$ $2\sin^2 2x = 1$ $2\cos^2 2x = 1$ $\sin 2x = \pm\frac{1}{2}\sqrt{2}$ $\cos 2x = \pm\frac{1}{2}\sqrt{2}$ Hence $x = 67.5^\circ \text{ or } 157.5^\circ$	M1 M1 A1 A1	8	Obtain linear equation in cos 2x or sin 2x Use correct solution method For correct value 67.5 For correct value 157.5 [Max 3 out of 4 if any extra answers present in range, or in radians] **SR** answer only is B1, B1 justification – ie graph or substitution is B2, B2
6	(i)	(a) $100 + 239 \times 5 = £1295$	M1 A1	2	For relevant use of $a + (n - 1)d$ For correct value 1295
		(b) $\frac{1}{2} \times 240 \times (100 + 1295) = £167400$	M1 A1	2	For relevant use of $\frac{1}{2}n(a+l)$ or equivalent For correct value 167400
	(ii)	$100r^{239} = 1500 \Rightarrow r = 1.01139...$ Hence total is $\frac{100(1.01139^{240} - 1)}{1.01139 - 1} = £124359$	B1 M1 A1 M1 A1	5 9	For correct statement of $100r^{239} = 1500$ Attempt to find r For correct value 1.01 For relevant use of GP sum formula For correct value 124359 (3 s.f. or better)

7	(i)	$AC^2 = 11^2 + 8^2 - 2\times11\times8\times\cos 0.8$ $= 62.3796...$ Hence AC=7.90 cm	M1 A1 A1	**3**	Attempt to use the cosine formula Correct unsimplified expression Show the given answer correctly
	(ii)	Area of sector = $\frac{1}{2}\times7.90^2\times1.7 = 53.0$ Area of triangle = $\frac{1}{2}\times7.90^2\times\sin1.7 = 30.9$ Hence shaded area = 22.1 cm^2	M1 M1 A1	**3**	Attempt area of sector using $\left(\frac{1}{2}\right)r^2\theta$ Attempt area of ΔACD, using $\left(\frac{1}{2}\right)r^2\sin\theta$, or equiv Obtain 22.1
	(iii)	(arc) $DC = 7.90\times1.7 = 13.4$ (line) $DC^2 = 7.90^2 + 7.90^2 - 2\times7.90\times7.90\times\cos1.7$ $DC = 11.9$ Hence perimeter = 25.3cm	M1 A1 M1 A1	**4** **<u>10</u>**	Use $r\theta$ to attempt arc length Obtain 13.4 Attempt length of line *DC* using cosine rule or equiv. Obtain 25.3
8	(i)	$f(2) = 12 \Rightarrow 4a + 2b = 6$ $f(-1) = 0 \Rightarrow a - b = 12$ Hence a = 5, b = –7	M1 A1 M1 A1 M1 A1	**6**	For equating f(2) to 12 For correct equation 4a + 2b = 6 For equating f(–1) to 0 For correct equation a – b = 12 For attempt to find a and b For both values correct
	(ii)	Quotient is $2x^2 + x - 9$ Remainder is 8	B1 M1 A1 M1 A1	**5** **<u>11</u>**	For correct lead term of 2x^2 For complete division attempt or equiv For completely correct quotient For attempt at remainder – either division or f(–2) For correct remainder

9	(i)		M1 A1 B1	 3	Attempt sketch of any exponential graph, in at least first quadrant Correct graph – must be in both quadrants For identification of (0, 1)
	(ii)	$A \approx \frac{1}{2}\times 0.5\times\left\{1+2\left(0.5^{\frac{1}{2}}+0.5+0.5^{\frac{3}{2}}\right)+0.5^{2}\right\}$ ≈ 1.09	B1 M1 A1 A1	 4	State, or imply, at least three correct *y*-values For correct use of trapezium rule, inc correct *h* For correct unsimplified expression For the correct value 1.09, or better
	(iii)	$\left(\frac{1}{2}\right)^x = \frac{1}{6} \Rightarrow x\log_{10}\frac{1}{2} = \log_{10}\frac{1}{6}$ $x = \frac{\log_{10}\frac{1}{6}}{\log_{10}\frac{1}{2}} = \frac{-\log_{10}6}{-\log_{10}2}$ Hence $= \frac{\log_{10}2+\log_{10}3}{\log_{10}2}$ $= 1+\frac{\log_{10}3}{\log_{10}2}$	M1 A1 M1 A1	 4	For equation $\left(\frac{1}{2}\right)^x = \frac{1}{6}$ and attempt at logs Obtain $x\log\left(\frac{1}{2}\right)=\log\left(\frac{1}{6}\right)$, or equivalent For use of log 6 = log 2 + log 3 For showing the given answer correctly
		OR $\left(\frac{1}{2}\right)^x = \frac{1}{6} \Rightarrow 2^x = 6$ $\Rightarrow x\log_{10}2 = \log_{10}6$ $x = \frac{\log_{10}6}{\log_{10}2}$ $= \frac{\log_{10}2+\log_{10}3}{\log_{10}2}$ $= 1+\frac{\log_{10}3}{\log_{10}2}$	M1 A1 M1 A1		For equation $2^x = 6$ and attempt at logs Obtain *x* log 2 = log 6, or equivalent For use of log 6 = log 2 + log 3 For showing the given answer correctly
		OR $\left(\frac{1}{2}\right)^x = \frac{1}{6} \Rightarrow 2^x = 6$ $2^{x-1} = 3$ $(x-1)\log_{10}2 = \log_{10}3$ Hence $x = 1+\frac{\log_{10}3}{\log_{10}2}$	M1 A1 M1 A1		Attempt to rearrange equation to $2^n = 3$ Obtain $2^{x-1} = 3$ For attempt at logs For showing the given answer correctly
		OR $x = \frac{\log_{10}2+\log_{10}3}{\log_{10}2}$ $= \frac{\log_{10}6}{\log_{10}2}$ $x\log_{10}2 = \log_{10}6$ $\log_{10}2^x = \log_{10}6$ $2^x = 6$ $\left(\frac{1}{2}\right)^x = \frac{1}{6}$	M1 A1 M1 A1	 **11**	Use log 2 + log 3 = log 6 Obtain *x*log 2 = log 6 Attempt to remove logarithms Show $\left(\frac{1}{2}\right)^x = \frac{1}{6}$ correctly