

1	$(3 + 2x)^3 = 27 + 54x + 36x^2 + 8x^3$	M1	For recognisable binomial expansion attempt
		A1	For any two terms correct, possibly unsimplified
		A1	For all four terms correct and simplified
	$(3 - 2x)^3 = 27 - 54x + 36x^2 - 8x^3$	B1√	For changing the appropriate signs
	Hence $(3 + 2x)^3 - (3 - 2x)^3 = 108x + 16x^3$	A1	5 For answer $108x + 16x^3$ or $4x(27 + 4x^2)$

5

2	(i) $u_2 = -1, u_3 = \frac{1}{2}, u_4 = 2, u_5 = -1$	B1	For correct value -1 for u_2
		B1√	For correct u_3 from their u_2
		B1√	3 For correct u_4 and u_5 from their u_3 and u_4

	(ii) u_1, u_4, u_7, \dots etc all have the value 2	B1	For recognising the repeating property
	Hence $u_{199} = 2$, giving $u_{200} = -1$	M1	For division by 3, or equivalent
		A1	For correctly linking relevant term to a term already found
		A1	4 For the correct answer -1

(SR - Answer only is B1)

7

3	(i) $\frac{LB}{\sin 65^\circ} = \frac{200}{\sin 35^\circ}$ OR $\frac{LA}{\sin 80^\circ} = \frac{200}{\sin 35^\circ}$	M1	For correct use of the sine rule in $\triangle LAB$ (could be in ii)
	$\Rightarrow LB = 316.0198\dots$ $\Rightarrow LA = 343.39\dots$	A1	For correct value of (or explicit expression for) LB or LA
	Hence $p = LB \sin 80^\circ = 311 \text{ m}$ $p = LA \sin 65^\circ = 311 \text{ m}$	M1	For calculation of perpendicular distance
		A1	4 For correct distance (rounding to) 311

	(ii) $LC^2 = 200^2 + 316^2 - 2 \times 200 \times 316 \times \cos 100^\circ$	M1	For use of cosine rule in $\triangle LBC$ or LAC
	(or $LC^2 = 400^2 + 343^2 - 2 \times 400 \times 343 \times \cos 65^\circ$)	A1√	For correct unsimplified numerical expression for LC^2 following their LA or LB
	Hence $LC = 402 \text{ m}$	A1	3 For correct distance (rounding to) 402

7

4	(i) $\frac{16}{1^2} = 16$ and $16 = 17 - 1^2$ stated		
	$1 = \frac{16}{4^2}$ and $1 = 17 - 4^2$ stated	B1	1 For complete verification for both points

	(ii) Area is $\int_1^4 \left(17 - x^2 - \frac{16}{x^2} \right) dx$	M1	For appropriate subtraction (at any stage) – correct order
	$= \left[17x - \frac{1}{3}x^3 + \frac{16}{x} \right]_1^4$	*M1	For integration attempt with any one term OK
		A1	For $17x - \frac{1}{3}x^3$ completely correct
		M1	For correct form kx^{-1} for third term
		A1	For correct k , for their stage of working
	$= 68 - \frac{64}{3} + 4 - 17 + \frac{1}{3} - 16 = 18$	M1dep*M	For use of limits – correct order
		A1	7 For correct answer 18

8

Pre-Standardisation Mark Scheme

4722/01

January 2005

5	(i) $\sin \theta \tan \theta = \sin \theta \times \frac{\sin \theta}{\cos \theta} = \frac{1 - \cos^2 \theta}{\cos \theta}$	M1	For use of $\tan \theta = \frac{\sin \theta}{\cos \theta}$
		M1	For use of $\cos^2 \theta + \sin^2 \theta = 1$
	Hence $1 - \cos^2 \theta = \cos \theta (\cos \theta + 1)$, i.e. $2 \cos^2 \theta + \cos \theta - 1 = 0$, or equiv	A1	3 For showing given equation correctly

	(ii) $(2 \cos \theta - 1)(\cos \theta + 1) = 0$	M1	For solution of quadratic equation in $\cos \theta$
	Hence $\cos \theta = \frac{1}{2}$ or -1	A1	For both values of $\cos \theta$ correct
	So $\theta = 60^\circ, 300^\circ, 180^\circ$	A1	For correct answer 60°
		A1	For correct answer 180°
		A1√	5 For a correct non-principal-value answer, following their value of $\cos \theta$ (excluding $\cos \theta = -1, 0, 1$) and no other values for θ .

8

6	(a) $\int (x^3 + 2x) dx = \frac{1}{4}x^4 + x^2 + c$	M1	For expanding and integration attempt
		A1	For $\frac{1}{4}x^4 + x^2$ correct
		B1	3 For addition of an arbitrary constant (this mark can be given in (b)(i) if not earned here), and no dx in either

	(b) (i) $\int x^{-\frac{1}{2}} dx = 2x^{\frac{1}{2}} + c$	B1	For use of $\frac{1}{\sqrt{x}} = x^{-\frac{1}{2}}$
		M1	For integral of the form $kx^{\frac{1}{2}}$
		A1	3 For correct term $2x^{\frac{1}{2}}$

	(ii) $0 = 2\sqrt{4} + c \Rightarrow c = -4$	M1	For use of $x = 4, y = 0$ to evaluate c
		A1t	For correct c from their answer in (b)(i)
	Hence curve is $y = 2x^{\frac{1}{2}} - 4$	A1t	3 For equation of the curve correctly stated

9

7	(i) Length of OD is 6 cm	B1	For stating or using the correct value of r
	Angle DOE is $\frac{1}{3}\pi / 1.047^\circ / 60^\circ / \frac{1}{6}$ of circle	B1	For stating or using the correct angle
	Hence arc length DE is 2π cm (allow 6.28 cm)	B1	For correct use of $s = r\theta$ or equiv in degrees
	Area is $\frac{1}{2} \times 6^2 \times \frac{1}{3}\pi = 6\pi \text{ cm}^2$ (or $\frac{60}{360} \times \pi \times 6^2$)	B1	4 For obtaining the given answer 6π correctly

	(ii) Area of small triangle is $\frac{1}{2} \times 6^2 \times \frac{1}{2}\sqrt{3} = 9\sqrt{3}$	*M1	For use of $\Delta = \frac{1}{2}ab \sin C$, or equivalent
		A1	For correct value $9\sqrt{3}$, or equiv
	Area of segment is $6\pi - 9\sqrt{3}$	M1dep*M	For relevant use of (sector - triangle)
	Hence shaded area is $(18\sqrt{3} - 6\pi) \text{ cm}^2$	A1	4 For correct answer $18\sqrt{3} - 6\pi$, or exact equiv
		*M1	Scheme for alternative approaches: Attempt area of big triangle / rhombus / segment, using $\Delta = \frac{1}{2}ab \sin C$, or equivalent
		A1	Correct area
		M1dep*M	Relevant subtraction
		A1	For correct answer $18\sqrt{3} - 6\pi$

8

8	(i) (a) Sketch showing exponential growth Intersection with y-axis is (0, 1)	M1	For correct shape in at least 1 st quadrant
		A1	2 For 1st and 2nd quadrants, and y-coordinate 1 stated

	(b) Sketch showing exponential decay Intersection with y-axis is (0, 2)	M1	For correct shape in at least 1 st quadrant
		A1	2 For 1st and 2nd quadrants, and y-coordinate 2 stated

(ii)	$a^x = 2b^x$ Hence $x \log_2 a = \log_2 2 + x \log_2 b$	B1	For stating the equation in x
		M1	For taking logs (any base)
		M1	For use of one log law
		M1	For use of a second log law
		A1	5 For showing the given answer correctly
	i.e. $x = \frac{1}{\log_2 a - \log_2 b}$		

9

9	(i) $ar^3 - a = 4(ar^2 - ar)$ Hence $r^3 - 4r^2 + 4r - 1 = 0$	M1	For using ar^{n-1} to form an equation
		A1	2 For showing the given equation correctly

(ii)	$1 - 4 + 4 - 1 = 0$ Factors are $(r-1)(r^2 - 3r + 1)$	B1	For correct substitution of $r = 1$, or state no remainder
		M1	For attempted division, or equivalent
		A1	3 For correct factor $r^2 - 3r + 1$

(iii)	$r = \frac{3 \pm \sqrt{5}}{2}$	M1	For solving the relevant quadratic equation
		A1	2 For correct roots in exact form

(iv)	The relevant value of r is $\frac{3 - \sqrt{5}}{2}$ (or decimal equiv) B1 Hence $S_\infty = \frac{a}{1 - \frac{1}{2}(3 - \sqrt{5})}$ $= \frac{2a}{-1 + \sqrt{5}} = \frac{2a(-1 - \sqrt{5})}{(-1 + \sqrt{5})(-1 - \sqrt{5})}$ $= \frac{1}{2}a(1 + \sqrt{5})$	M1	For selecting the appropriate value of r
		M1	For relevant use of $\frac{a}{1-r}$
		M1	For correct process for rationalising, using two term surd expression
		A1	4 For showing the given answer correctly

11