Mark Scheme 4752
June 2007

1	(i) $-\sqrt{3}$ (ii) $\frac{5}{3}\pi$	1 2	Accept any exact form accept $\frac{5\pi}{3}$, $1\frac{2}{3}\pi$. M1 π rad = 180° used correctly	3
2	$y' = 6 \times \frac{3}{2} x^{\frac{1}{2}}$ or $9x^{\frac{1}{2}}$ o.e. $y'' = \frac{9}{2} x^{-\frac{1}{2}}$ o.e. $\sqrt{36} = 6$ used interim step to obtain $\frac{3}{4}$	2 1 M1 A1	1 if one error in coeff or power, or extra term f.t. their y′ only if fractional power f.t. their y″ www answer given	5
3	(i) $y = 2f(x)$ (ii) $y = f(x - 3)$	2 2	1 if 'y=' omitted [penalise only once] M1 for $y = kf(x)$, $k > 0$ M1 for $y = f(x + 3)$ or $y = f(x - k)$	4
4	(i) 11 27 or ft from their 11 (ii) 20	1 1 2	 M1 for $1 \times 2 + 2 \times 3 + 3 \times 4$ soi, or 2,6,12 identified, or for substituting n = 3 in standard formulae	4
5	$\theta = 0.72$ o.e 13.6 [cm]	2 3	M1 for $9 = \frac{1}{2} \times 25 \times \theta$ No marks for using degrees unless attempt to convert B2 ft for $10 + 5 \times$ their θ or for 3.6 found or M1 for $s = 5\,\theta$ soi	5
6	(i) $\log_a 1 = 0$, $\log_a a = 1$ (ii) showing both sides equivalent	1+1 3	NB, if not identified, accept only in this order M1 for correct use of 3rd law and M1 for correct use of 1st or 2nd law. Completion www A1. Condone omission of *a*.	5
7	(i) curve with increasing gradient any curve through (0, 1) marked (ii) 2.73	G1 G1 3	correct shape in both quadrants M1 for $x \log 3 = \log 20$ (or $x = \log_3 20$) and M1 for $x = \log 20 \div \log 3$ or B2 for other versions of 2.726833.. or B1 for other answer 2.7 to 2.8	5
8	(i) $2(1 - \sin^2\theta) + 7\sin\theta = 5$ (ii) $(2\sin\theta - 1)(\sin\theta - 3)$ $\sin\theta = \frac{1}{2}$ 30° and 150°	1 M1 DM1 A1 A1	for $\cos^2\theta + \sin^2\theta = 1$ o.e. used 1st and 3rd terms in expansion correct f.t. factors B1,B1 for each solution obtained by any valid method, ignore extra solns outside range, 30°, 150° plus extra soln(s) scores 1	5

9	**i**	$y' = 6x^2 - 18x + 12$ $= 12$ $y = 7$ when $x = 3$ tgt is $y - 7 = 12(x - 3)$ verifying $(-1, -41)$ on tgt	M1 M1 B1 M1 A1	condone one error subst of $x = 3$ in their y' f.t. their y and y' or B2 for showing line joining (3, 7) and $(-1, -41)$ has gradient 12	5
	ii	$y' = 0$ soi quadratic with 3 terms $x = 1$ or 2 $y = 3$ or 2	M1 M1 A1 A1	Their y' Any valid attempt at solution or A1 for (1, 3) and A1 for (2,2) marking to benefit of candidate	4
	iii	cubic curve correct orientation touching x- axis only at (0.2,0) max and min correct curve crossing y axis only at -2	G1 G1 G1	 f.t.	3
10	**i**	970 [m]	4	M3 for attempt at trap rule ½×10×(28+22+2[19+14+11+12+16]) M2 with 1 error, M1 with 2 errors. Or M3 for 6 correct trapezia, M2 for 4 correct trapezia, M1 for 2 correct trapezia.	4
	ii	concave curve or line of traps is above curve (19+14+11 +11+12+16) × 10 830 to 880 incl.[m]	1 M1 A1	Accept suitable sketch M1 for 3 or more rectangles with values from curve.	3
	iii	$t = 10$, $v_{\text{model}} = 19.5$ difference = 0.5 compared with 3% of 19 = 0.57	B1 B1f.t.	or $\dfrac{0.5}{19} \times 100 \approx 2.6$	2
	iv	$28t - \frac{1}{2}t^2 + 0.005t^3$ o.e. value at 60 [− value at 0] 960	M1 M1 A1	2 terms correct, ignore + c ft from integrated attempt with 3 terms	3
11	**ai**	13	1		1
	aii	120	2	M1 for attempt at AP formula ft their a, d or for 3 + 5 + …+ 21	2
	bi	$\dfrac{125}{1296}$	2	M1 for $\dfrac{1}{6} \times \left(\dfrac{5}{6}\right)^3$	2
	ii	$a = 1/6$, $r = 5/6$ s.o.i. $S_\infty = \dfrac{\frac{1}{6}}{1 - \frac{5}{6}}$ o.e.	1+1 1	If not specified, must be in right order	3
	iii	$\left(\frac{5}{6}\right)^{n-1} < 0.006$ $(n-1)\log_{10}\left(\frac{5}{6}\right) < \log_{10} 0.006$ $n - 1 > \dfrac{\log_{10} 0.006}{\log_{10}\left(\frac{5}{6}\right)}$ $n_{\min} = 30$ Or $\log(1/6) + \log(5/6)^{n-1} < \log 0.001$ $(n-1)\log(5/6) < \log(0.001/(1/6))$	M1 M1 DM1 B1 M1 M1	 condone omission of base, but not brackets NB change of sign must come at correct place	4