Mark Scheme

Section A

1	$6x^5 + \frac{1}{2}x^{-\frac{1}{2}}$ o.e.	B1	$6x^5$	
		B1	$x^{\frac{1}{2}}$ soi	
		B1	$\frac{1}{2}x^{-\frac{1}{2}}$ isw	3
2	$x^4/4$	B1		
	$\frac{x^{-2}}{-2}$	B2	B1 for kx^{-2}	
	c	B1		4
3	At least 1 period of sine curve	G1		
	Sine curve from 0 to 360	G1	± 1 indicated	
	191.537 rot to 3 or more sf	B1	After B1 B1, -1 for extras in the range	
	348.463 rot to 3 or more sf	B1	SC1 for 192.8 and 347.2 (grads)	4
			SC1 for 180.2 and 359.8 (radians)	
4	9.0 or 8.96 or 8.960	B3	M1 for	
			$[BC^2=]6.8^2+4.1^2-2\times4.1\times6.8\times\cos108$	
			A1 for 80.2(8..), 8.37(grads), 6.49 (rads)	
	13.2577	B2	Correctly rounded to 3 or more sf	5
			M1 for $0.5\times4.1\times6.8\times\sin108$	
			For complete long methods using BC,	
			allow M1 and A1 for 13.2 to 13.3	**[16]**
5	$a = 4$, $r = 1/2$ identified	B1	Stated or identified by correct use	
	2^{-17}	T2	M1 20th term = their(a)x(their r)^{19}	
	8	S2	M1 S = their (a) / (1−their (r))	5
6	4, 7, 10, 13, 16 ignore extras	B1	For showing 1st four or 2nd four terms	
	15250	B4	B1 for d = 3 soi	
			B1 for $a = 4$ soi	5
			M1 for use of 100/2[2a + 99d] o.e.	
7	(i) 2.4, $2\frac{2}{5}$, $\frac{12}{5}$	B3	M1 for $30 = \frac{1}{2} \times 25 \times q$ o.e.	
			M1 for $q = (2 \times 30) / 5^2$	5
	(ii) 22	P2	M1 for (arc =)5 x their 2.4	
8	(i) 2.5, 2.50, 2.500, 2.499..	B2	M1 for $\log_{10} 316$ or ln 316/ln 10	
	(ii) 6 www	B3	B2 for $6 \log_a a$ or $\log_a(a^6)$	
			Or B1 for $2\log_a(a)$ or $-\log_a a^{-4}$	5
			SC1 Using a=10 $\Rightarrow$ 6	
			SC2 Using numerical a, not 10 $\Rightarrow$ 6	**[20]**
			Total for section A	36

Section B

9	i**A**	6.25	B2	M1 for $x = 5$ used to find y	2
	i**B**	(V =) area of cross-section $\times$ length	E1		
		$(\dfrac{100}{4})[\dfrac{10}{2}x^2 - \dfrac{1}{3}x^3]$ o.e.	M1		
		[val at $x = 10$] − [val at $x = 0$]	M1	Subs of correct limits into their integrand	
		4166 to 4167 or 4170	A2	A1 for 166.6... or 16666.6... or 41.6…rot to 3 sf or more	5
	ii	52.62	B4	M3 for- 2/2×[2.15x2+2(5.64x2+6.44x2)]oe Or M2 if one slip Or M1 if 2 slips or one trap evaluated	5 **[12]**
		Their(5262) – their (4167)	M1	Must be >0	
10	i	$y' = 3x^2 - 12x$	B1B1		
		use of $y' = 0$	M1		
		$x = 0$ and 4	A1		
		(0, 12) and (4, −20)	A1	Allow y = 12 and y = -20	
		$y'' = 6x - 12$ used	M1	y' used each side of TP or good sketch	7
		max when $x = 0$, min when $x = 4$	A1	Both stated, only one needs testing	
	ii	when $x = 2$ $y' = -12$	B1		
		grad of normal = 1/12	B1ft	from their y'	
		$y + 4 = 1/12(x − 2)$	M1ft	accept any numerical m Or -4 = their(m) x 2 + c	4 **[11]**
		$y = \frac{1}{12}x - 4\frac{1}{6}$	A1	Any recognisable 25/6, at worst 4.1	
11	i	Excess temperature	B1		2
		At t =0 oe	B1		
	ii	$\log z = \log z_0 + \log (10^{-kt})$	B1		
		$= \log z_0 - kt\log 10$	B1	nb AG	2
	iii	Z= 46 31 20 14 9		If z= 68, 53…P1, L1,M1, M1, M1 available	
		$\log z$: 1.66 1.49 1.30 1.15 0.95	T1		
		correctly plotted	P1	ft their values, within 2mm	
		line of best fit	L1	Ruled, using their points	
		$k = 0.017$ to 0.019 or 0.02	G2	M1 for attempting +/- gradient	9
		z_0= 66 to 73	B2	M1 for (log) z_0= 1.82 to 1.86	
		temp of drink = 25 to 27	C2	M1 3 to 5 or their $69 \times 10^{-70 \text{ x their } k}$	**[13]**