

Mathematics (MEI)

Advanced GCE **4752**

Concepts for Advanced Mathematics (C2)

Mark Scheme for June 2010

SECTION A

1	$[1], \frac{1}{2}, \frac{1}{3}, \frac{1}{4}$	2	B1 for $[1], \frac{1}{2}, \frac{1}{3}$
2 (i)	$2\frac{1}{12}$ or $\frac{25}{12}$ or $2.08(3\dots)$	2	M1 for $\frac{1}{1} + \frac{1}{2} + \frac{1}{3} + \frac{1}{4}$
2 (ii)	$\sum_{r=2}^6 r(r+1)$ o.e.	2	M1 for $[f(r) =] r(r+1)$ o.e. M1 for $[a =] 6$
3 (i)	$3x^2 - 12x - 15$	2	M1 if one term incorrect or an extra term is included.
3 (ii)	Their $\frac{dy}{dx} = 0$ s.o.i. $x = 5$ $x = -1$	M1 B1 B1	
4	crossing x-axis at 0 and 2.5 min at (1.25, -6.25) crossing x-axis at 0 and 5 min at (2.5, -18.75)	1 1 1 1	
5	$x - \frac{6x^{-2}}{-2}$ o.e. their $[5 + \frac{3}{25}] - [2 + \frac{3}{4}]$ $= 2.37$ o.e. c.a.o.	2 M1 A1	M1 for 1 term correct Dependent on at least M1 already earned i.s.w.
6	attempt to integrate $6x^2 + 12x^{\frac{1}{2}}$ $[y =] 2x^3 + 8x^{1.5} + c$ Substitution of (4, 10) $[y =] 2x^3 + 8a^{1.5} - 182$ or $c = -182$	M1 A2 M1 A1	accept un-simplified; A1 for 2 terms correct dependent on attempted integral with + c term
7	$3.5 \log_a x$ or $k = 3.5$	2	B1 for $3 \log_a x$ or $\frac{1}{2} \log_a x$ or $\log_a x^{3\frac{1}{2}}$ seen

8	Subst. of $1 - \cos^2 \theta$ or $1 - \sin^2 \theta$ $5 \cos^2 \theta = 1$ or $5 \sin^2 \theta = 4$ $\cos \theta = \pm \sqrt{\text{their } \frac{1}{5}}$ or $\sin \theta = \pm \sqrt{\text{their } \frac{4}{5}}$ o.e. 63.4, 116.6, 243.4, 296.6	M1 A1 M1 B2	Accept to nearest degree or better; B1 for 2 correct (ignore any extra values in range).
9	$\log 18 = \log a + n \log 3$ <u>and</u> $\log 6 = \log a + n \log 2$ $\log 18 - \log 6 = n (\log 3 - \log 2)$ $n = 2.71$ to 2 d.p. c.a.o. $\log 6 = \log a + 2.70951 \dots \log 2$ o.e. $a = 0.92$ to 2 d.p. c.a.o.	M1* DM1 A1 M1 A1	or $18 = a \times 3^n$ <u>and</u> $6 = a \times 2^n$ $3 = \left(\frac{3}{2}\right)^n$ $n = \frac{\log 3}{\log 1.5} = 2.71$ c.a.o. $6 = a \times 2^{2.70951}$ o.e. $= 0.92$ c.a.o.

Section A Total: 36

SECTION B

10 (i)	$\frac{dy}{dx} = 4x^3$ when $x = 2$, $\frac{dy}{dx} = 32$ s.o.i. when $x = 2$, $y = 16$ s.o.i. $y = 32x - 48$ c.a.o.	M1 A1 B1 A1	i.s.w.
10 (ii)	34.481	2	M1 for $\frac{2.1^4 - 2^4}{0.1}$
10 (iii) (A)	$16 + 32h + 24h^2 + 8h^3 + h^4$ c.a.o.	3	B2 for 4 terms correct B1 for 3 terms correct
10 (iii) (B)	$32 + 24h + 8h^2 + h^3$ or ft	2	B1 if one error
10 (iii) (C)	as $h \rightarrow 0$, result $\rightarrow$ their 32 from (iii) (B) gradient of tangent is limit of gradient of chord	1 1	

11 (a)	$10.6^2 + 9.2^2 - 2 \times 10.6 \times 9.2 \times \cos 68^\circ$ o.e. $QR = 11.1(3\dots)$ $\frac{\sin 68}{\text{their } QR} = \frac{\sin Q}{9.2}$ or $\frac{\sin R}{10.6}$ o.e. $Q = 50.01\dots^\circ$ or $R = 61.98\dots^\circ$ bearing = 174.9 to 175°	M1 A1 M1 A1 B1	 Or correct use of Cosine Rule 2 s.f. or better
11 (b) (i)	$(A) \frac{1}{2} \times 80^2 \times \frac{2\pi}{3}$ $= \frac{6400\pi}{3}$	M1 A1	 6702.(...) to 2 s.f. or more
11 (b) (ii)	$DC = 80 \sin\left(\frac{\pi}{3}\right) = 80 \frac{\sqrt{3}}{2}$ Area = $\frac{1}{2} \times \text{their } DA \times 40\sqrt{3}$ or $\frac{1}{2} \times 40\sqrt{3} \times 80 \times \sin(\text{their } DCA)$ o.e. area of triangle = $800\sqrt{3}$ or 1385.64... to 3s.f. or more	B1 M1 A1	both steps required s.o.i.
11 (b) (iii)	area of $\frac{1}{4}$ circle = $\frac{1}{2} \times \frac{\pi}{2} \times (40\sqrt{3})^2$ o.e. “6702” + “1385.6” – “3769.9” = 4300 to 4320	M1 M1 A1	[=3769.9...] i.e. their(b) (i) + their (b) (ii) – their $\frac{1}{4}$ circle o.e. $933\frac{1}{3}\pi + 800\sqrt{3}$

12	(i) (A)	1024	2	M1 for number of buds = 2^{10} s.o.i.
12	(i) (B)	2047	2	M1 for $1+2+4+\dots+2^{10}$ or for $2^{11} - 1$ or (their 1024) + 512 + 256 + ... + 1
12	(ii) (A)	no. of nodes = $1 + 2 + \dots + 2^{n-1}$ s.o.i. $\frac{7 \times (2^n - 1)}{2 - 1}$	1 1	no. of leaves = $7 + 14 + \dots + 7 \times 2^{n-1}$
12	(ii) (B)	$7(2^n - 1) > 200\,000$ $2^n > \frac{200\,000}{7} + 1$ or $\frac{200\,007}{7}$ $n \log 2 > \log \left(\frac{200\,007}{7} \right)$ and completion to given ans [n =] 15 c.a.o.	M1 M1 M1 B1	or $\log 7 + \log 2^n > \log 200\,007$

Section B Total: 36