OCR
RECOGNISING ACHIEVEMENT

GCE

Mathematics (MEI)

Advanced Subsidiary GCE

Unit **4752:** Concepts for Advanced Mathematics

Mark Scheme for June 2011

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SECTION A

1	$\frac{1}{2}x^4 + 3x$ F[5] – F[2] [=327.5 − 14] =313.5 o.e.	**M1** **M1** **A1**	accept unsimplified at least one term correctly integrated, may be implied by A1	ignore + c condone omission of brackets 313.5 unsupported scores 0
2	0.05, 2000, 1.25×10^{-6} or $\frac{1}{20}$, 2000, $\frac{1}{800\,000}$ o.e. divergent	**B2** **B1**	**B1** for two correct allow "alternate terms tend to zero and to infinity" o.e.	 do *not* allow "oscillating", "getting bigger and smaller", "getting further apart"
3(i)	$m = \frac{\sqrt{1+2\times4.1}-\sqrt{1+2\times4}}{4.1-4}$ s.o.i grad = $\frac{\sqrt{9.2}-\sqrt{9}}{4.1-4}$ s.o.i 0.3315 cao	**M1** **M1** **A1**		no marks for use of Chain Rule or any other attempt to differentiate **SC2** for 0.33…. appearing only embedded in equation of chord
3(ii)	selection of value in (4, 4.1) and 4 or of two values in [3.9, 4.1] centred on 4 answer closer to 1/3 than 0.3315(...)	**M1** **A1**		allow selection of 4 and value in (3.9, 4)
4	$6 = ab$ and $3.6 = ab^2$ $a = 10$, $b = 0.6$ c.a.o.	**M1** **A2**	$\log 6 = \log a + \log b$ *and* $\log 3.6 = \log a + \log b^2$ **A1** each; if **M0** then **B3** for both, **B1** for one	

5	$[\frac{dy}{dx} =]\ 32x^3$ c.a.o. substitution of $x = ½$ in their $\frac{dy}{dx}$ grad normal = $\frac{-1}{their 4}$ when $x = ½$, $y = 4\ ½$ o.e. $y - 4\frac{1}{2} = -\frac{1}{4}(x - \frac{1}{2})$ i.s.w	**M1** **M1** **M1** **B1** **A1**	 [= 4] $y = -\frac{1}{4}x + 4\frac{5}{8}$ o.e.	 must see kx^3 their 4 must be obtained by calculus
6	$\frac{dy}{dx} = 6x^{\frac{1}{2}} - 2$ $y = kx^{\frac{3}{2}} - 2x + c$ o.e. $y = 4x^{\frac{3}{2}} - 2x + c$ o.e. correct substitution of $x = 9$ and $y = 4$ in their equation of curve $y = 4x^{\frac{3}{2}} - 2x - 86$	 **M2** **A1** **M1 dep** **A1**	 **M1** for $k\,x^{\frac{3}{2}}$ and **M1** for -2x + c dependent on at least **M1** already awarded allow **A1** for $c = -86$ i.s.w. if simplified equation for y seen earlier	$x^{\frac{1}{6}}$ is a mistake, not a misread "$y =$" need not be stated at this point, but must be seen at some point for full marks must see "+ c"

7	$\frac{\sin\theta}{\cos\theta} = 2\sin\theta$ $2\cos\theta - 1 = 0$ *and* $\sin\theta = 0$ $[\theta =]$ 0, 180, 360, $[\theta =]$ 60, 300 if 4 marks awarded, lose 1 mark for extra values in the range, ignore extra values outside the range	**M1** **A1** **B1** **B1**	*may* be implied by $2\cos\theta - 1 = 0$ or better	or, if to advantage of candidate **B4** for all 5 correct **B3** for 4 correct **B2** for 3 correct **B1** for 2 correct if extra value(s) in range, deduct one mark from total do not award if values embedded in trial and improvement approach
8	$\log p = \log s + \log t^n$ $\log p = \log s + n\log t$ $[n =]\frac{\log p - \log s}{\log t}$ or $\frac{\log\left(\frac{p}{s}\right)}{\log t}$ [base not required]	**M1** **M1** **A1**	or $\frac{p}{s} = t^n$ $n\log t = \log\left(\frac{p}{s}\right)$ as final answer (i.e. penalise further incorrect simplification)	or **A2** for $[n =]\log_t\left(\frac{p}{s}\right)$ [base t needed] following first M1
9	$\log 16^{\frac{1}{2}}$ or $[-]\log 5^2$ s.o.i. $\log(4\times75)$ or $\log\frac{75}{25}$ s.o.i. $x = 12$ www	**M1** **M1** **A1**	$x = \frac{4\times75}{25}$ implies **M1M1**	if $a = 10$ assumed, $x = 12$ c.a.o. scores **B3** www no follow through
10	$t_1 = -\sin\theta$ $t_2 = \sin\theta$	**B1** **B1**	www www	e.g. $\sin(\theta + 360) = \sin\theta + \sin360 = \sin\theta$ **B0**

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SECTION B

11(i)	$200 - 2\pi r^2 = 2\pi rh$ $h = \frac{200 - 2\pi r^2}{2\pi r}$ o.e. substitution of correct h into $V = \pi r^2 h$ $V = 100r - \pi r^3$ convincingly obtained	**M1** **M1** **M1** **A1**	$100 = \pi r^2 + \pi rh$ $100r = \pi r^3 + \pi r^2 h$ $100r = \pi r^3 + V$ $V = 100r - \pi r^3$ or **M1 f**or $h = \frac{V}{\pi r^2}$ **M1** for $200 = 2\pi r^2 + 2\pi r \times \frac{V}{\pi r^2}$ **M1** for $200 = 2\pi r^2 + 2\frac{V}{r}$ **A1** for $V = 100r - \pi r^3$ convincingly obtained	**sc3** for complete argument working backwards: $V = 100r - \pi r^3$ $\pi r^2 h = 100r - \pi r^3$ $\pi rh = 100 - \pi r^2$ $100 = \pi rh + \pi r^2$ $200 = A = 2\pi rh + 2\pi r^2$ **sc0** if argument is incomplete
11(ii)	$\frac{dV}{dr} = 100 - 3\pi r^2$ $\frac{d^2V}{dr^2} = -6\pi r$	**B2** **B1**	**B1** for each term	allow 9.42(….) r^2 or better if decimalised -18.8(…) r or better if decimalised

11(iii)	their $\frac{dV}{dr} = 0$ s.o.i. $r = 3.26$ c.a.o. $V = 217$ c.a.o.	**M1** **A2** **A1**	must contain r as the only variable **A1** for $r = (\pm)\sqrt{\frac{100}{3\pi}}$; may be implied by 3.25… deduct 1 mark only in this part if answers not given to 3 sf,	there must be evidence of use of calculus

12(i) (A)	390	**B2**	**M1** for $500 - 11 \times 10$	
12(i) (B)	$S_{24} = \frac{24}{2}(2\times500+(24-1)\times-10)$ o.e. i.s.w. *or* $S_{24} = \frac{24}{2}(500+270)$ o.e. i.s.w. [=9240] (answer given)	**B2**	nothing simpler than $12(1000 + 23\times\text{-}10)$ or $\frac{24}{2}(1000-230)$ or $12(2\times500-230)$ if **B2** not awarded, then **M1** for use of a.p. formula for S_{24} with $n = 24$, $a = 500$ and $d = -10$ or **M1** for $l = 270$ s.o.i.	condone omission of final bracket or "(23)-10" if recovered in later work if they write the sum out, all the terms must be listed for 2 marks $12 \times (1000 - 230)$ or 12×770 on its own do not score
12(ii) (A)	368.33(...) or 368.34	**B2**	**M1** for 460×0.98^{11}	
12(ii) (B)	$J_{20} = 310$ $M_{20} = 313.36(...)$, 313.4, 313.3, 313.37 or 313 $J_{19} = 320$ $M_{19} = 319.76(...)$, 319.8 or 319.7	**B3**	**B3** for all 4 values correct or **B2** for 3 values correct or **B1** for 2 values correct	values which are clearly wrongly attributed do not score
12(ii) (C)	8837 to 8837.06	**B2**	**M1** for $S_{24} = \frac{460(1-0.98^{24})}{1-0.98}$ o.e.	
12(ii) (D)	$\frac{a(1-0.98^{24})}{(1-0.98)} = 9240$ o.e. 480.97 to 480.98	**M1** **A1**	f.t. their power of 24 from (ii)C	

13(i)	arc AC = 2.1 × 1.8 = 3.78 c.a.o. area = their 3.78 × 5.5 = 20.79 or 20.8 i.s.w.	**M1** **A1** **M1** **dep*** **A1**	$\frac{103}{360} \times 2\pi \times 2.1$ dependent on first M1	103° or better 3.78 must be seen but may be embedded in area formula
13(ii)	BD = 2.1 cos (π − 1.8) or 2.1cos1.3(4159…..) or 2.1sin0.2(292…) r.o.t to 1 d.p. or more = 0.48	**M2** **A1**	**M1** for $\cos(\pi - 1.8) = \frac{BD}{2.1}$ o.e. allow any answer which rounds to 0.48	**M2** for BD = 2.1 cos 76.8675…° or 2.1sin13.1324…rounded to 2 or more sf or **M2** for CD = 2.045... r.o.t. to 3 s.f. or better and BD = $\sqrt{(2.1^2 - 2.045^2)}$
13(iii)	sector area = 3.969 triangle area = 0.487 to 0.491 24.5	**M2** **M2** **A1**	**M1** for ½ × 2.1^2 × 1.8 **M1** for ½ × 2.1 × their 0.48 × sin (π − 1.8) *or* ½ × their 0.48 × 2.045.. r.o.t. to 3 s.f. or better allow any answer which rounds to 24.5	or equivalent with degrees for first two Ms N.B. 5.5 × 3.969 = 21.8295 so allow M2 for 21.8295 may be sin 1.8 instead of sin (π − 1.8) N.B. 5.5 × area = 2.6785 to 2.7005 so allow M2 for a value in this range

Section B Total: 36

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