OCR
RECOGNISING ACHIEVEMENT

GCE

Mathematics (MEI)

Advanced Subsidiary GCE

Unit **4752:** Concepts for Advanced Mathematics

Mark Scheme for June 2011

OCR (Oxford Cambridge and RSA) is a leading UK awarding body, providing a wide range of qualifications to meet the needs of pupils of all ages and abilities. OCR qualifications include AS/A Levels, Diplomas, GCSEs, OCR Nationals, Functional Skills, Key Skills, Entry Level qualifications, NVQs and vocational qualifications in areas such as IT, business, languages, teaching/training, administration and secretarial skills.

It is also responsible for developing new specifications to meet national requirements and the needs of students and teachers. OCR is a not-for-profit organisation; any surplus made is invested back into the establishment to help towards the development of qualifications and support which keep pace with the changing needs of today's society.

This mark scheme is published as an aid to teachers and students, to indicate the requirements of the examination. It shows the basis on which marks were awarded by Examiners. It does not indicate the details of the discussions which took place at an Examiners' meeting before marking commenced.

All Examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes should be read in conjunction with the published question papers and the Report on the Examination.

OCR will not enter into any discussion or correspondence in connection with this mark scheme.

Any enquiries about publications should be addressed to:

OCR Publications
PO Box 5050
Annesley
NOTTINGHAM
NG15 0DL

Telephone: 0870 770 6622
Facsimile: 01223 552610
E-mail: publications@ocr.org.uk

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 -2*x* + 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	$\log 16^{½}$ 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**

Section A Total: 36

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