OCR
RECOGNISING ACHIEVEMENT

GCE

Mathematics (MEI)

Advanced Subsidiary GCE **4751**

Introduction to Advanced Mathematics (C1)

Mark Scheme for June 2010

Oxford Cambridge and RSA Examinations

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SECTION A

1	$y = 3x + c$ or $y - y_1 = 3(x - x_1)$ $y - 5 =$ their $m(x - 4)$ o.e. $y = 3x - 7$ or simplified equiv.	**M1** **M1** **A1**	allow M1 for 3 clearly stated/ used as gradient of required line or (4, 5) subst in their $y = mx + c$; allow M1 for $y - 5 = m(x - 4)$ o.e. condone $y = 3x + c$ and $c = -7$ or **B3** www
2	(i) $250a^6b^7$ (ii) 16 cao (iii) 64	**2** **1** **2**	**B1** for two elements correct; condone multiplication signs left in SC1 for eg $250 + a^6 + b^7$ condone ± 64 **M1** for $[\pm]4^3$ or for $\sqrt{4096}$ or for only -64
3	$ac = \sqrt{y} - 5$ o.e. $ac + 5 = \sqrt{y}$ o.e. $[y =](ac + 5)^2$ o.e. isw	**M1** **M1** **M1**	**M1** for each of 3 correct or ft correct steps s.o.i. leading to y as subject or some/all steps may be combined; allow **B3** for $[y =](ac + 5)^2$ o.e. isw or **B2** if one error
4 (i)	$2 - 2x > 6x + 5$ $-3 > 8x$ o.e. or ft $x < -3/8$ o.e. or ft isw	**M1** **M1** **M1**	or $1 - x > 3x + 2.5$ for collecting terms of their inequality correctly on opposite sides eg $-8x > 3$ allow **B3** for correct inequality found after working with equation allow **SC2** for $-3/8$ o.e. found with equation or wrong inequality
4 (ii)	$-4 < x <$ ½ o.e.	**2**	accept as two inequalities **M1** for one 'end' correct or for -4 and ½
5 (i)	$7\sqrt{3}$	**2**	**M1** for $\sqrt{48} = 4\sqrt{3}$ or $\sqrt{27} = 3\sqrt{3}$

5 (ii)	$\frac{10+15\sqrt{2}}{7}$ www isw	**3**	**B1** for 7 [B0 for 7 wrongly obtained] and **B2** for $10+15\sqrt{2}$ or **B1** for one term of numerator correct; if **B0**, then **M1** for attempt to multiply num and denom by $3+\sqrt{2}$
6	$5 + 2k$ soi $k = 12$ attempt at f(3) $27 + 36 + m = 59$ o.e. $m = -4$ cao	**M1** **A1** **M1** **A1** **A1**	allow M1 for expansion with $5x^3 + 2kx^3$ and no other x^3 terms or M1 for $(29 - 5) / 2$ soi must substitute 3 for x in cubic not product or long division as far as obtaining $x^2 + 3x$ in quotient or from division $m - (-63) = 59$ o.e. or for $27 + 3k + m = 59$ or ft their k
7	$1+2x+\frac{3}{2}x^2+\frac{1}{2}x^3+\frac{1}{16}x^4$ oe (must be simplified) isw	**4**	**B3** for 4 terms correct, or **B2** for 3 terms correct or for all correct but unsimplified (may be at an earlier stage, but factorial or ${}^nC_r$ notation must be expanded/worked out) or **B1** for 1, 4, 6, 4, 1 soi or for $1+\ldots+\frac{1}{16}x^4$ [must have at least one other term]
8	$5(x + 2)^2 - 14$	**4**	**B1** for $a = 5$, and **B1** for $b = 2$ and **B2** for $c = -14$ or **M1** for $c = 6 -$ their ab^2 or **M1** for [their a](6/their a – their b^2) [no ft for $a = 1$]
9	mention of -5 as a square root of 25 or $(-5)^2 = 25$ $-5 -5 \neq 0$ o.e. or $x + 5 = 0$	**M1** **M1**	condone $-5^2 = 25$ or, dep on first M1 being obtained, allow **M1** for showing that 5 is the only soln of $x - 5 = 0$ allow M2 for $x^2 - 25 = 0$ $(x + 5)(x - 5)$ [= 0] so $x - 5 = 0$ or $x + 5 = 0$

Section A Total: 36

SECTION B

10 (i)	$(2x - 3)(x + 1)$	**M2**	**M1** for factors with one sign error or giving two terms correct allow M1 for $2(x - 1.5)(x + 1)$ with no better factors seen
	$x = 3/2$ and -1 obtained	**B1**	or ft their factors
10 (ii)	graph of quadratic the correct way up and crossing both axes	**B1**	
	crossing x-axis only at 3/2 and -1 or ft from their roots in (i), or their factors if roots not given	**B1**	for $x = 3/2$ condone 1 and 2 marked on axis and crossing roughly halfway between; intns must be shown labelled or worked out nearby
	crossing y-axis at -3	**B1**	
10 (iii)	use of $b^2 - 4ac$ with numbers subst (condone one error in substitution) (may be in quadratic formula)	**M1**	may be in formula or $(x - 2.5)^2 = 6.25 - 10$ or $(x - 2.5)^2 + 3.75 = 0$ oe (condone one error)
	$25 - 40 < 0$ or -15 obtained	**A1**	or $\sqrt{-15}$ seen in formula or $(x - 2.5)^2 = -3.75$ oe or $x = 2.5 \pm \sqrt{-3.75}$ oe
10 (iv)	$2x^2 - x - 3 = x^2 - 5x + 10$ o.e.	**M1**	attempt at eliminating y by subst or subtraction
	$x^2 + 4x - 13$ [= 0]	**M1**	or $(x + 2)^2 = 17$; for rearranging to form $ax^2 + bx + c$ [= 0] or to completing square form condone one error for each of 2nd and 3rd **M1s**
	use of quad. formula on resulting eqn (do not allow for original quadratics used)	**M1**	or $x + 2 = \pm\sqrt{17}$ o.e. 2nd and 3rd **M1s** may be earned for good attempt at completing square as far as roots obtained
	$-2 \pm \sqrt{17}$ cao	**A1**	

11 (i)	grad AB = $\frac{1-3}{5-(-1)}$ [= −1/3]	**M1**	
	$y - 3$ = their grad $(x - (-1))$ or $y - 1$ = their grad $(x - 5)$	**M1**	or use of y = their gradient $x + c$ with coords of A or B or **M2** for $\frac{y-3}{1-3} = \frac{x-(-1)}{5-(-1)}$ o.e.
	$y = -1/3x + 8/3$ or $3y = -x + 8$ o.e isw	**A1**	o.e. eg $x + 3y - 8 = 0$ or $6y = 16 - 2x$ allow **B3** for correct eqn www
11 (ii)	when $y = 0$, $x = 8$; when $x = 0$, $y = 8/3$ or ft their (i)	**M1**	allow $y = 8/3$ used without explanation if already seen in eqn in (i)
	[Area =] ½ × 8/3 × 8 o.e. cao isw	**M1**	NB answer 32/3 given; allow 4 × 8/3 if first M1 earned; or M1 for $\int_0^8 \left[\frac{1}{3}(8-x)\right]dx = \left[\frac{1}{3}\left(8x - \frac{1}{2}x^2\right)\right]_0^8$ and M1 dep for $\frac{1}{3}(64 - 32[-0])$
11 (iii)	grad perp = −1/grad AB stated, or used after their grad AB stated in this part	**M1**	or showing 3 × −1/3 = −1 if (i) is wrong, allow the first M1 here ft, provided the answer is correct ft
	midpoint [of AB] = (2, 2)	**M1**	must state 'midpoint' or show working
	$y - 2$ = their grad perp $(x - 2)$ or ft their midpoint	**M1**	for **M3** this must be correct, starting from grad AB = −1/3, and also needs correct completion to given ans $y = 3x - 4$
	<u>alt method working back from ans</u>:	**or**	mark one method or the other, to benefit of candidate, not a mixture
	grad perp = −1/grad AB and showing/stating same as given line	**M1**	eg stating − 1/3 × 3 = −1
	finding intn of their $y = -1/3x - 8/3$and $y = 3x - 4$ is (2, 2)	**M1**	or showing that (2, 2) is on $y = 3x - 4$, having found (2, 2) first
	showing midpt of AB is (2, 2)	**M1**	[for both methods: for **M3** must be fully correct]

11	**(iv)**	subst $x = 3$ into $y = 3x - 4$ and obtaining centre = (3, 5)	**M1**	or using $(-1 - 3)^2 + (3 - b)^2 = (5 - 3)^2 + (1 - b)^2$ and finding (3, 5)
		$r^2 = (5 - 3)^2 + (1 - 5)^2$ o.e.	**M1**	or $(-1 - 3)^2 + (3 - 5)^2$ or ft their centre using A or B
		$r = \sqrt{20}$ o.e. cao	**A1**	
		eqn is $(x - 3)^2 + (y - 5)^2 = 20$ or ft their r and y-coord of centre	**B1**	condone $(x - 3)^2 + (y - b)^2 = r^2$ o.e. or $(x - 3)^2 + (y - \text{their } 5)^2 = r^2$ o.e. (may be seen earlier)
12	**(i)**	trials of at calculating f(x) for at least one factor of 30	**M1**	**M0** for division or inspection used
		details of calculation for f(2) or f(−3) or f(−5)	**A1**	
		attempt at division by $(x - 2)$ as far as $x^3 - 2x^2$ in working	**M1**	or equiv for $(x + 3)$ or $(x + 5)$; or inspection with at least two terms of quadratic factor correct
		correctly obtaining $x^2 + 8x + 15$	**A1**	or B2 for another factor found by factor theorem
		factorising a correct quadratic factor	**M1**	for factors giving two terms of quadratic correct; M0 for formula without factors found
		$(x - 2)(x + 3)(x + 5)$	**A1**	condone omission of first factor found; ignore '= 0' seen allow last four marks for $(x - 2)(x + 3)(x + 5)$ obtained; for all 6 marks must see factor theorem use first
12	**(ii)**	sketch of cubic right way up, with two turning points	**B1**	0 if stops at x-axis
		values of intns on x axis shown, correct (−5, −3, and 2) or ft from their factors/ roots in (i)	**B1**	on graph or nearby in this part mark intent for intersections with both axes
		y-axis intersection at −30	**B1**	or $x = 0$, $y = -30$ seen in this part if consistent with graph drawn

12 (iii)	$(x - 1)$ substituted for x in either form of eqn for $y = f(x)$	**M1**	correct or ft their (i) or (ii) for factorised form; condone one error; allow for new roots stated as $-4,-2$ and 3 or ft
	$(x - 1)^3$ expanded correctly (need not be simplified) or two of their factors multiplied correctly	**M1 dep**	or **M1** for correct or correct ft multiplying out of all 3 brackets at once, condoning one error $[x^3 - 3x^2 + 4x^2 + 2x^2 + 8x - 6x - 12x - 24]$
	correct completion to given answer [condone omission of '$y =$']	**M1**	unless all 3 brackets already expanded, must show at least one further interim step allow **SC1** for $(x + 1)$ subst and correct exp of $(x + 1)^3$ or two of their factors ft or, for those using given answer: **M1** for roots stated or used as $-4,-2$ and 3 or ft **A1** for showing all 3 roots satisfy given eqn **B1** for comment re coefft of x^3 or product of roots to show that eqn of translated graph is not a multiple of RHS of given eqn

Section B Total: 36

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