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Mark Scheme (Pre-Standardisation)
June 2011

GCE

GCE Core Mathematics C1 (6663/01)

General Marking Guidance

- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should mark according to the mark scheme not according to their perception of where the grade boundaries may lie.
- There is no ceiling on achievement. All marks on the mark scheme should be used appropriately.
- All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e. if the answer matches the mark scheme. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme.
- Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.
- When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the team leader must be consulted.
- Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.

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EDEXCEL GCE MATHEMATICS

General Instructions for Marking

1. The total number of marks for the paper is 75.

2. The Edexcel Mathematics mark schemes use the following types of marks:

   - **M** marks: method marks are awarded for 'knowing a method and attempting to apply it', unless otherwise indicated.
   - **A** marks: Accuracy marks can only be awarded if the relevant method (M) marks have been earned.
   - **B** marks are unconditional accuracy marks (independent of M marks)
   - Marks should not be subdivided.

3. Abbreviations

   These are some of the traditional marking abbreviations that will appear in the mark schemes and can be used if you are using the annotation facility on ePEN.

   - bod – benefit of doubt
   - ft – follow through
   - the symbol $\surd$ will be used for correct ft
   - cao – correct answer only
   - cso - correct solution only. There must be no errors in this part of the question to obtain this mark
   - isw – ignore subsequent working
   - awrt – answers which round to
   - SC: special case
   - oe – or equivalent (and appropriate)
   - dep – dependent
   - indep – independent
   - dp decimal places
   - sf significant figures
   - $*$ The answer is printed on the paper
   - $\sqsubset$ The second mark is dependent on gaining the first mark

4. All A marks are 'correct answer only' (cao.), unless shown, for example, as A1 ft to indicate that previous wrong working is to be followed through. After a misread however, the subsequent A marks affected are treated as A ft, but manifestly absurd answers should never be awarded A marks.

5. For misreading which does not alter the character of a question or materially simplify it, deduct two from any A or B marks gained, in that part of the question affected. If you are using the annotation facility on ePEN, indicate this action by 'MR' in the body of the script.

6. If a candidate makes more than one attempt at any question:
   - If all but one attempt is crossed out, mark the attempt which is NOT crossed out.
   - If either all attempts are crossed out or none are crossed out, mark all the attempts and score the highest single attempt.

7. Ignore wrong working or incorrect statements following a correct answer.

8. Marks for each question are scored by clicking in the marking grids that appear below each student response on ePEN. The maximum mark allocation for each question/part question(item) is set out in the marking grid and you should allocate a score of '0' or '1' for each mark, or "trait", as shown:

	0	1
aM		●
aA	●	
bM1		●
bA1	●	
bB	●	
bM2		●
bA2		●

9. Be careful when scoring a response that is either all correct or all incorrect. It is very easy to click down the '0' column when it was meant to be '1' and all correct.

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General Principals for Core Mathematics Marking

(But note that specific mark schemes may sometimes override these general principles).

Method mark for solving 3 term quadratic:

1. Factorisation

$(x^2 + bx + c) = (x + p)(x + q),$ where $|pq| = |c|$, leading to x = ...

$(ax^2 + bx + c) = (mx + p)(nx + q),$ where $|pq| = |c|$ and $|mn| = |a|$, leading to x = ...

2. Formula

Attempt to use correct formula (with values for a, b and c).

3. Completing the square

Solving $x^2 + bx + c = 0$: $(x \pm p)^2 \pm q \pm c,\ p \neq 0,\ q \neq 0$, leading to x = ...

Method marks for differentiation and integration:

1. Differentiation

Power of at least one term decreased by 1. ($x^n \to x^{n-1}$)

2. Integration

Power of at least one term increased by 1. ($x^n \to x^{n+1}$)

Use of a formula

Where a method involves using a formula that has been learnt, the advice given in recent examiners' reports is that the formula should be quoted first.
Normal marking procedure is as follows:
Method mark for quoting a correct formula and attempting to use it, even if there are mistakes in the substitution of values.
Where the formula is not quoted, the method mark can be gained by implication from correct working with values, but may be lost if there is any mistake in the working.

Exact answers

Examiners' reports have emphasised that where, for example, an exact answer is asked for, or working with surds is clearly required, marks will normally be lost if the candidate resorts to using rounded decimals.

Answers without working

The rubric says that these may not gain full credit. Individual mark schemes will give details of what happens in particular cases. General policy is that if it could be done "in your head", detailed working would not be required. Most candidates do show working, but there are occasional awkward cases and if the mark scheme does not cover this, please contact your team leader for advice.

June 2011
6663 Core Mathematics C1
Mark Scheme

Question Number	Scheme	Marks
1 **(a)**	5 (or ±5)	B1 (1)
(b)	$25^{-\frac{3}{2}} = \frac{1}{25^{\frac{3}{2}}}$ and attempt to find $25^{\frac{3}{2}}$	M1
	$\frac{1}{125}$ or 0.008 (or $\pm\frac{1}{125}$)	A1 (2) **3**
	Notes	
	(b) M: Requires reciprocal and <u>any</u> attempt to evaluate $25^{\frac{3}{2}}$. Accept $\frac{1}{5^3}, \frac{1}{\sqrt{15625}}, \frac{1}{25\times5}$ for M1	
	Correct answer with no working scores both marks	

Question Number	Scheme	Marks
2 **(a)**	$\frac{dy}{dx} = 10x^4 - 3x^{-4}$ or $10x^4 - \frac{3}{x^4}$	M1 A1 A1 (3)
(b)	$\frac{2x^6}{6} + 7x + \frac{x^{-2}}{-2} = \frac{x^6}{3} + 7x - \frac{x^{-2}}{2} + C$	M1 A1 A1 B1 (4) **7**
	Notes (a) M1: Attempt to differentiate $x^n \to x^{n-1}$ (for any of the 3 terms) The 7 differentiated to give 0 is sufficient evidence for M1 1st A1: One correct (non-zero) term, possibly unsimplified. 2nd A1: Fully correct simplified answer. (b) M1: Attempt to integrate $x^n \to x^{n+1}$ (i.e. ax^6 or ax or ax^{-2}, where a is any non-zero constant). 1st A1: Two correct terms, possibly unsimplified. 2nd A1: All three terms correct and simplified. Allow $7x^1$, but <u>not</u> $\frac{7x^1}{1}$. B1: + C	

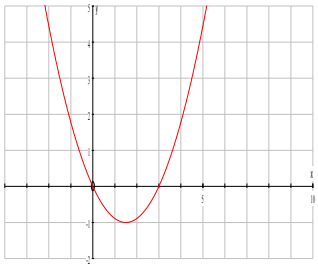
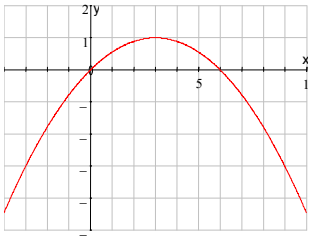
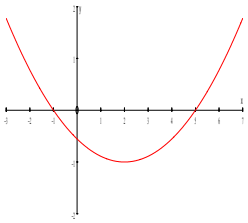
Question Number	Scheme	Marks
3	Mid-point of PQ is (4, 3)	B1
	PQ: $m = \dfrac{0-6}{9-(-1)}$, $\left(= -\dfrac{3}{5}\right)$	B1
	Gradient perpendicular to PQ $= -\dfrac{1}{m}$ $\left(= \dfrac{5}{3}\right)$	M1
	$y - 3 = \dfrac{5}{3}(x-4)$	M1
	$5x - 3y - 11 = 0$ (Allow rearrangements e.g. $3y = 5x - 11$)	A1 (5)
		5
	Notes 1st M: Negative reciprocal of their numerical value for m 2nd M: Equation of a line through their (4, 3) with any gradient except 0 or ∞. If the 4 and 3 are the wrong way round the 2nd M mark can still be given if a correct formula (e.g. $y - y_1 = m(x - x_1)$) is seen, otherwise M0. If (4, 3) is substituted into $y = mx + c$ to find c, the 2nd M mark is for attempting this. A1: Requires integer form with an = sign	

Question Number	Scheme	Marks
4	Either $y^2 = 4 - 4x + x^2$ $4(4 - 4x + x^2) - x^2 = 11$ or $4(2-x)^2 - x^2 = 11$ $3x^2 - 16x + 5 = 0$ $(3x-1)(x-5) = 0, \quad x = \ldots$ $x = \frac{1}{3} \quad x = 5$ $y = \frac{5}{3} \quad y = -3$ Or $x^2 = 4 - 4y + y^2$ $4y^2 - (4 - 4y + y^2) = 11$ or $4y^2 - (2-y)^2 = 11$ $3y^2 + 4y - 15 = 0$ Correct 3 terms $(3y-5)(y+3) = 0, \quad y = \ldots$ $y = \frac{5}{3} \quad y = -3$ $x = \frac{1}{3} \quad x = 5$	M1 M1 A1 M1 A1 M1 A1 (7) **7**
	Notes 1st M: Squaring to give 3 or 4 terms 2nd M: Substitute to give quadratic in one variable 3rd M: Attempt to solve a 3 term quadratic. 4th M: Attempt at least one *y* value (or *x* value). If *y* solutions are given as *x* values, or vice-versa, penalise at the end, so that it is possible to score M1 M1A1 M1 A1 M0 A0. "Non-algebraic" solutions: No working, and only one correct solution pair found (e.g. $x = 5$, $y = -3$): M0 M0 A0 M0 A0 M1 A1 No working, and both correct solution pairs found, but not demonstrated: M0 M0 A0 M1 A1 M1 A1 Both correct solution pairs found, and demonstrated: Full marks	

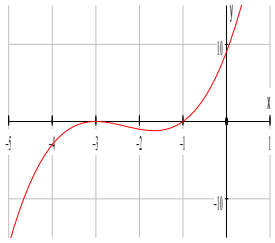
Question Number	Scheme	Marks
5		
(a)	$(a_2 =)\ 5k+3$	B1 (1)
(b)	$(a_3 =)\ 5(5k+3)+3$ $= 25k+18$ (*)	M1 A1 cso (2)
(c)		
(i)	$a_4 = 5(25k+18)+3 \quad (=125k+93)$	M1
	$\sum_{r=1}^{4} a_r = k+(5k+3)+(25k+18)+(125k+93)$	M1
	$= 156k+114$	A1
(ii)	$= 6(26k+19)$ (or explain why divisible by 6)	A1 ft (4) **7**
	Notes (b) 1st M: Substitutes their a_2 into $5a_2+3$ (c) 1st M1: Substitutes their a_3 into $5a_3+3$ 2nd M1: Adds their four terms 1st A1: All correct so far 2nd A1ft: Limited ft – previous answer must be divisible by 6 (eg $156k+42$)	

Question Number	Scheme	Marks
6		
(a)	$p = \frac{1}{2},\ q = 2$ or $6x^{\frac{1}{2}},\ 3x^2$	B1, B1 (2)
(b)	$\frac{6x^{\frac{3}{2}}}{\left(\frac{3}{2}\right)} + \frac{3x^3}{3}$ $\left(= 4x^{\frac{3}{2}} + x^3\right)$	M1 A1
	$x = 4, y = 90$: $32 + 64 + C = 90 \Rightarrow C = -6$	M1 A1
	$y = 4x^{\frac{3}{2}} + x^3 - 6$	A1 ft (5) **7**
	Notes (b) 1st M: Attempt to integrate $x^n \rightarrow x^{n+1}$ (for either term) 1st A: cao, but terms need not be simplified (+C not required for this mark) 2nd M: Using $x = 4$ and $y = 90$ to form an equation in C. 2nd A: cao 3rd A: ft dependent on both M's, but coefficients must be simplified if necessary. If there is a 'restart' in part (b) it can be marked independently of part (a), but marks for part (a) cannot be scored for work seen in (b). Numerator and denominator integrated separately: First M mark **cannot** be awarded so only mark available is second M mark.	

Question Number	Scheme	Marks
7		
(a)	Discriminant: $b^2 - 4ac = (k+3)^2 - 4k$	M1 A1 (2)
(b)	$(k+3)^2 - 4k = k^2 + 2k + 9 = (k+1)^2 + 8$	M1 A1 (2)
(c)	For real roots, $b^2 - 4ac \geq 0$ (or $b^2 - 4ac > 0$) $(k+1)^2 \geq 0$ for all k, so $b^2 - 4ac > 0$, so roots are real for all k (or equiv.)	M1 A1 cso (2) **6**
	Notes (a) M1: attempt to find discriminant – substitution is required If formula $b^2 - 4ac$ is seen at least 2 of a, b and c must be correct If formula $b^2 - 4ac$ is **not** seen all 3 of a, b and c must be correct Use of $b^2 + 4ac$ is M0 A1: correct unsimplified (b) M1: Attempt at completion of square (see earlier notes) A1: both correct (c) M1: States condition as on scheme **or** attempts to explain that their $(k+1)^2 + 8$ is greater than 0 A1: The final mark (A1cso) requires a reason and a conclusion	

Question Number	Scheme	Marks
8 **(a)**	 Shape ∪ through (0, 0)	B1
	(3, 0)	B1
	(1.5, –1)	B1 (3)
(b)	 Shape ∩	B1
	(0, 0) and (6, 0)	B1
	(3, 1)	B1 (3)
(c)	 Shape ∪, <u>not</u> through (0, 0)	M1
	Minimum in 4th quadrant	A1
	$(-p, 0)$ and $(6 - p, 0)$	B1
	$(3 - p, -1)$	B1 (4)
		10

Question Number	Scheme	Marks
9		
(a)	Series has 50 terms	B1
	$S = \frac{1}{2}(50)(2+100) = 2550$ or $S = \frac{1}{2}(50)(4+49\times 2) = 2550$	M1 A1
		(3)
(b)		
(i)	$\frac{100}{k}$	B1
(ii)	Sum: $\frac{1}{2}\left(\frac{100}{k}\right)(k+100)$ or $\frac{1}{2}\left(\frac{100}{k}\right)\left(2k+\left(\frac{100}{k}-1\right)k\right)$	M1 A1
	$= 50 + \frac{5000}{k}$ (*)	A1 cso
		(4)
(c)	50^{th} term $= a+(n-1)d$	
	$= (2k+1)+49(2k+3)$	M1
	$= 100k+148$	A1
		(2)
		9
	Notes	
	(a) M for attempt to use $\frac{1}{2}n(a+l)$ or $\frac{1}{2}n(2a+(n-1)d)$	
	(c) M for use of formula $a+49d$ with $a = 2k+1$ and $d = 2k+3$	

Question Number	Scheme	Marks
10 **(a)**	 Shape (cubic in this orientation) Touching x-axis at -3 Intersection at -1 on x-axis Intersection at 9 on y-axis	B1 B1 B1 B1 (4)
(b)	$y=(x+1)(x^2+6x+9)=x^3+7x^2+15x+9$ or equiv.(possibly unsimplified) $\frac{dy}{dx}=3x^2+14x+15$ **(*)**	B1 M1 A1 cso (3)
(c)	At $x=-5$: $\frac{dy}{dx}=75-70+15=20$ At $x=-5$: $y=-16$ $y-(-16)=20(x-(-5))$ or $y = 20x + c$ with (-5, -16) used to find c $y=20x+84$	B1 B1 M1 A1 (4)
(d)	Parallel: $3x^2+14x+15=20$ $(3x-1)(x+5)=0$ $x=\ldots$ $x=\frac{1}{3}$	M1 M1 A1 (3) **14**
	Notes (b) M: Usual condition Attempt to differentiate $x^n \to x^{n-1}$ (for any of the 4 terms) The 9 differentiated to give 0 is sufficient evidence for M1 A1: Fully correct simplified answer. (c) M: If the –5 and -16 are the wrong way round or – omitted the M mark can still be given if a correct formula is seen, (e.g. $y-y_1=m(x-x_1)$) otherwise M0. (d) 1st M: Putting their derivative expression equal to their value for gradient 2nd M: Attempt to solve quadratic (see notes)	