

GCE Edexcel GCE Mathematics Core Mathematics C1 (6663)

June 2006

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Mark Scheme (Results)

Mathematics

Edexcel GCE



June 2006 6663 Core Mathematics C1 Mark Scheme

Question number	Scheme	Marks
1.	$\frac{6x^3}{3} + 2x + \frac{x^{\frac{1}{2}}}{\frac{1}{2}} (+c)$	M1
		A1
	$= 2x^3 + 2x + 2x^{\frac{1}{2}}$	A1
	+c	B1
		4
	M1 for some attempt to integrate $x^n \to x^{n+1}$ 1 st A1 for either $\frac{6}{3}x^3$ or $\frac{x^{\frac{1}{2}}}{\frac{1}{2}}$ or better 2 nd A1 for all terms in <i>x</i> correct. Allow $2\sqrt{x}$ and $2x^1$. B1 for + <i>c</i> , when first seen with a changed expression.	

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Question number		Scheme	Marks
2.	Critical Valu	es	
	$(x\pm a)(x\pm b)$	with $ab=18$ or $x = \frac{7 \pm \sqrt{49 - 72}}{2}$ or $\left(x - \frac{7}{2}\right)^2 \pm \left(\frac{7}{2}\right)^2 - 18$	M1
	(x-9)(x+2)	or $x = \frac{7 \pm 11}{2}$ or $x = \frac{7}{2} \pm \frac{11}{2}$	A1
	Solving Inequ	x > 9 or x < -2 Choosing "outside"	M1 A1 4
			•
	1 st M1	For attempting to find critical values	
	1 111	Factors alone are OK for M1 $x =$ appearing somewhere for the form	nula and as
	1 st A1.	as written.	
	2 nd M1	For choosing outside region. Can f.t. their critical values.	
		They must have two different critical values.	
		- $2 > x > 9$ is M1A0 but ignore if it follows a correct version	
		-2 < x < 9 is M0A0 whatever the diagram looks like.	
	2 nd A1	Use of \geq in final answer gets A0	

Question number		Scheme	Marks	
3.	(a) y	U shape touching <i>x</i> -axis	B1	
		(-3,0)	B1	
		(0,9)	B1	
	-3	/9 x	(3)	
	(b) y			
		Translated parallel to y-axis up $(0, 0, k)$		
		$\int 9+\kappa \qquad (0,9+\kappa)$	Б11.1.	
			(2)	
		→ x		
				5
(a)	2 nd B1	They can score this even if other intersections with the <i>x</i> -axis are given.		
	2 nd B1 & 3 rd B1	The -3 and 9 can appear on the sketch as shown		
(b)	M1	Follow their curve in (a) up only.		
		If it is not obvious do not give it. e.g. if it cuts y-axis in (a)		
		but doesn't in (b) then it is M0.		
	B1f.t.	Follow through their 9		

Question number		Scheme		
4. (a)	$a_2 = 4$ $a_3 = 3 \times a_2 - 5$	5 = 7	B1 B1f.t.	
(b)	$a_4 = 3a_3 - 5(=$	=16) and $a_5 = 3a_4 - 5(= 43)$	M1	(2)
	3+4+7+1	6 + 43	M1	
	= 73		A1c.a.o.	(3)
				5
(a)	2 nd B1f.t.	Follow through their a_2 but it must be a value. $3 \times 4 - 5$ is B0 Give wherever it is first seen.		
(b)	1 st M1	For two further attempts to use of $a_{n+1} = 3a_n - 5$, wherever seen. Condone arithmetic slips		
	2 nd M1	For attempting to add 5 relevant terms (i.e. terms derived from an attempt to use the recurrence formula) or an expression. Follow through their values for $a_2 - a_5$		
		Use of formulae for arithmetic series is M0A0 but could get 1^{st} M1 if a_4 and a_5 are correctly attempted.		

Question number		Scheme	Marks				
5. (a)	$(y = x^4 + 6x^{\frac{1}{2}})$	$\Rightarrow y'= 4x^3 + 3x^{-\frac{1}{2}}$ or $4x^3 + \frac{3}{\sqrt{x}}$	M1A1A1 (3)				
(b)	$\left(x+4\right)^2 = x^2 +$	-8x + 16	M1				
	$\frac{\left(x+4\right)^2}{x} = x + \frac{1}{x}$	$8 + 16x^{-1}$ (allow 4+4 for 8)	A1				
	$(y = \frac{\left(x+4\right)^2}{x} =$	$\Rightarrow y' =) 1 - 16x^{-2} \qquad \text{o.e.}$	M1A1 (4) 7				
(a)	M1	For some attempt to differentiate $x^n \to x^{n-1}$	I				
	1 st A1	For one correct term as printed.					
	2 nd A1	For both terms correct as printed.					
		$4x^3 + 3x^{-\frac{1}{2}} + c$ scores M1A1A0					
(b)	1 st M1	For attempt to expand $(x+4)^2$, must have x^2 , x , x^0 terms and at least	st 2 correct				
		e.g. $x^2 + 8x + 8$ or $x^2 + 2x + 16$					
	1 st A1	Correct expression for $\frac{(x+4)^2}{x}$. As printed but allow $\frac{16}{x}$ and $8x^0$					
	2 nd M1	nd M1 For some correct differentiation, any term. Can follow through their simplification.					
		N.B. $\frac{x^2 + 8x + 16}{x}$ giving rise to $(2x + 8)/1$ is M0A0					
ALT	Product or Qu	otient rule (If in doubt send to review)					
	M2	For correct use of product or quotient rule. Apply usual rules on fo	ormulae.				
	1 st A1	For $\frac{2(x+4)}{x}$ or $\frac{2x(x+4)}{x^2}$					
	2 nd A1	for $-\frac{\left(x+4\right)^2}{x^2}$					

Question number	Scheme	Marks	
6. (a)	$16 + 4\sqrt{3} - 4\sqrt{3} - (\sqrt{3})^2 \text{ or } 16 - 3$ = 13	M1 A1c.a.o (2)	
(b)	$\frac{26}{4+\sqrt{3}} \times \frac{4-\sqrt{3}}{4-\sqrt{3}}$	M1	
	$= \frac{26(4-\sqrt{3})}{13} = \frac{8-2\sqrt{3}}{13} \text{or} 8+(-2)\sqrt{3} \text{or} a=8 \text{ and } b=-2$	A1 (2) 4	
(a)	M1 For 4 terms, at least 3 correct e.g. $8 + 4\sqrt{3} - 4\sqrt{3} - (\sqrt{3})^2$ or $16 \pm 8\sqrt{3} - (\sqrt{3})^2$ or $16 + 3$ 4^2 instead of 16 is OK $(4 + \sqrt{3})(4 + \sqrt{3})$ scores M0A0		
(b)	M1 For a correct attempt to rationalise the denominator Can be implied NB $\frac{-4+\sqrt{3}}{-4+\sqrt{3}}$ is OK		

Question number		Scheme		Marks	
7.	a + (n	(-1)d = k	<i>k</i> = 9 or 11	M1	
	$(u_{11} =) a + 10$	<i>d</i> = 9		A1c.a.o.	
	$\frac{n}{2}[2a$	$(n-1)d$] = 77 or $\frac{(a+l)}{2} \times n = 77$	<i>l</i> = 9 or 11	M1	
	$(S_{11} =) \frac{11}{2}(2a)$	$(S_{11} =) \frac{11}{2}(2a+10d) = 77$ or $\frac{(a+9)}{2} \times 11 = 77$ A			
	$e.g. \ a+10d = a+5d =$	<i>e.g.</i> $a + 10d = 9$ a + 5d = 7 or $a + 9 = 14$		M1	
		a = 5 and $d = 0.4$ or exact equivalent		A1 A1 7	
	1 st M1	Use of u_n to form a linear equation in a and d . a -	+ <i>nd</i> =9 is M0A0		
	1 st A1	For $a + 10d = 9$.			
	2 nd M1				
	2 nd A1	A correct equation based on S_n .			
	3 rd M1	Solving (LHS simultaneously) or (RHS a linear equivalent of the second s	uation in <i>a</i>)		
		Must lead to $a = \dots$ or $d = \dots$ and depends on one	previous M		
	3 rd A1	for $a = 5$			
	$4^{th} A1$	for $d = 0.4$ (o.e.)			
	<u>ALT</u>	Uses $\frac{(a+l)}{2} \times n = 77$ to get $a = 5$, gets second and	third M1A1 i.e.	4/7	
		Then uses $\frac{n}{2}[2a + (n-1)d] = 77$ to get <i>d</i> , gets 1 st N	M1A1 and 4 th A1		
	MR	Consistent MR of 11 for 9 leading to $a = 3$, $d = 0.3$	8 scores M1A0M	1A0M1A1ftA1ft	

Question number		Scheme					
8. (a)	$b^2 - 4ac =$	$b^{2} - 4ac = 4p^{2} - 4(3p + 4) = 4p^{2} - 12p - 16 (=0)$					
	or $(x+p)$	or $(x+p)^2 - p^2 + (3p+4) = 0 \implies p^2 - 3p - 4 = 0$					
	(p - 4)((p-4)(p+1) = 0					
		p = (-1 or) 4					
(b)	$x = \frac{-b}{2a}$ of	or $(x+p)(x+p) = 0 \implies x =$	M1				
		x (= -p) = -4	A1f.t. (2)				
			6				
(a)	1 st M1	1 st M1 For use of $b^2 - 4ac$ or a full attempt to complete the square leading to a 3TQ					
		May use $b^2 = 4ac$. One of b or c must be correct.					
	1 st A1	For a correct 3TQ in p. Condone missing "=0" but all 3 terms must	be on one side.				
	2 nd M1						
	2 nd A1						
		es 4/4.					
(b)	M1	For a full method leading to a repeated root $x = \dots$					
	A1f.t.	For $x = -4$ (- their <i>p</i>)					
	Trial and	Trial and Improvement					
	M2 For substituting values of p into the equation and attempting to factorize. (Really need to get to $p = 4$ or -1)						
	A2c.s.o.	Achieve $p = 4$. Don't give without valid method being seen.					

Question number	Scheme	Marks					
9. (a)	$f(x) = x[(x-6)(x-2)+3]$ or $x^3 - 6x^2 - 2x^2 + 12x + 3x = x($	M1					
	$f(x) = x(x^2 - 8x + 15)$ b = -8 or c = 15	A1					
	both and $a = 1$	A1 (3)					
(b)	$(x^{2} - 8x + 15) = (x - 5)(x - 3)$ f(x) = x(x - 5)(x - 3)	M1 A1 (2)					
(c)	y Shape	B1					
	their 3 <u>or</u> their 5	B1f.t.					
	$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	B1f.t. (3)					
		8					
(a)	M1 for a correct method to get the factor of x . x (as printed is the minimum.						
	$1^{st} A1$ for $b = -8$ or $c = 15$.	. 1					
	-8 comes from -6-2 and must be coefficient of x, and 15 from $6x^2+3$ and m $2^{nd} \wedge 1$ for $a=1, b=-8$ and $a=15$. Must have $n(n^2-8n+15)$	ust have no xs.					
(b)	2 All for $a = 1$, $b = -8$ and $c = 15$. Must have $x(x = -8x + 15)$. M1 for attempt to factorize their 2TO from part (a)						
(0)	A1 for all 3 terms correct. They must include the x						
	For part (c) they must have at most 2 non-zero roots of their $f(x) = 0$ to ft th	eir 3 and their 5.					
(c)	1 st B1 for correct shape (i.e. from bottom left to top right and two turning	points.)					
	2 nd B1f.t. for crossing at their 3 or their 5 indicated on graph or in text.	- · ·					
	3^{rd} B1f.t. if graph passes through (0, 0) [needn't be marked] and both their 3	3^{rd} B1f.t. if graph passes through (0, 0) [needn't be marked] and both their 3 and their 5.					

Question number		Scheme			Marks		
10.(a)	$f(x) = \frac{2x^2}{2} + \frac{3}{2}$	$\frac{x^{-1}}{-1}(+c)$	$-\frac{3}{x}$ is OK		M1A1		
	$(3, 7\frac{1}{2})$ gives -	$\frac{15}{2} = 9 - \frac{3}{3} + c$	3^2 or 3^{-1} are OK instead of	9 or $\frac{1}{3}$	M1A1f.	.t.	
		$c = -\frac{1}{2}$			A1		(5)
(b)	$f(-2) = 4 + \frac{3}{2} - \frac{3}{2}$	$\frac{1}{2}$ (*)			B1c.s.o	•	(1)
(c)	$m=-4+\frac{3}{4},$	= -3.25			M1,A1		
	Equation of ta 4y + 13x + 6=0	ngent is: $y - 5 = -3.25(x + 2)$		o.e.	M1 A1	(4)	
							10
(a)	1 st M1 1 st A1 2 nd M1 2 nd A1f.t.	for some attempt to integrate <i>x</i> for both <i>x</i> terms as printed or b for use of $(3,7\frac{1}{2})$ or (-2, 5) to f substitution. No + <i>c</i> is M0. So for a correct equation for <i>c</i> . For fraction/fraction and signs (e.g.	$x^n \rightarrow x^{n+1}$ etter. Ignore (+ <i>c</i>) here. form an equation for <i>c</i> . There me changes in <i>x</i> terms of func- illow through their integration x to +).	e must b ction ne n. They	e some o eded. 7 must tio	corre dy up	ct
(b)	B1cso	If $(-2, 5)$ is used to find c in (a)	B0 here unless they verify fo	(3)=7.5.			
(c)	1 st M1	for attempting $m = f'(\pm 2)$					
	1 st A1	for $-\frac{13}{4}$ or -3.25					
	2 nd M1	for attempting equation of tang	ent at (-2, 5), f.t. their <i>m</i> , bas	ed on $\frac{d}{d}$	$\frac{y}{x}$.		
	2 nd A1	o.e. must have <i>a</i> , <i>b</i> and <i>c</i> intege	ers and $= 0$.				
		Treat (a) and (b) together as a b	oatch of 6 marks.				

Question number	Scheme	Marks
11.(a)	$m = \frac{8-2}{11+1} (=\frac{1}{2})$	M1 A1
	$y-2 = \frac{1}{2}(x-1)$ or $y-8 = \frac{1}{2}(x-11)$ o.e.	M1
	$y = \frac{1}{2}x + \frac{5}{2}$ accept exact equivalents e.g. $\frac{6}{12}$	A1c.a.o. (4)
(b)	Gradient of $l_2 = -2$	M1
	Equation of l_2 : $y - 0 = -2(x - 10)$ [$y = -2x + 20$]	M1
	$\frac{1}{2}x + \frac{5}{2} = -2x + 20$	M1
	x = 7 and $y = 6$ depend on all 3 Ms	A1, A1 (5)
(c)	$RS^{2} = (10-7)^{2} + (0-6)^{2} (= 3^{2} + 6^{2})$	M1
	$RS = \sqrt{45} = 3\sqrt{5} (*)$	A1c.s.o. (2)
(d)	$PQ = \sqrt{12^2 + 6^2}, = 6\sqrt{5}$ or $\sqrt{180}$ or $PS = 4\sqrt{5}$ and $SQ = 2\sqrt{5}$	M1,A1
	Area = $\frac{1}{2}PQ \times RS = \frac{1}{2}6\sqrt{5} \times 3\sqrt{5}$	dM1
	<u>= 45</u>	A1 c.a.o. (4)
		15
(a)	1 st M1 for attempting $\frac{y_1 - y_2}{x_1 - x_2}$, must be y over x. No formula condone one	e sign slip, but if
	formula is quoted then there must be some correct substitution.	
	2^{nd} M1 for attempting to find equation of l_1 .	
(b)	1 st M1 for using the perpendicular gradient rule	
	2^{nd} M1 for attempting to find equation of l_2 . Follow their gradient provide 3^{rd} M1 for forming a suitable equation to find S	d different.
(c)	M1 for expression for RS or RS^2 . Ft their S coordinates	
(d)	1 st M1 for expression for PQ or PQ^2 . $PQ^2 = 12^2 + 6^2$ is M1 but $PQ = 12^2 + 6^2$	$+6^2$ is M0
	$2^{nd} dM1$ for a full, correct attempt at area of triangle. Dependent on previou	is M1.

GENERAL PRINCIPLES FOR C1 MARKING

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 $x = \dots$

2. Formula

Attempt to use <u>correct</u> formula (with values for *a*, *b* and *c*).

3. <u>Completing the square</u>

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

Method marks for differentiation and integration:

1. Differentiation

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

2. Integration

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

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:

<u>Method mark</u> for quoting a correct formula and attempting to use it, even if there are mistakes in the substitution of values. There must be some correct substitution.

Where the formula is <u>not</u> quoted, the method mark can be gained by implication from <u>correct</u> working with values, but will be lost if there is any mistake in the working.

Exact answers

Examiners' reports have emphasised that where, for example, an <u>exact</u> 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 <u>may</u> gain no 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 <u>not</u> cover this, please contact your team leader for advice.

Misreads

A misread must be consistent for the whole question to be interpreted as such.

These are not common. In clear cases, please deduct the <u>first 2 A (or B)</u> marks which <u>would have been lost by</u> <u>following the scheme</u>. (Note that 2 marks is the <u>maximum</u> misread penalty, but that misreads which alter the nature or difficulty of the question cannot be treated so generously and it will usually be necessary here to follow the scheme as written).

Sometimes following the scheme as written is more generous to the candidate than applying the misread rule, so in this case use the scheme as written.