edexcel
advancing learning, changing lives

Mark Scheme (Results)

January 2012

GCE Core Mathematics C1 (6663) Paper 1

Edexcel is one of the leading examining and awarding bodies in the UK and throughout the world. We provide a wide range of qualifications including academic, vocational, occupational and specific programmes for employers.

Through a network of UK and overseas offices, Edexcel's centres receive the support they need to help them deliver their education and training programmes to learners.

For further information, please call our GCE line on 0844 576 0025, our GCSE team on 0844 576 0027, or visit our website at www.edexcel.com.

If you have any subject specific questions about the content of this Mark Scheme that require the help of a subject specialist, you may find our **Ask The Expert** email service helpful.

Ask The Expert can be accessed online at the following link:
http://www.edexcel.com/Aboutus/contact-us/

January 2012
Publications Code US030304

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.

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 $\sqrt{}$ 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
- ⌈ 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.

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

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

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

2. Formula

Attempt to use correct formula (with values for *a*, *b* and *c*), leading to x = …

3. Completing the square

Solving $x^2 + bx + c = 0$: $\left(x \pm \frac{b}{2}\right)^2 \pm q \pm c, \quad q \neq 0$, 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.

January 2012
C1 6663
Mark Scheme

Question	Scheme	Marks
1. **(a)**	$4x^3+3x^{-\frac{1}{2}}$	M1A1A1 (3)
(b)	$\frac{x^5}{5}+4x^{\frac{3}{2}}+C$	M1A1A1 (3) **6 marks**
	Notes	
(a)	M1 for $x^n \to x^{n-1}$ i.e. x^3 or $x^{-\frac{1}{2}}$ seen 1st A1 for $4x^3$ <u>or</u> $6\times\frac{1}{2}\times x^{-\frac{1}{2}}$ (o.e.) (ignore any + c for this mark) 2nd A1 for simplified terms i.e. <u>both</u> $4x^3$ <u>and</u> $3x^{-\frac{1}{2}}$ or $\frac{3}{\sqrt{x}}$ and no $+c$ $\left[\frac{3}{1}x^{-\frac{1}{2}}\text{ is A0}\right]$ Apply ISW here and award marks when first seen	
(b)	M1 for $x^n \to x^{n+1}$ applied to y only so x^5 or $x^{\frac{3}{2}}$ seen. Do not award for integrating their answer to part (a) 1st A1 for $\frac{x^5}{5}$ or $\frac{6x^{\frac{3}{2}}}{\frac{3}{2}}$ (or better). Allow $1/5x^5$ here but not for 2nd A1 2nd A1 for fully correct and simplified answer with $+C$. Allow $(1/5)x^5$ If + C appears earlier but not on a line where 2nd A1 could be scored then A0	

Question	Scheme	Marks
2. (a)	$\sqrt{32} = 4\sqrt{2}$ or $\sqrt{18} = 3\sqrt{2}$	B1
	$\left(\sqrt{32}+\sqrt{18}=\right)$ $\underline{7\sqrt{2}}$	B1 (2)
(b)	$\times\dfrac{3-\sqrt{2}}{3-\sqrt{2}}$ or $\times\dfrac{-3+\sqrt{2}}{-3+\sqrt{2}}$ seen	M1
	$\left[\dfrac{\sqrt{32}+\sqrt{18}}{3+\sqrt{2}}\times\dfrac{3-\sqrt{2}}{3-\sqrt{2}}=\right]$ $\dfrac{a\sqrt{2}\left(3-\sqrt{2}\right)}{[9-2]}$ $\rightarrow$ $\dfrac{3a\sqrt{2}-2a}{[9-2]}$ (or better)	dM1
	$= \underline{3\sqrt{2}, -2}$	A1, A1 (4)
ALT	$(b\sqrt{2}+c)(3+\sqrt{2}) = 7\sqrt{2}$ leading to: $3b+c=7$, $3c+2b=0$	M1
	e.g. $3(7-3b)+2b=0$ (o.e.)	dM1
		6 marks
	Notes	

(a) 1^{st} B1 for either surd simplified

2^{nd} B1 for $7\sqrt{2}$ or accept $a = 7$. Answer only scores B1B1

NB Common error is $\sqrt{32}+\sqrt{18}=\sqrt{50}=5\sqrt{2}$ this scores B0B0 but can use their "5" in (b) to get M1M1

(b) 1^{st} M1 for an attempt to multiply by $\dfrac{3-\sqrt{2}}{3-\sqrt{2}}$ (o.e.) Allow poor use of brackets

2^{nd} dM1 for using $a\sqrt{2}$ to correctly obtain a numerator of the form $p + q\sqrt{2}$ where p and q are non-zero integers. Allow arithmetic slips e.g. $21\sqrt{2}$ - 28 or
Follow through their $a = 7$ or a new value found in (b). Ignore denominator.
Allow use of letter a. Dependent on 1^{st} M1

So is M0 until they reduce $p + q$

1^{st} A1 for or accept $b = 3$ from correct working

2^{nd} A1 for or accept $c = $ 2 from correct working

Simultaneous Equations

1^{st} M1 for and forming 2 simultaneous equations. Ft their $a = 7$

2^{nd} dM1 for solving their simultaneous equations: reducing to a linear equation in one variable

Question	Scheme	Marks
3. **(a)**	$5x > 20$	M1
	$\underline{\boldsymbol{x > 4}}$	A1 (2)
(b)		
	[= 0]	M1
	$x = 6$,	A1
	, $x > 6$	M1, A1ft
		(4)
		6 marks
	Notes	
(a)	M1 for reducing to the form $px > q$ with one of p or q correct Using $px = q$ is M0 unless > appears later on A1 $x > 4$ only	
(b)	1st M1 for multiplying out and attempting to solve a 3TQ with at least $\pm 4x$ or ± 12 See **General Principles** for definitions of "attempt to solve"	

1st A1 for 6 and seen. Allow $x > 6$, $x >$ etc to score this mark.
Values may be on a sketch.

2nd M1 for choosing the "outside region" for their critical values. Do not award simply for a diagram or table – they must have chosen their "outside" regions

2nd A1ft follow through their 2 distinct critical values. Allow "," "or" or a "blank" between answers. Use of "and" is M1A0 i.e. loses the final A1

scores M1A0 i.e. loses the final A1 but apply ISW if $x > 6$, $x <$ has been seen

Accept (o.e)

Use of ≤ instead of < (or ≥ instead of >) loses the final A mark in (b) unless A mark was lost in (a) for $x \geq 4$ in which case allow it here.

Question	Scheme	Marks
4. (a)	$a + 5$	
	$=$ **(*)**	
	$41 =$ or	
	$(a + 9)(a - 4) = 0$	
	$a = 4$ or	

Notes

B1 accept $a1 + 5$ or (etc)

M1 must see a(their) + 5

A1cso must have seen $a(a[1] + 5) + 5$ (etc or better) Must have both brackets
incorrect working seen

1st M1 for forming a suitable equation using and 41 and an attempt to collec
reduce to 3TQ (o.e). Allow one error in sign. Accept for example
If completing the square should get to

2nd M1 Attempting to solve their relevant 3TQ (**see General Principles**)

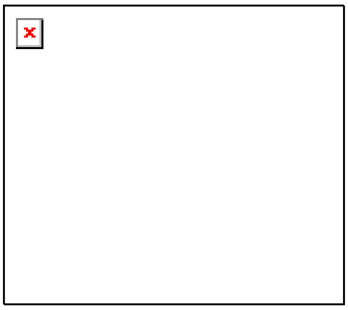
A1 for both 4 and seen. If $a = 4$ and is followed by $< a < 4$ appl
No working or trial and improvement leading to <u>both</u> answers scores 3/3
for only one answer.

Allow use of other letters instead of a

Question	Scheme	Marks
5. (a)	(o.e.)	M1

(o.e.) e.g.

, so no roots or no intersections or no solutions



Curve: shape and passing through (0, 0)
shape and passing through (5, 0)

Line : +ve gradient and no intersections with C. If no C drawn score B0

Line passing through (0, 2) and (0.8, 0) marked on axes

Notes

1st M1 for forming a suitable equation in one variable

1st A1 for a correct 3TQ equation. Allow missing "= 0" Accept

2nd M1 for an attempt to evaluate discriminant for their 3TQ. Allow for

Allow if it is part of a solution using the formula e.g.

Correct formula quoted and some correct substitution or a correct expre
False factorising is M0

2nd A1 for correct evaluation of discriminant for a correct 3TQ e.g. 25 – 32 (or
comment indicating no roots or equivalent. For <u>contradictory</u> statement

2nd M1 for attempt at completing the square

2nd A1 for and a suitable comment

Coordinates must be seen <u>on</u> the diagram. Do not award if only in the body
"Passing through" means <u>not</u> stopping at and <u>not</u> touching.
Allow (0, x) and (y, 0) if marked on the correct places on the correc

1st B1 for correct shape and passing through origin. Can be assumed if it passes
intersection of axes

2nd B1 for correct shape and 5 marked on x-axis
for shape stopping at <u>both</u> (5, 0) <u>and</u> (0, 0) award B0B1

3rd B1 for a line of positive gradient that (if extended) has no intersection with t
extended). Must have both graphs on same axes for this mark. If no C gi

4th B1 for straight line passing through 0.8 on x-axis and 2 on y-axis
Accept exact fraction equivalents to

Question	Scheme	Marks
6. (a)	(or exact equivalent)	B1 (1)
(b)	*B*: (0, 4) [award when first seen – may be in (c)]	B1
	Gradient:	M1
	or equiv. e.g.	A1 (3)
(c)	*A*: [award when first seen – may be in (b)]	B1
	C: [award when first seen – may be in (b)]	B1ft
	Area: Using	M1
		A1 cso (4)
ALT	(from similar triangles) (or possibly using *C*)	2nd B1ft
	Area: Using N.B. *AB* =	M1
		A1
		8 marks

	Notes	

(a) B1 for seen. Do not award for and must be in part (a)

(b)
B1 for coordinates of *B*. Accept 4 marked on *y*-axis (clearly labelled)
M1 for use of perpendicular gradient rule. Follow through their value for *m*
A1 for a correct equation (any form, need not be simplified). Answer only 3/3

(c)
1st B1 for the coordinates of *A* (clearly labelled). Accept – 6 marked on *x*-axis
2nd B1ft for the coordinates of *C* (clearly labelled) or *AC* =
Accept x = marked on *x*-axis. Follow through from if >0

M1 for an expression for the area of the triangle (all lengths > 0). Ft their 4, - 6 and

A1 cso for or exact equivalent seen but must be a single fraction or etc

on its own can only score full marks if *A*, *B* and *C* are all correct.
2nd B1ft If they use this approach award this mark for *C* (if seen) or *BC*
2nd M1 must get as far as:

Question	Scheme	Marks
7.	or	M1A1
	10 = 8 – 6 + 10 + *c*	M1
	c =	A1
	f(1) = = (o.e.)	A1ft (5)
		5 marks
	Notes	
	1st M1 for attempt to integrate 1st A1 all correct, possibly unsimplified. Ignore +*c* here. 2nd M1 for using $x = 2$ <u>and</u> f(2) = 10 to form a linear equation in c. Allow sign errors. They should be substituting into a <u>changed</u> expression 2nd A1 for $c =$ 3rd A1ft for Follow through their <u>numerical</u> c ( ) This mark is dependent on 1st M1 and 1st A1 only.	