

# Mark Scheme (Results) January 2011

GCE

## GCE Core Mathematics C1 (6663) Paper 1

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## 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  $\checkmark$  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
- $\square$  The second mark is dependent on gaining the first mark

January 2011  
Core Mathematics C1 6663  
Mark Scheme

Question Number	Scheme	Marks
1. (a)	$16^{\frac{1}{4}} = 2$ or $\frac{1}{16^{\frac{1}{4}}}$ or better $\left(16^{-\frac{1}{4}} = \right) \frac{1}{2}$ or 0.5 (ignore $\pm$ )	M1  A1  (2)
(b)	$\left(2x^{-\frac{1}{4}}\right)^4 = 2^4 x^{-\frac{4}{4}}$ or $\frac{2^4}{x^{\frac{4}{4}}}$ or equivalent $x\left(2x^{-\frac{1}{4}}\right)^4 = 2^4$ or 16	M1  A1 cao  (2) 4
<b>Notes</b>		
(a)	M1 for a correct statement dealing with the $\frac{1}{4}$ or the $-$ power This may be awarded if 2 is seen or for reciprocal of their $16^{\frac{1}{4}}$ s.c $\frac{1}{4}$ is M1 A0 , also $2^{-1}$ is M1 A0 $\pm \frac{1}{2}$ is not penalised so M1 A1	
(b)	M1 for <b>correct</b> use of the power 4 on both the 2 and the $x$ terms A1 for cancelling the $x$ and simplifying to one of these two forms. Correct answers with no working get full marks	

Question Number	Scheme	Marks
2.	$\left(\int =\right) \frac{12x^6}{6}, -\frac{3x^3}{3}, +\frac{4x^{\frac{4}{3}}}{\frac{4}{3}}, (+c)$ $= \underline{2x^6 - x^3 + 3x^{\frac{4}{3}} + c}$	M1A1,A1,A1  A1  5
	<b>Notes</b>	
	<p>M1 for some attempt to integrate: <math>x^n \rightarrow x^{n+1}</math> i.e <math>ax^6</math> or <math>ax^3</math> or <math>ax^{\frac{4}{3}}</math> or <math>ax^{\frac{1}{3}}</math>, where <math>a</math> is a non zero constant</p> <p>1<sup>st</sup> A1 for <math>\frac{12x^6}{6}</math> or better</p> <p>2<sup>nd</sup> A1 for <math>-\frac{3x^3}{3}</math> or better</p> <p>3<sup>rd</sup> A1 for <math>\frac{4x^{\frac{4}{3}}}{\frac{4}{3}}</math> or better</p> <p>4<sup>th</sup> A1 for each term correct and simplified and the <math>+c</math> occurring in the final answer</p>	

Question Number	Scheme	Marks
3.	$\frac{5-2\sqrt{3}}{\sqrt{3}-1} \times \frac{(\sqrt{3}+1)}{(\sqrt{3}+1)}$ $= \frac{\dots}{2} \quad \text{denominator of 2}$ Numerator = $5\sqrt{3} + 5 - 2\sqrt{3}\sqrt{3} - 2\sqrt{3}$ So $\frac{5-2\sqrt{3}}{\sqrt{3}-1} = -\frac{1}{2} + \frac{3}{2}\sqrt{3}$	M1  A1  M1  A1  <b>4</b>
	<b>Alternative:</b> $(p+q\sqrt{3})(\sqrt{3}-1) = 5-2\sqrt{3}$ , and form simultaneous equations in $p$ and $q$ $-p+3q=5$ and $p-q=-2$ Solve simultaneous equations to give $p = -\frac{1}{2}$ and $q = \frac{3}{2}$ .	M1  A1  M1 A1
	<b>Notes</b>	
	1 <sup>st</sup> M1 for multiplying numerator and denominator by same correct expression 1 <sup>st</sup> A1 for a correct denominator as a single number (NB depends on M mark) 2 <sup>nd</sup> M1 for an attempt to multiply the numerator by $(\sqrt{3} \pm 1)$ and get 4 terms with at least 2 correct. 2 <sup>nd</sup> A1 for the answer as written or $p = -\frac{1}{2}$ and $q = \frac{3}{2}$ . Allow -0.5 and 1.5. (Apply isw if correct answer seen, then slip writing $p = , q =$ )	
	Answer only (very unlikely) is full marks if correct – no part marks	

Question Number	Scheme	Marks
4		
(a)	$(a_2 =) 6 - c$	B1 (1)
(b)	$a_3 = 3(\text{their } a_2) - c \quad (= 18 - 4c)$ $a_1 + a_2 + a_3 = 2 + "(6 - c)" + "(18 - 4c)"$ $"26 - 5c" = 0$ So $c = 5.2$	M1 M1 A1ft A1 o.a.e (4) 5
	<b>Notes</b>	
(b)	1 <sup>st</sup> M1 for attempting $a_3$ . Can follow through their answer to (a) but it must be an expression in $c$ . 2 <sup>nd</sup> M1 for an attempt to find the sum $a_1 + a_2 + a_3$ must see evidence of sum 1 <sup>st</sup> A1ft for their sum put equal to 0. Follow through their values but answer must be in the form $p + qc = 0$ A1 – accept any correct equivalent answer	

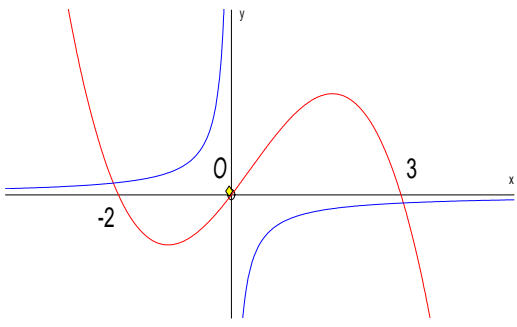
Question Number	Scheme	Marks
5. (a)	<p>Correct shape with a single crossing of each axis</p> <p><math>y = 1</math> labelled or stated</p> <p><math>x = 3</math> labelled or stated</p>	<p>B1</p> <p>B1</p> <p>B1</p> <p>(3)</p>
(b)	<p>Horizontal translation so crosses the <math>x</math>-axis at <math>(1, 0)</math></p> <p>New equation is <math>(y =) \frac{x \pm 1}{(x \pm 1) - 2}</math></p> <p>When <math>x = 0</math> <math>y =</math></p> $= \frac{1}{3}$	<p>B1</p> <p>M1</p> <p>M1</p> <p>A1</p> <p>(4)</p> <p>7</p>
<b>Notes</b>		
(b)	<p>B1 for point <math>(1,0)</math> identified - this may be marked on the sketch as 1 on <math>x</math> axis. Accept <math>x = 1</math>.</p> <p>1<sup>st</sup> M1 for attempt at new equation and either numerator or denominator correct</p> <p>2<sup>nd</sup> M1 for setting <math>x = 0</math> in their new equation and solving as far as <math>y = \dots</math></p> <p>A1 for <math>\frac{1}{3}</math> or exact equivalent. Must see <math>y = \frac{1}{3}</math> or <math>(0, \frac{1}{3})</math> or point marked on <math>y</math>-axis.</p> <p><b>Alternative</b></p> <p><math>f(-1) = \frac{-1}{-1-2} = \frac{1}{3}</math> scores M1M1A0 unless <math>x = 0</math> is seen or they write the point as <math>(0, \frac{1}{3})</math> or give <math>y = 1/3</math></p> <p>Answers only: <math>x = 1</math>, <math>y = 1/3</math> is full marks as is <math>(1,0)</math> <math>(0, 1/3)</math></p> <p>Just 1 and <math>1/3</math> is B0 M1 M1 A0</p> <p>Special case : Translates 1 unit to left</p> <p>(a) B0, B1, B0</p> <p>(b) Mark (b) as before</p> <p>May score B0 M1 M1 A0 so 3/7 or may ignore sketch and start again scoring full marks for this part.</p>	



Question Number	Scheme	Marks
6.  (a)	$S_{10} = \frac{10}{2}[2a + 9d] \text{ or}$ $S_{10} = a + a + d + a + 2d + a + 3d + a + 4d + a + 5d + a + 6d + a + 7d + a + 8d + a + 9d$ $162 = 10a + 45d \quad *$	M1   A1cso (2)
(b)	$(u_n = a + (n-1)d \Rightarrow ) 17 = a + 5d$  $10 \times (b) \text{ gives } 10a + 50d = 170$ (a) is $10a + 45d = 162$  Subtract $5d = 8$ so $d = \underline{1.6}$ o.e.  Solving for $a$ $a = 17 - 5d$  so $a = \underline{9}$	B1 (1)  M1  A1 M1 A1 (4) 7
	<b>Notes</b>	
(a)	M1 for use of $S_n$ with $n = 10$	
(b)	1 <sup>st</sup> M1 for an attempt to eliminate $a$ or $d$ from their two linear equations 2 <sup>nd</sup> M1 for using their value of $a$ or $d$ to find the other value.	

Question Number	Scheme	Marks
7.	$(f(x) =) \frac{12x^3}{3} - \frac{8x^2}{2} + x(+c)$ $(f(-1) = 0 \Rightarrow) 0 = 4 \times (-1) - 4 \times 1 - 1 + c$ $c = 9$ $[f(x) = 4x^3 - 4x^2 + x + 9]$	M1 A1 A1 M1 A1  5
	<b>Notes</b>	
	1 <sup>st</sup> M1 for an attempt to integrate $x^n \rightarrow x^{n+1}$ 1 <sup>st</sup> A1 for at least 2 terms in $x$ correct - needn't be simplified, ignore $+c$ 2 <sup>nd</sup> A1 for all the terms in $x$ correct but they need not be simplified. No need for $+c$ 2 <sup>nd</sup> M1 for using $x = -1$ and $y = 0$ to form a linear equation in $c$ . No $+c$ gets M0A0 3 <sup>rd</sup> A1 for $c = 9$ . Final form of $f(x)$ is not required.	
8 .		
(a)	$b^2 - 4ac = (k - 3)^2 - 4(3 - 2k)$ $k^2 - 6k + 9 - 4(3 - 2k) > 0 \quad \text{or} \quad (k - 3)^2 - 12 + 8k > 0 \quad \text{or better}$ $\underline{k^2 + 2k - 3 > 0} \quad *$	M1  M1 A1cso (3)
(b)	$(k + 3)(k - 1)[= 0]$ Critical values are $k = 1$ or $-3$ (choosing "outside" region) $\underline{k > 1 \quad \text{or} \quad k < -3}$	M1 A1 M1 A1 cao (4) 7
	<b>Notes</b>	
(a)	1 <sup>st</sup> M1 for attempt to find $b^2 - 4ac$ with one of $b$ or $c$ correct 2 <sup>nd</sup> M1 for a correct inequality symbol and an attempt to expand. A1cso no incorrect working seen	
(b)	1 <sup>st</sup> M1 for an attempt to factorize <b>or</b> solve leading to $k = (2 \text{ values})$ 2 <sup>nd</sup> M1 for a method that leads them to choose the "outside" region. Can follow through their critical values. 2 <sup>nd</sup> A1 Allow " , " instead of "or" $\geq$ loses the final A1 $1 < k < -3$ scores M1A0 unless a correct version is seen before or after this one.	

Question Number	Scheme	Marks
9.		
(a)	$(8 - 3 - k = 0)$ so $\underline{k = 5}$	B1 (1)
(b)	$2y = 3x + k$ $y = \frac{3}{2}x + \dots$ and so $m = \frac{3}{2}$ o.e.	M1 A1 (2)
(c)	Perpendicular gradient = $-\frac{2}{3}$ Equation of line is: $y - 4 = -\frac{2}{3}(x - 1)$ $\underline{3y + 2x - 14 = 0}$ o.e.	B1ft M1A1ft A1 (4)
(d)	$y = 0, \Rightarrow B(7, 0)$ or $\underline{x = 7}$ $x = 7$ or $-\frac{c}{a}$	M1A1ft (2)
(e)	$AB^2 = (7 - 1)^2 + (4 - 0)^2$ $AB = \sqrt{52}$ or $2\sqrt{13}$	M1 A1 (2) 11
<b>Notes</b>		
(b)	M1 for an attempt to rearrange to $y = \dots$ A1 for clear statement that gradient is 1.5, can be $m = 1.5$ o.e.	
(c)	B1ft for using the perpendicular gradient rule correctly on their "1.5"  M1 for an attempt at finding the equation of the line through A using their gradient. Allow a sign slip 1 <sup>st</sup> A1ft for a correct equation of the line follow through their changed gradient  2 <sup>nd</sup> A1 as printed or equivalent with integer coefficients – allow $\underline{3y + 2x = 14}$ or $\underline{3y = 14 - 2x}$	
(d)	M1 for use of $y = 0$ to find $x = \dots$ in their equation A1ft for $x = 7$ or $-\frac{c}{a}$	
(e)	M1 for an attempt to find $AB$ or $AB^2$ A1 for any correct surd form- need not be simplified	

Question Number	Scheme	Marks
10. (a)	 <p>(i) correct shape ( -ve cubic) Crossing at (-2, 0) Through the origin Crossing at (3,0)</p> <p>(ii) 2 branches in correct quadrants not crossing axes One intersection with cubic on each branch</p>	B1 B1 B1 B1  B1  B1 (6)
(b)	<p>“2” solutions</p> <p>Since only “2” intersections</p>	B1ft dB1ft (2) 8
<b>Notes</b>		
(b)	<p>B1ft for a value that is compatible with their sketch dB1ft This mark is dependent on the value being compatible with their sketch. For a comment relating the number of solutions to the number of intersections.</p> <p>[ Only allow 0, 2 or 4]</p>	
11. (a)	$\left(\frac{dy}{dx} = \right) \frac{3}{2}x^2 - \frac{27}{2}x^{\frac{1}{2}} - 8x^{-2}$	M1A1A1A1 (4)
(b)	$x = 4 \Rightarrow y = \frac{1}{2} \times 64 - 9 \times 2^3 + \frac{8}{4} + 30$ $= 32 - 72 + 2 + 30 = -8 *$	M1 A1cso (2)
(c)	$x = 4 \Rightarrow y' = \frac{3}{2} \times 4^2 - \frac{27}{2} \times 2 - \frac{8}{16}$ $= 24 - 27 - \frac{1}{2} = -\frac{7}{2}$ <p>Gradient of the normal = <math>-1 \div -\frac{7}{2}</math></p> <p>Equation of normal: <math>y - -8 = \frac{2}{7}(x - 4)</math></p> $\underline{7y - 2x + 64 = 0}$	M1 A1 M1 M1A1ft A1 (6) 12

Question Number	Scheme		Marks
	<b>Notes</b>		
(a)	1 <sup>st</sup> M1 for an attempt to differentiate $x^n \rightarrow x^{n-1}$ 1 <sup>st</sup> A1 for one correct term in $x$ 2 <sup>nd</sup> A1 for 2 terms in $x$ correct 3 <sup>rd</sup> A1 for all correct $x$ terms. No 30 term and no $+c$ .		
(b)	M1 for substituting $x = 4$ into $y =$ and attempting $4^{\frac{3}{2}}$ A1 note this is a printed answer		
(c)	1 <sup>st</sup> M1 Substitute $x = 4$ into $y'$ (allow slips) A1 Obtains $-3.5$ or equivalent 2 <sup>nd</sup> M1 for correct use of the perpendicular gradient rule using their gradient. (May be slip doing the division) Their gradient must have come from $y'$  3 <sup>rd</sup> M1 for an attempt at equation of tangent or normal at $P$ 2 <sup>nd</sup> A1ft for correct use of their changed gradient to find <b>normal</b> at $P$ . Depends on 1 <sup>st</sup> , 2 <sup>nd</sup> and 3 <sup>rd</sup> Ms 3 <sup>rd</sup> A1 for any equivalent form with integer coefficients		

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