

# Mark Scheme (Results)

June 2011

GCE Core Mathematics C1 (6663) Paper 1

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

**June 2011**  
**Core Mathematics C1 6663**  
**Mark Scheme**

Question Number	Scheme	Marks
<b>1.</b> <b>(a)</b>	5 (or $\pm 5$ )	B1  (1)
<b>(b)</b>	$25^{-\frac{3}{2}} = \frac{1}{25^{\frac{3}{2}}}$ <b>or</b> $25^{\frac{3}{2}} = 125$ or better  $\frac{1}{125}$ or 0.008 (or $\pm \frac{1}{125}$ )	M1  A1  (2) <b>3</b>
<b>Notes</b>		
<p>(a) Give B1 for 5 or <math>\pm 5</math> Anything else is B0 (including just <math>-5</math>)</p> <p>(b) M: Requires reciprocal OR <math>25^{\frac{3}{2}} = 125</math>            Accept <math>\frac{1}{5^3}</math>, <math>\frac{1}{\sqrt{15625}}</math>, <math>\frac{1}{25 \times 5}</math>, <math>\frac{1}{25\sqrt{25}}</math>, <math>\frac{1}{\sqrt{25^3}}</math> for M1</p> <p>Correct answer with no working ( or notation errors in working) scores both marks i.e. M1 A1</p> <p>M1A0 for <math>-\frac{1}{125}</math> without <math>+\frac{1}{125}</math></p>		

Question Number	Scheme	Marks
<b>2.</b>  <b>(a)</b>	$\frac{dy}{dx} = 10x^4 - 3x^{-4} \quad \text{or} \quad 10x^4 - \frac{3}{x^4}$	M1 A1 A1  (3)
<b>(b)</b>	$\left(\int =\right) \frac{2x^6}{6} + 7x + \frac{x^{-2}}{-2} = \frac{x^6}{3} + 7x - \frac{x^{-2}}{2} + C$	M1 A1 A1  B1  (4) <b>7</b>
<p style="text-align: center;"><b>Notes</b></p> <p>(a) M1: Attempt to differentiate <math>x^n \rightarrow x^{n-1}</math> (for any of the 3 terms)            i.e. <math>ax^4</math> or <math>ax^{-4}</math>, where <math>a</math> is any non-zero constant or            the 7 differentiated to give 0 is sufficient evidence for M1            1<sup>st</sup> A1: One correct (non-zero) term, possibly unsimplified.            2<sup>nd</sup> A1: Fully correct <b>simplified</b> answer.</p> <p>(b) M1: Attempt to integrate <math>x^n \rightarrow x^{n+1}</math>            (i.e. <math>ax^6</math> or <math>ax</math> or <math>ax^{-2}</math>, where <math>a</math> is any non-zero constant).            1<sup>st</sup> A1: Two correct terms, possibly unsimplified.            2<sup>nd</sup> A1: All three terms correct and <b>simplified</b>.</p> <p>Allow correct equivalents to printed answer, e.g. <math>\frac{x^6}{3} + 7x - \frac{1}{2x^2}</math> or <math>\frac{1}{3}x^6 + 7x - \frac{1}{2}x^{-2}</math></p> <p>Allow <math>\frac{1x^6}{3}</math> or <math>7x^1</math></p> <p>B1: + C appearing at any stage in part (b) (independent of previous work)</p>		

Question Number	Scheme	Marks
3.	Mid-point of $PQ$ is $(4, 3)$ $PQ: m = \frac{0-6}{9-(-1)}, \left( = -\frac{3}{5} \right)$ Gradient perpendicular to $PQ = -\frac{1}{m} \left( = \frac{5}{3} \right)$ $y-3 = \frac{5}{3}(x-4)$ $5x-3y-11=0$ or $3y-5x+11=0$ or multiples e.g. $10x-6y-22=0$	B1 B1 M1 M1 A1 (5) <b>5</b>
	<b><u>Notes</u></b>	

B1: correct midpoint.  
 B1: correct numerical expression for gradient – need not be simplified  
 1<sup>st</sup> M: Negative reciprocal of their numerical value for  $m$   
 2<sup>nd</sup> M: Equation of a line through **their**  $(4, 3)$  with any gradient except 0 or  $\infty$ .

If the 4 and 3 are the wrong way round the 2<sup>nd</sup> 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 2<sup>nd</sup> M mark is for attempting this.

A1: Requires integer form with an = zero (see examples above)

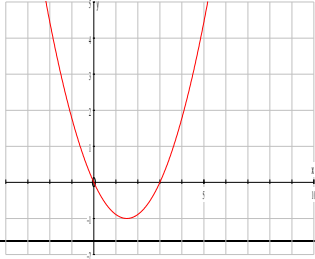
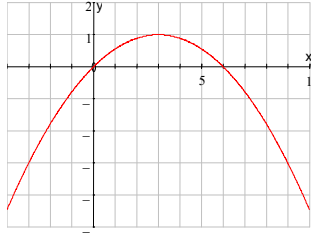
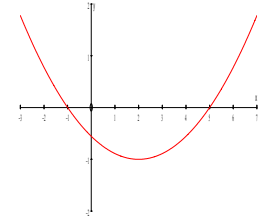







Question Number	Scheme	Marks
<b>6.</b>  <b>(a)</b>	$p = \frac{1}{2}, q = 2$ or $6x^{\frac{1}{2}}, 3x^2$	B1, B1  (2)
<b>(b)</b>	$\frac{6x^{\frac{3}{2}}}{\left(\frac{3}{2}\right)} + \frac{3x^3}{3} \quad \left( = 4x^{\frac{3}{2}} + x^3 \right)$ $x = 4, y = 90: 32 + 64 + C = 90 \Rightarrow C = -6$ $y = 4x^{\frac{3}{2}} + x^3 + \text{"their - 6"}$	M1 A1ft  M1 A1  A1  (5) <b>7</b>
Notes		
<p>(a) Accept any equivalent answers, e.g. <math>p = 0.5, q = 4/2</math></p> <p>(b) 1<sup>st</sup> M: Attempt to integrate <math>x^n \rightarrow x^{n+1}</math> (for either term)</p> <p>1<sup>st</sup> A: fit their <math>p</math> and <math>q</math>, but terms need not be simplified (+<math>C</math> not required for this mark)</p> <p>2<sup>nd</sup> M: Using <math>x = 4</math> <u>and</u> <math>y = 90</math> to form an equation in <math>C</math>.</p> <p>2<sup>nd</sup> A: cao</p> <p>3<sup>rd</sup> A: answer as shown with simplified correct coefficients and powers – but follow through their value for <math>C</math></p> <p>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).</p> <p><u>Numerator and denominator integrated separately:</u></p> <p>First M mark <b>cannot</b> be awarded so only mark available is second M mark. So 1 out of 5 marks.</p>		

Question Number	Scheme	Marks
7. (a)	Discriminant: $b^2 - 4ac = (k + 3)^2 - 4k$ or equivalent	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 $b^2 - 4ac > 0$ or $(k + 1)^2 + 8 > 0$ $(k + 1)^2 \geq 0$ for all $k$ , so $b^2 - 4ac > 0$ , so roots are real for all $k$ (or equiv.)	M1 A1 cso (2) <b>6</b>
Notes		
<p>(a) M1: attempt to find discriminant – substitution is required  If formula <math>b^2 - 4ac</math> is seen at least 2 of <math>a</math>, <math>b</math> and <math>c</math> must be correct  If formula <math>b^2 - 4ac</math> is <b>not</b> seen all 3 of <math>a</math>, <math>b</math> and <math>c</math> must be correct  Use of <math>b^2 + 4ac</math> is M0  A1: correct unsimplified</p> <p>(b) M1: Attempt at completion of square (see earlier notes)  A1: both correct (no ft for this mark)</p> <p>(c) M1: States condition as on scheme <b>or</b> attempts to explain that their <math>(k + 1)^2 + 8</math> is greater than 0  A1: The final mark (A1cso) requires <math>(k + 1)^2 \geq 0</math> and conclusion. We will allow <math>(k + 1)^2 &gt; 0</math> (or word positive) also allow <math>b^2 - 4ac \geq 0</math> and conclusion.</p>		

Question Number	Scheme	Marks
<p><b>8.</b></p> <p><b>(a)</b></p>	 <p>Shape <math>\cup</math> through <math>(0, 0)</math></p> <p><math>(3, 0)</math></p> <p><math>(1.5, -1)</math></p>	<p>B1</p> <p>B1</p> <p>B1</p> <p>(3)</p>
<p><b>(b)</b></p>	 <p>Shape <math>\cap</math></p> <p><math>(0, 0)</math> and <math>(6, 0)</math></p> <p><math>(3, 1)</math></p>	<p>B1</p> <p>B1</p> <p>B1</p> <p>(3)</p>
<p><b>(c)</b></p>	 <p>Shape <math>\cup</math>, <u>not</u> through <math>(0, 0)</math></p> <p>Minimum in 4<sup>th</sup> quadrant</p> <p><math>(-p, 0)</math> and <math>(6 - p, 0)</math></p> <p><math>(3 - p, -1)</math></p>	<p>M1</p> <p>A1</p> <p>B1</p> <p>B1</p> <p>(4)</p> <p><b>10</b></p>
<b>Notes</b>		
<p>(a) B1: U shaped parabola through origin          B1: <math>(3, 0)</math> stated or 3 labelled on <math>x</math> axis          B1: <math>(1.5, -1)</math> or equivalent e.g. <math>(3/2, -1)</math></p> <p>(b) B1: Cap shaped parabola in any position</p> <p>B1: through origin (may not be labelled) and <math>(6, 0)</math> stated or 6 labelled on <math>x</math> - axis          B1: <math>(3, 1)</math> shown</p> <p>(c) M1: U shaped parabola not through origin          A1: Minimum in 4<sup>th</sup> quadrant (depends on M mark having been given)          B1: Coordinates stated or shown on <math>x</math> axis          B1: Coordinates stated</p> <p>Note: If values are taken for <math>p</math>, then it is possible to give M1A1B0B0 even if there are several attempts. (In this case all minima should be in fourth quadrant)</p>		

Question Number	Scheme	Marks
<b>9.</b> <b>(a)</b>	Series has 50 terms $S = \frac{1}{2}(50)(2 + 100) = 2550 \quad \text{or} \quad S = \frac{1}{2}(50)(4 + 49 \times 2) = 2550$	B1 M1 A1 (3)
<b>(b)</b> <b>(i)</b> <b>(ii)</b>	$\frac{100}{k}$ <p>Sum: <math>\frac{1}{2}\left(\frac{100}{k}\right)(k + 100)</math> or <math>\frac{1}{2}\left(\frac{100}{k}\right)\left(2k + \left(\frac{100}{k} - 1\right)k\right)</math></p> $= 50 + \frac{5000}{k} \quad (*)$	B1 M1 A1 A1 cso (4)
<b>(c)</b>	$50^{\text{th}} \text{ term} = a + (n - 1)d$ $= (2k + 1) + 49(2k + 3)$ $= 100k + 148$ <div style="display: inline-block; vertical-align: middle; border-left: 1px solid black; padding-left: 10px; margin-left: 20px;"> <math display="block">\text{Or } 2k + 49(2k) + 1 + 49(3)</math> <math display="block">= 100k + 148</math> </div>	M1 A1 (2) <b>9</b>
<p>Notes</p> <p>(a) B for seeing attempt to use <math>n = 50</math> or <math>n = 50</math> stated            M for attempt to use <math>\frac{1}{2}n(a + l)</math> or <math>\frac{1}{2}n(2a + (n - 1)d)</math> with <math>a = 2</math> and values for other variables (Using <math>n = 100</math> may earn B0 M1A0)</p> <p>(b) M for use of <math>a = k</math> and <math>d = k</math> or <math>l = 100</math> with their value for <math>n</math>, could be numerical or even letter <math>n</math> in correct formula for sum.            A1: Correct formula with <math>n = 100/k</math>            A1: NB Answer is printed – so no slips should have appeared in working</p> <p>(c) M for use of formula <math>a + 49d</math> with <math>a = 2k + 1</math> and with <math>d</math> obtained from difference of terms            A1: Requires this simplified answer</p>		

Question Number	Scheme	Marks
<p><b>10.</b> <b>(a)</b></p>	 <p>Shape (cubic in this orientation) <b>Touching</b> <math>x</math>-axis at <b>-3</b> <b>Crossing</b> at <b>-1</b> on <math>x</math>-axis Intersection at <b>9</b> on <math>y</math>-axis</p>	<p>B1 B1 B1 B1 <b>(4)</b></p>
<p><b>(b)</b></p>	<p><math>y = (x+1)(x^2 + 6x + 9) = x^3 + 7x^2 + 15x + 9</math> or equiv. (possibly unsimplified) Differentiates their polynomial correctly – may be unsimplified <math>\frac{dy}{dx} = 3x^2 + 14x + 15</math> (*)</p>	<p>B1 M1 A1 cso <b>(3)</b></p>
<p><b>(c)</b></p>	<p>At <math>x = -5</math>: <math>\frac{dy}{dx} = 75 - 70 + 15 = 20</math> At <math>x = -5</math>: <math>y = -16</math> <math>y - (-16) = 20(x - (-5))</math> or <math>y = 20x + c</math> with <math>(-5, -16)</math> used to find <math>c</math> <math>y = 20x + 84</math></p>	<p>B1 B1 M1 A1 <b>(4)</b></p>
<p><b>(d)</b></p>	<p>Parallel: <math>3x^2 + 14x + 15 = 20</math> <math>(3x - 1)(x + 5) = 0</math> <math>x = \dots</math> <math>x = \frac{1}{3}</math></p>	<p>M1 M1 A1 <b>(3)</b> <b>14</b></p>
<p style="text-align: center;"><b>Notes</b></p> <p>(a) Crossing at <math>-3</math> is B0. Touching at <math>-1</math> is B0 (b) M: This needs to be correct differentiation here A1: Fully correct simplified answer. (c) M: If the <math>-5</math> and <math>-16</math> are the wrong way round or – omitted the M mark can still be given if a correct formula is seen, (e.g. <math>y - y_1 = m(x - x_1)</math>) otherwise M0. <math>m</math> should be numerical and not 0 or infinity and should not have involved negative reciprocal. (d) 1<sup>st</sup> M: Putting the derivative expression equal to their value for gradient 2<sup>nd</sup> M: Attempt to solve quadratic (see notes) This may be implied by correct answer.</p>		

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