

Centre No.						Paper Reference	Surname	Initial(s)
Candidate No.						<b>6 6 6 3 / 0 1</b>	Signature	

Paper Reference(s)

**6663/01**

**Edexcel GCE**  
**Core Mathematics C1**  
**Advanced Subsidiary**



Friday 13 January 2012 – Morning  
Time: 1 hour 30 minutes

Examiner's use only

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Team Leader's use only

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Question Number	Leave Blank
1	
2	
3	
4	
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6	
7	
8	
9	
10	
Total	

Materials required for examination  
Mathematical Formulae (Pink)

Items included with question papers  
Nil

**Calculators may NOT be used in this examination.**

**Instructions to Candidates**

In the boxes above, write your centre number, candidate number, your surname, initials and signature. Check that you have the correct question paper. Answer ALL the questions. You must write your answer to each question in the space following the question.

**Information for Candidates**

A booklet 'Mathematical Formulae and Statistical Tables' is provided. Full marks may be obtained for answers to ALL questions. The marks for individual questions and the parts of questions are shown in round brackets: e.g. (2). There are 10 questions in this question paper. The total mark for this paper is 75. There are 28 pages in this question paper. Any blank pages are indicated.

**Advice to Candidates**

You must ensure that your answers to parts of questions are clearly labelled. You should show sufficient working to make your methods clear to the Examiner. Answers without working may not gain full credit.



*Turn over*

Leave blank

1. Given that  $y = x^4 + 6x^{\frac{1}{2}}$ , find in their simplest form

(a)  $\frac{dy}{dx}$

(3)

(b)  $\int y dx$

(3)

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**January 2012**  
**C1 6663**  
**Mark Scheme**

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

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2. (a) Simplify

$$\sqrt{32} + \sqrt{18}$$

giving your answer in the form  $a\sqrt{2}$ , where  $a$  is an integer.**(2)**

- (b) Simplify

$$\frac{\sqrt{32} + \sqrt{18}}{3 + \sqrt{2}}$$

giving your answer in the form  $b\sqrt{2} + c$ , where  $b$  and  $c$  are integers.**(4)**

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Question	Scheme	Marks
<p>2. (a)</p> <p>(b)</p>	$\sqrt{32} = 4\sqrt{2} \text{ or } \sqrt{18} = 3\sqrt{2}$ $(\sqrt{32} + \sqrt{18}) = \underline{7\sqrt{2}}$ <p>or</p> $\times \frac{3-\sqrt{2}}{3-\sqrt{2}} \text{ or } \times \frac{-3+\sqrt{2}}{-3+\sqrt{2}} \text{ seen}$ $\left[ \frac{\sqrt{32} + \sqrt{18}}{3+\sqrt{2}} \times \frac{3-\sqrt{2}}{3-\sqrt{2}} = \right] \frac{a\sqrt{2}(3-\sqrt{2})}{[9-2]} \rightarrow \frac{3a\sqrt{2}-2a}{[9-2]} \text{ (or better)}$ $= \underline{3\sqrt{2}, -2}$	<p>B1</p> <p>B1 (2)</p> <p>M1</p> <p>dM1</p> <p>A1, A1 (4)</p>
<p>ALT</p>	<p><math>(b\sqrt{2} + c)(3 + \sqrt{2}) = 7\sqrt{2}</math> leading to: <math>3b + c = 7, \quad 3c + 2b = 0</math></p> <p>e.g. <math>3(7 - 3b) + 2b = 0</math> (o.e.)</p>	<p>M1</p> <p>dM1</p>
<b>6 marks</b>		
<b>Notes</b>		
<p>(a)</p> <p>(b)</p> <p>ALT</p>	<p>1<sup>st</sup> B1 for either surd simplified</p> <p>2<sup>nd</sup> B1 for <math>7\sqrt{2}</math> or accept <math>a = 7</math>. Answer only scores B1B1</p> <p>NB Common error is <math>\sqrt{32} + \sqrt{18} = \sqrt{50} = 5\sqrt{2}</math> this scores B0B0 but can use their "5" in (b) to get M1M1</p> <p>1<sup>st</sup> M1 for an attempt to multiply by <math>\frac{3-\sqrt{2}}{3-\sqrt{2}}</math> (o.e.) Allow poor use of brackets</p> <p>2<sup>nd</sup> dM1 for using <math>a\sqrt{2}</math> to correctly obtain a numerator of the form <math>p + q\sqrt{2}</math> where <math>p</math> and <math>q</math> are non-zero integers. Allow arithmetic slips e.g. <math>21\sqrt{2} - 28</math> or <math>3\sqrt{2} \times \sqrt{2} = 3</math></p> <p>Follow through their <math>a = 7</math> or a new value found in (b). Ignore denominator.</p> <p>Allow use of letter <math>a</math>. Dependent on 1<sup>st</sup> M1</p> <p>So <math>3\sqrt{32} - \sqrt{64} + 3\sqrt{8} - \sqrt{36}</math> is M0 until they reduce <math>p + q\sqrt{2}</math></p> <p>1<sup>st</sup> A1 for <math>3\sqrt{2}</math> or accept <math>b = 3</math> from correct working</p> <p>2<sup>nd</sup> A1 for <math>-2</math> or accept <math>c = -2</math> from correct working</p> <p><b>Simultaneous Equations</b></p> <p>1<sup>st</sup> M1 for <math>(b\sqrt{2} + c)(3 + \sqrt{2}) = 7\sqrt{2}</math> and forming 2 simultaneous equations. Ft their <math>a = 7</math></p> <p>2<sup>nd</sup> dM1 for solving their simultaneous equations: reducing to a linear equation in one variable</p>	



Question	Scheme	Marks
<p>3. (a)</p> <p>(b)</p>	<p><math>5x &gt; 20</math></p> <p style="text-align: center;"><u><math>x &gt; 4</math></u></p> <p><math>x^2 - 4x - 12 = 0</math>  <math>(x + 2)(x - 6) = 0</math></p> <p style="text-align: center;"><math>x = 6, -2</math>  <math>x &lt; -2, x &gt; 6</math></p>	<p>M1 A1 (2)</p> <p>M1 A1 M1, A1ft (4)</p> <p><b>6 marks</b></p>
<b>Notes</b>		
<p>(a)</p> <p>(b)</p>	<p>M1 for reducing to the form <math>px &gt; q</math> with one of <math>p</math> or <math>q</math> correct                  Using <math>px = q</math> is M0 unless <math>&gt;</math> appears later on                  A1 <math>x &gt; 4</math> only</p> <p>1<sup>st</sup> M1 for multiplying out and attempting to solve a 3TQ with at least <math>\pm 4x</math> or <math>\pm 12</math>                  See <b>General Principles</b> for definitions of “attempt to solve”                  1<sup>st</sup> A1 for 6 and <math>-2</math> seen. Allow <math>x &gt; 6, x &gt; -2</math> etc to score this mark.                  Values may be on a sketch.                  2<sup>nd</sup> 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                  2<sup>nd</sup> 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  <math>-2 &gt; x &gt; 6</math> scores M1A0 i.e. loses the final A1 but apply ISW if <math>x &gt; 6, x &lt; -2</math> has been seen                  Accept <math>(-\infty, -2) \cup (6, \infty)</math> (o.e)                  Use of <math>\leq</math> instead of <math>&lt;</math> (or <math>\geq</math> instead of <math>&gt;</math>) loses the final A mark in (b) unless A mark was lost in (a) for <math>x \geq 4</math> in which case allow it here.</p>	

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4. A sequence  $x_1, x_2, x_3, \dots$  is defined by

$$x_1 = 1$$

$$x_{n+1} = ax_n + 5, \quad n \geq 1$$

where  $a$  is a constant.

(a) Write down an expression for  $x_2$  in terms of  $a$ . (1)

(b) Show that  $x_3 = a^2 + 5a + 5$  (2)

Given that  $x_3 = 41$

(c) find the possible values of  $a$ . (3)

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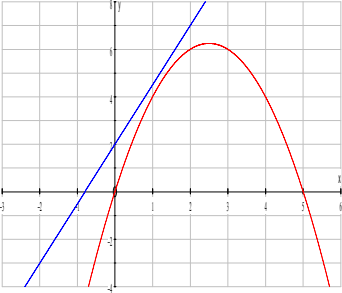
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Question	Scheme	Marks
4. (a)	$(x_2 =) a + 5$	B1 (1)
(b)	$(x_3) = a(a+5) + 5$ $= a^2 + 5a + 5$ (*)	M1 A1cso (2)
(c)	$41 = a^2 + 5a + 5 \Rightarrow a^2 + 5a - 36 (= 0)$ or $36 = a^2 + 5a$ $(a + 9)(a - 4) = 0$ $a = 4$ or $-9$	M1 M1 A1 (3) <b>6 marks</b>
<b>Notes</b>		
(a)	B1 accept $a + 5$ or $1 \times a + 5$ (etc)	
(b)	M1 must see $a$ (their $x_2$ ) + 5 A1cso must have seen $a(a + 5) + 5$ (etc or better) Must have both brackets (...) and no incorrect working seen	
(c)	1 <sup>st</sup> M1 for forming a suitable equation using $x_3$ and 41 and an attempt to collect like terms and reduce to 3TQ (o.e). Allow one error in sign. Accept for example $a^2 + 5a + 46 (= 0)$ If completing the square should get to $(a \pm \frac{5}{2})^2 = 36 + \frac{25}{4}$ 2 <sup>nd</sup> M1 Attempting to solve their relevant 3TQ ( <b>see General Principles</b> ) A1 for both 4 and $-9$ seen. If $a = 4$ and $-9$ is followed by $-9 < a < 4$ apply ISW. No working or trial and improvement leading to <u>both</u> answers scores 3/3 but no marks for only one answer. Allow use of other letters instead of $a$	



Question	Scheme	Marks
<p>5. (a)</p> <p>(b)</p>	$x(5-x) = \frac{1}{2}(5x+4) \quad (\text{o.e.})$ $2x^2 - 5x + 4 (= 0) \quad (\text{o.e.}) \text{ e.g. } x^2 - 2.5x + 2 (= 0)$ $b^2 - 4ac = (-5)^2 - 4 \times 2 \times 4$ $= 25 - 32 < 0, \text{ so no roots } \underline{\text{or}} \text{ no intersections } \underline{\text{or}} \text{ no solutions}$  <p>Curve: <math>\cap</math> shape and passing through (0, 0)  <math>\cap</math> shape and passing through (5, 0)</p> <p>Line : +ve gradient and no intersections with C. If no C drawn score B0</p> <p>Line passing through (0, 2) and (-0.8, 0) marked on axes</p>	<p>M1</p> <p>A1</p> <p>M1</p> <p>A1 (4)</p> <p>B1</p> <p>B1</p> <p>B1</p> <p>B1 (4)</p> <p><b>8 marks</b></p>
<b>Notes</b>		

<p>(a)</p> <p>ALT</p> <p>(b)</p> <p>SC</p>	<p>1<sup>st</sup> M1 for forming a suitable equation in one variable</p> <p>1<sup>st</sup> A1 for a correct 3TQ equation. Allow missing “= 0” Accept <math>2x^2 + 4 = 5x</math> etc</p> <p>2<sup>nd</sup> M1 for an attempt to evaluate discriminant for their 3TQ. Allow for <math>b^2 &gt; 4ac</math> or <math>b^2 &lt; 4ac</math></p> <p>Allow if it is part of a solution using the formula e.g. <math>(x =) \frac{5 \pm \sqrt{25 - 32}}{4}</math></p> <p>Correct formula quoted and some correct substitution or a correct expression</p> <p>False factorising is M0</p> <p>2<sup>nd</sup> A1 for correct evaluation of discriminant for a correct 3TQ e.g. <math>25 - 32</math> (or better) <u>and</u> a comment indicating no roots or equivalent. For <u>contradictory</u> statements score A0</p> <p>2<sup>nd</sup> M1 for attempt at completing the square <math>a \left[ \left( x \pm \frac{b}{2a} \right)^2 - q \right] + c</math></p> <p>2<sup>nd</sup> A1 for <math>\left( x - \frac{5}{4} \right)^2 = -\frac{7}{16}</math> and a suitable comment</p> <p><b>Coordinates must be seen <u>on</u> the diagram. Do not award if only in the body of the script.</b></p> <p><b>“Passing through” means <u>not</u> stopping at and <u>not</u> touching.</b></p> <p><b>Allow (0, x) and (y, 0) if marked on the correct places on the correct axis.</b></p> <p>1<sup>st</sup> B1 for correct shape and passing through origin. Can be assumed if it passes through the intersection of axes</p> <p>2<sup>nd</sup> B1 for correct shape and 5 marked on x-axis</p> <p>for <math>\cap</math> shape stopping at <u>both</u> (5, 0) <u>and</u> (0, 0) award B0B1</p> <p>3<sup>rd</sup> B1 for a line of positive gradient that (if extended) has no intersection with their C (possibly extended). Must have both graphs on same axes for this mark. If no C given score B0</p> <p>4<sup>th</sup> B1 for straight line passing through -0.8 on x-axis and 2 on y-axis</p> <p>Accept exact fraction equivalents to -0.8 or 2 (e.g. <math>\frac{4}{5}</math>)</p>	
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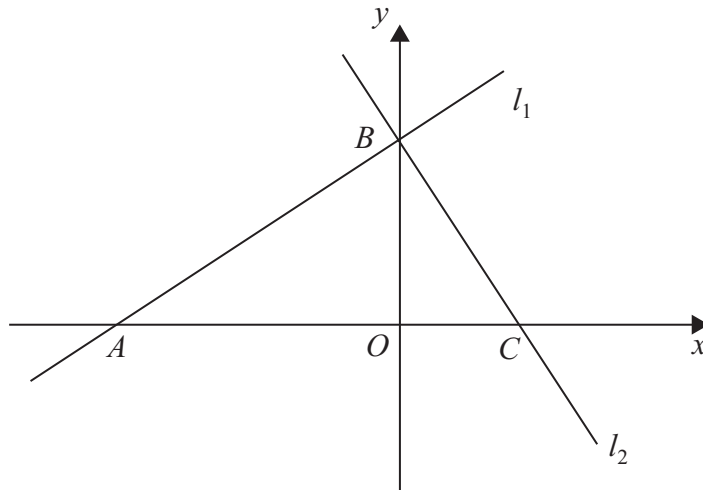


Figure 1

The line  $l_1$  has equation  $2x - 3y + 12 = 0$

- (a) Find the gradient of  $l_1$ . (1)

The line  $l_1$  crosses the  $x$ -axis at the point  $A$  and the  $y$ -axis at the point  $B$ , as shown in Figure 1.

The line  $l_2$  is perpendicular to  $l_1$  and passes through  $B$ .

- (b) Find an equation of  $l_2$ . (3)

The line  $l_2$  crosses the  $x$ -axis at the point  $C$ .

- (c) Find the area of triangle  $ABC$ . (4)

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Question	Scheme	Marks
6. (a)	$(m =) \frac{2}{3}$ (or exact equivalent)	B1 (1)
(b)	$B: (0, 4)$ [award when first seen – may be in (c)] Gradient: $\frac{-1}{m} = -\frac{3}{2}$ $y - 4 = -\frac{3x}{2}$ or equiv. e.g. $\left( y = -\frac{3x}{2} + 4, \quad 3x + 2y - 8 = 0 \right)$	B1 M1 A1 (3)
(c)	$A: (-6, 0)$ [award when first seen – may be in (b)] $C: \frac{3x}{2} = 4 \Rightarrow x = \frac{8}{3}$ [award when first seen – may be in (b)] Area: Using $\frac{1}{2}(x_C - x_A)y_B$ $= \frac{1}{2}\left(\frac{8}{3} + 6\right)4 = \frac{52}{3} \left( = 17\frac{1}{3} \right)$	B1 B1ft M1 A1 cso (4)
ALT	$BC = \frac{4}{6}\sqrt{52}$ (from similar triangles) (or possibly using C) Area: Using $\frac{1}{2}(AB \times BC)$ N.B. $AB = \sqrt{6^2 + 4^2} = \sqrt{52}$ $= \frac{1}{2} \times \sqrt{52} \times \left(\frac{2}{3}\sqrt{52}\right) = \frac{52}{3} \left( = 17\frac{1}{3} \right)$	2 <sup>nd</sup> B1ft M1 A1
<b>Notes</b>		<b>8 marks</b>
Use of Det	<p>(a) B1 for <math>\frac{2}{3}</math> seen. Do not award for <math>\frac{2}{3}x</math> and must be in part (a)</p> <p>(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</p> <p>(c) 1<sup>st</sup> B1 for the coordinates of A (clearly labelled). Accept – 6 marked on x-axis                      2<sup>nd</sup> B1ft for the coordinates of C (clearly labelled) or <math>AC = \frac{26}{3}</math>.                      Accept <math>x = \frac{8}{3}</math> marked on x-axis. Follow through from <math>l_2</math> if &gt;0</p> <p>M1 for an expression for the area of the triangle (all lengths &gt; 0). Ft their 4, - 6 and <math>\frac{8}{3}</math></p> <p>A1 cso for <math>\frac{52}{3}</math> or exact equivalent seen but must be a single fraction or <math>17\frac{1}{3}</math> or <math>17\frac{2}{6}</math> etc                      17<math>\frac{1}{3}</math> on its own can only score full marks if A, B and C are all correct.</p> <p>ALT 2<sup>nd</sup> B1ft If they use this approach award this mark for C (if seen) or BC</p> <p>2<sup>nd</sup> M1 must get as far as: <math>\frac{1}{2} x_A \times y_B - x_C \times y_B </math></p>	



Question	Scheme	Marks
<p>7.</p>	$[f(x) = \frac{3x^3}{3} - \frac{3x^2}{2} + 5x + c] \quad \text{or} \quad \left\{ x^3 - \frac{3}{2}x^2 + 5x + c \right\}$ $10 = 8 - 6 + 10 + c$ $c = -2$ $f(1) = 1 - \frac{3}{2} + 5 \quad "-2" = \frac{5}{2} \quad (\text{o.e.})$	<p>M1A1</p> <p>M1</p> <p>A1</p> <p>A1ft (5)</p> <p><b>5 marks</b></p>
<b>Notes</b>		
<p>1<sup>st</sup> M1 for attempt to integrate <math>x^n \rightarrow x^{n+1}</math></p> <p>1<sup>st</sup> A1 all correct, possibly unsimplified. Ignore +c here.</p> <p>2<sup>nd</sup> M1 for using <math>x = 2</math> <u>and</u> <math>f(2) = 10</math> to form a linear equation in <math>c</math>. Allow sign errors. They should be substituting into a <u>changed</u> expression</p> <p>2<sup>nd</sup> A1 for <math>c = -2</math></p> <p>3<sup>rd</sup> A1ft for <math>\frac{9}{2} + c</math> Follow through their <u>numerical</u> <math>c</math> (<math>\neq 0</math>)</p> <p>This mark is dependent on 1<sup>st</sup> M1 and 1<sup>st</sup> A1 only.</p>		

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8. The curve  $C_1$  has equation

$$y = x^2(x + 2)$$

(a) Find  $\frac{dy}{dx}$

(2)

(b) Sketch  $C_1$ , showing the coordinates of the points where  $C_1$  meets the  $x$ -axis.

(3)

(c) Find the gradient of  $C_1$  at each point where  $C_1$  meets the  $x$ -axis.

(2)

The curve  $C_2$  has equation

$$y = (x - k)^2(x - k + 2)$$

where  $k$  is a constant and  $k > 2$

(d) Sketch  $C_2$ , showing the coordinates of the points where  $C_2$  meets the  $x$  and  $y$  axes.

(3)

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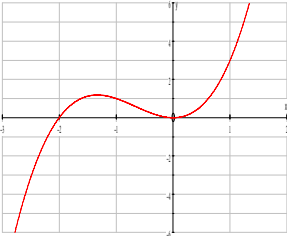

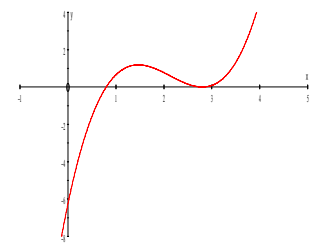
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Question	Scheme	Marks
8. (a)	$[y = x^3 + 2x^2]$ so $\frac{dy}{dx} = 3x^2 + 4x$	M1A1 (2)
(b)	 <p>Shape </p> <p>Touching <math>x</math>-axis at origin Through and not touching or stopping at <math>-2</math> on <math>x</math>-axis. Ignore extra intersections.</p>	B1 B1 B1 (3)
(c)	At $x = -2$ : $\frac{dy}{dx} = 3(-2)^2 + 4(-2) = 4$	M1
	At $x = 0$ : $\frac{dy}{dx} = 0$	(Both values correct) A1 (2)
(d)	 <p>Horizontal translation (touches <math>x</math>-axis still) <math>k - 2</math> and <math>k</math> marked on positive <math>x</math>-axis <math>k^2(2 - k)</math> (o.e) marked on negative <math>y</math>-axis</p>	M1 B1 B1 (3)
<b>10 marks</b>		

**Notes**

<b>Prod Rule</b>	(a) M1 for attempt to multiply out and then some attempt to differentiate $x^n \rightarrow x^{n-1}$ Do not award for $2x(x + 2)$ or $2x(1 + 2)$ etc Award M1 for a correct attempt: 2 products with a + and at least one product correct A1 for both terms correct. (If +c or extra term is included score A0)	
	(b) 1 <sup>st</sup> B1 for correct shape (anywhere). Must have 2 clear turning points. 2 <sup>nd</sup> B1 for graph touching at origin (not crossing or ending) 3 <sup>rd</sup> B1 for graph passing through (not stopping or touching at) $-2$ on $x$ axis and $-2$ marked on axis	
<b>SC</b>	B0B0B1 for $y = x^3$ <u>or</u> cubic with straight line between $(-2, 0)$ and $(0, 0)$	
	(c) M1 for attempt at $y'(0)$ or $y'(-2)$ . Follow through their 0 or $-2$ and their $y'(x)$ <u>or</u> for a <u>correct</u> statement of zero gradient for an identified point on their curve that touches $x$ -axis A1 for both correct answers	
	(d) For the M1 in part (d) ignore any coordinates marked – just mark the shape. M1 for a horizontal translation of their (b). Should still touch $x$ -axis if it did in (b) <u>Or</u> for a graph of correct shape with min. and intersection in correct order on +ve $x$ -axis 1 <sup>st</sup> B1 for $k$ and $k - 2$ on the positive $x$ -axis. Curve must pass through $k - 2$ and touch at $k$ 2 <sup>nd</sup> B1 for a correct intercept on negative $y$ -axis in terms of $k$ . Allow $(0, 2k^2 - k^3)$ (o.e.) seen in script if curve passes through $-ve$ $y$ -axis	

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9. A company offers two salary schemes for a 10-year period, Year 1 to Year 10 inclusive.

Scheme 1: Salary in Year 1 is £ $P$ .  
Salary increases by £ $(2T)$  each year, forming an arithmetic sequence.

Scheme 2: Salary in Year 1 is £ $(P + 1800)$ .  
Salary increases by £ $T$  each year, forming an arithmetic sequence.

(a) Show that the **total** earned under Salary Scheme 1 for the 10-year period is

$$£(10P + 90T) \tag{2}$$

For the 10-year period, the **total** earned is the same for both salary schemes.

(b) Find the value of  $T$ . (4)

For this value of  $T$ , the salary in Year 10 under Salary Scheme 2 is £29 850

(c) Find the value of  $P$ . (3)

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Question	Scheme	Marks
<p>9. (a)</p> <p>(b)</p> <p>(c)</p>	<p><math>S_{10} = \frac{10}{2}[2P + 9 \times 2T]</math> <u>or</u> <math>\frac{10}{2}(P + [P + 18T])</math>                      e.g. <math>5[2P + 18T]</math> <u>=</u> (£) <math>(10P + 90T)</math> <u>or</u> (£) <math>10P + 90T</math> (*)</p> <p>Scheme 2: <math>S_{10} = \frac{10}{2}[2(P + 1800) + 9T] = \{10P + 18000 + 45T\}</math>  <math>10P + 90T = 10P + 18000 + 45T</math>  <math>90T = 18000 + 45T</math>  <math>T = 400</math> (only)</p> <p>Scheme 2, Year 10 salary: <math>[a + (n - 1)d] = (P + 1800) + 9T</math>  <math>P + 1800 + "3600" = 29850</math>  <math>P = (\text{£}) \underline{24450}</math></p>	<p>M1 A1cso (2)</p> <p>M1A1 M1 A1 (4)</p> <p>B1ft M1 A1 (3)</p> <p><b>9 marks</b></p>
<b>Notes</b>		
<p>(a)</p> <p><b>List</b></p> <p>(b)</p> <p><b>List</b></p> <p>(c)</p> <p><b>MR</b></p>	<p>M1 for identifying <math>a = P</math> or <math>d = 2T</math> and attempt at <math>S_{10}</math>. Using <math>n = 10</math> and one of <math>a</math> or <math>d</math> correct. Must see evidence for M mark, at least one line before the answer.                      A1cso for simplifying to given answer. No incorrect working seen.                      Do not penalise missing end bracket in working eg <math>5(2P + 18T)</math>                      M1A1 for a full list seen (with + signs or written in columns) and no incorrect working seen. Any missing terms is M0A0</p> <p>1<sup>st</sup> M1 for attempting <math>S_{10}</math> for scheme 2 (allow missing (...) brackets e.g. <math>2P + 1800 + 9T</math>)                      Using <math>n = 10</math> and at least one of <math>a</math> or <math>d</math> correct.                      1<sup>st</sup> A1 for a correct expression for <math>S_{10}</math> using scheme 2 (needn't be multiplied out )                      Allow M1A1 if they reach <math>10P + 18000 + 45T</math> with no incorrect working seen  <math>10P + 18000 + 45T</math> with no working is M1A1                      2<sup>nd</sup> M1 for forming an equation using the two sums that would enable <math>P</math> to be eliminated.                      Follow through their expressions provided <math>P</math> would disappear.                      2<sup>nd</sup> A1 for <math>T = 400</math> Answer only (4/4)</p> <p>B1 for using <math>u_{10}</math> for scheme 2 . Can be <math>9T</math> or follow through their <u>value</u> of <math>T</math>                      M1 for forming an equation based on <math>u_{10}</math> for scheme 2 and using 29850 and their <u>value</u> of <math>T</math>                      A1 for 24450 seen Answer only (3/3)</p> <p>If they misread scheme 2 as scheme 1 in part (c) apply MR rule and award B0M1A0 max for an equation based on <math>u_{10}</math> for scheme 1 and using 29850 and their <u>value</u> of <math>T</math></p>	

10.

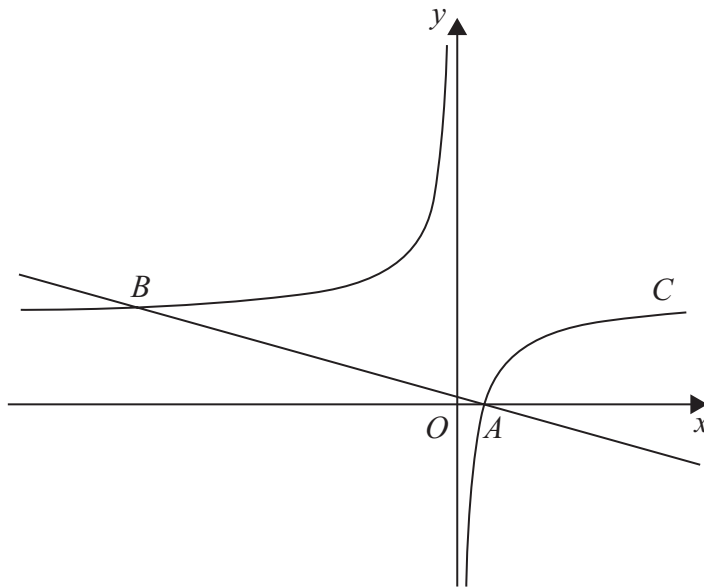


Figure 2

Figure 2 shows a sketch of the curve  $C$  with equation

$$y = 2 - \frac{1}{x}, \quad x \neq 0$$

The curve crosses the  $x$ -axis at the point  $A$ .

(a) Find the coordinates of  $A$ . (1)

(b) Show that the equation of the normal to  $C$  at  $A$  can be written as

$$2x + 8y - 1 = 0 \quad (6)$$

The normal to  $C$  at  $A$  meets  $C$  again at the point  $B$ , as shown in Figure 2.

(c) Find the coordinates of  $B$ . (4)

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Question	Scheme	Marks
<p><b>10. (a)</b></p> <p><b>(b)</b></p> <p><b>(c)</b></p>	<p><math>\left(\frac{1}{2}, 0\right)</math></p> <p><math>\frac{dy}{dx} = x^{-2}</math></p> <p>At <math>x = \frac{1}{2}</math>, <math>\frac{dy}{dx} = \left(\frac{1}{2}\right)^{-2} = 4</math> (<math>= m</math>)</p> <p>Gradient of normal <math>= -\frac{1}{m} \left( = -\frac{1}{4} \right)</math></p> <p>Equation of normal: <math>y - 0 = -\frac{1}{4}\left(x - \frac{1}{2}\right)</math></p> <p style="text-align: right;"><math>2x + 8y - 1 = 0</math> (*)</p> <p><math>2 - \frac{1}{x} = -\frac{1}{4}x + \frac{1}{8}</math></p> <p style="text-align: center;"><math>[ = 2x^2 + 15x - 8 = 0 ]</math> or <math>[ 8y^2 - 17y = 0 ]</math></p> <p><math>(2x - 1)(x + 8) = 0</math> leading to <math>x = \dots</math></p> <p style="text-align: center;"><math>x = \left[\frac{1}{2}\right]</math> or <math>-8</math></p> <p style="text-align: center;"><math>y = \frac{17}{8}</math> (or exact equivalent)</p>	<p>B1 (1)</p> <p>M1A1</p> <p>A1</p> <p>M1</p> <p>M1</p> <p>A1cso (6)</p> <p>M1</p> <p>M1</p> <p>A1</p> <p>A1ft (4)</p> <p><b>11 marks</b></p>
<b>Notes</b>		
<p><b>(a)</b></p> <p><b>(b)</b></p> <p><b>(c)</b></p>	<p>B1 accept <math>x = \frac{1}{2}</math> if evidence that <math>y = 0</math> has been used. Can be written on graph. Use ISW</p> <p>1<sup>st</sup> M1 for <math>kx^{-2}</math> even if the '2' is not differentiated to zero. If no evidence of <math>\frac{dy}{dx}</math> seen then 0/6</p> <p>1<sup>st</sup> A1 for <math>x^{-2}</math> (o.e.) only</p> <p>2<sup>nd</sup> A1 for using <math>x = 0.5</math> to get <math>m = 4</math> (correctly) (or <math>m = 1/0.25</math>)</p> <p>To score final A1cso must see at least one intermediate equation for the line after <math>m = 4</math></p> <p>2<sup>nd</sup> M1 for using the perpendicular gradient rule on their <math>m</math> coming from their <math>\frac{dy}{dx}</math></p> <p>Their <math>m</math> must be a value not a letter.</p> <p>3<sup>rd</sup> M1 for using a changed gradient (based on <math>y'</math>) and their A to find equation of line</p> <p>3<sup>rd</sup> A1cso for reaching printed answer with no incorrect working seen.</p> <p>Accept <math>2x + 8y = 1</math> or equivalent equations with <math>\pm 2x</math> and <math>\pm 8y</math></p> <p>Trial and improvement requires sight of first equation.</p> <p>1<sup>st</sup> M1 for attempt to form a suitable equation in one variable. Do not penalise poor use of brackets etc.</p> <p>2<sup>nd</sup> M1 for simplifying their equation to a 3TQ and attempting to solve. May be <math>\Rightarrow</math> by <math>x = -8</math></p> <p>1<sup>st</sup> A1 for <math>x = -8</math> (ignore a second value). If found <math>y</math> first allow ft for <math>x</math> if <math>x &lt; 0</math></p> <p>2<sup>nd</sup> A1ft for <math>y = \frac{17}{8}</math> Follow through their <math>x</math> value in line or curve provided answer is <math>&gt; 0</math></p> <p>This second A1 is dependent on <u>both</u> M marks</p>	