





June 2010  
Core Mathematics C1 6663  
Mark Scheme

Question Number	Scheme	Marks
1.	$(\sqrt{75} - \sqrt{27}) = 5\sqrt{3} - 3\sqrt{3}$ $= 2\sqrt{3}$	M1 A1 2
	<u>Notes</u>	
	M1 for $5\sqrt{3}$ from $\sqrt{75}$ or $3\sqrt{3}$ from $\sqrt{27}$ seen anywhere A1 for $2\sqrt{3}$ ; allow $\sqrt{12}$ or $k = 2, x = 3$ allow $k = 1, x = 12$ <u>Some Common errors</u> $\sqrt{75} - \sqrt{27} = \sqrt{48}$ leading to $4\sqrt{3}$ is M0A0 $25\sqrt{3} - 9\sqrt{3} = 16\sqrt{3}$ is M0A0	



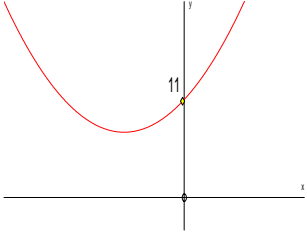
Question Number	Scheme	Marks
2.	$\frac{8x^4}{4} + \frac{6x^{\frac{3}{2}}}{\frac{3}{2}} - 5x + c$ $= 2x^4 + 4x^{\frac{3}{2}} - 5x + c$	<p>M1 A1</p> <p>A1 A1</p> <p style="text-align: right;"><b>4</b></p>
<b>Notes</b>		
<p>M1 for some attempt to integrate a term in <math>x</math>: <math>x^n \rightarrow x^{n+1}</math></p> <p>1<sup>st</sup> A1 for correct, possibly un-simplified <math>x^4</math> or <math>x^{\frac{3}{2}}</math> term. e.g. <math>\frac{8x^4}{4}</math> or <math>\frac{6x^{\frac{3}{2}}}{\frac{3}{2}}</math></p> <p>2<sup>nd</sup> A1 for <u>both</u> <math>2x^4</math> and <math>4x^{\frac{3}{2}}</math> terms correct and simplified on the same line  N.B. some candidates write <math>4\sqrt{x^3}</math> or <math>4x^{1\frac{1}{2}}</math> which are, of course, fine for A1</p> <p>3<sup>rd</sup> A1 for <math>-5x + c</math>. Accept <math>-5x^1 + c</math>.  The <math>+c</math> must appear on the same line as the <math>-5x</math>  N.B. We do not need to see one line with a fully correct integral</p> <p>Ignore ISW (ignore incorrect subsequent working) if a correct answer is followed by an incorrect version.</p> <p>Condone poor use of notation e.g. <math>\int 2x^4 + 4x^{\frac{3}{2}} - 5x + c</math> will score full marks.</p>		



Question Number	Scheme	Marks
3. (a)	$3x - 6 < 8 - 2x \rightarrow 5x < 14$ (Accept $5x - 14 < 0$ (o.e.)) $x < 2.8$ or $\frac{14}{5}$ or $2\frac{4}{5}$ (condone $\leq$ )	M1 A1 (2)
(b)	Critical values are $x = \frac{7}{2}$ and $-1$  Choosing "inside" $-1 < x < \frac{7}{2}$	B1  M1 A1 (3)
(c)	$-1 < x < 2.8$	B1ft (1)
<b>Accept any exact equivalents to -1, 2.8, 3.5</b>		
<b>Notes</b>		
(a)	M1 for attempt to rearrange to $kx < m$ (o.e.) Either $k = 5$ or $m = 14$ should be correct Allow $5x = 14$ or even $5x > 14$	
(b)	B1 for both correct critical values. (May be implied by a correct inequality) M1 ft their values and choose the "inside" region A1 for fully correct inequality (Must be in part (b): do not give marks if only seen in (c)) Condone seeing $x < -1$ in working provided $-1 < x$ is in the final answer. e.g. $x > -1$ , $x < \frac{7}{2}$ <u>or</u> $x > -1$ "or" $x < \frac{7}{2}$ <u>or</u> $x > -1$ "blank space" $x < \frac{7}{2}$ score M1A0  BUT allow $x > -1$ and $x < \frac{7}{2}$ to score M1A1 (the "and" must be seen)  Also $(-1, \frac{7}{2})$ will score M1A1  NB $x < -1, x < \frac{7}{2}$ is of course M0A0 and a number line even with "open" ends is M0A0  Allow 3.5 instead of $\frac{7}{2}$	
(c)	B1ft for $-1 < x < 2.8$ (ignoring their previous answers) <u>or</u> ft their answers to part (a) and part (b) provided both answers were regions and not single values. Allow use of "and" between inequalities as in part (b) If their set is empty allow a suitable description in words or the symbol $\emptyset$ .  <u>Common error:</u> If (a) is correct and in (b) they simply leave their answer as $x < -1$ , $x < 3.5$ then in (c) $x < -1$ would get B1ft as this is a correct follow through of these 3 inequalities.  Penalise use of $\leq$ only on the A1 in part (b). [i.e. condone in part (a)]	





Question Number	Scheme	Marks
4. (a)	$(x+3)^2 + 2$ <p>or <math>p = 3</math> or <math>\frac{6}{2}</math> <math>q = 2</math></p>	B1 B1 (2)
(b)	 <p>U shape with min in 2<sup>nd</sup> quad (Must be above x-axis and not on y=axis)</p> <p>U shape crossing y-axis at (0, 11) only (Condone (11,0) marked on y-axis)</p>	B1 B1 (2)
(c)	$b^2 - 4ac = 6^2 - 4 \times 11$ $= \underline{-8}$	M1 A1 (2) <b>6</b>
<b>Notes</b>		
(a)	Ignore an “= 0” so $(x+3)^2 + 2 = 0$ can score both marks	
(b)	<p>The U shape can be interpreted fairly generously. Penalise an obvious V on 1<sup>st</sup> B1 only. The U needn't have equal “arms” as long as there is a clear min that “holds water”</p> <p>1<sup>st</sup> B1 for U shape with minimum in 2<sup>nd</sup> quad. Curve need not cross the y-axis but minimum should NOT touch x-axis and should be left of (not on) y-axis</p> <p>2<sup>nd</sup> B1 for U shaped curve crossing at (0, 11). Just 11 marked on y-axis is fine. The point must be marked on the sketch (do not allow from a table of values) Condone stopping at (0, 11)</p>	
(c)	<p>M1 for some correct substitution into <math>b^2 - 4ac</math>. This may be as part of the quadratic formula but must be in part (c) and must be only numbers (no x terms present). Substitution into <math>b^2 &lt; 4ac</math> or <math>b^2 = 4ac</math> or <math>b^2 &gt; 4ac</math> is M0</p> <p>A1 for - 8 only. If they write <math>- 8 &lt; 0</math> treat the <math>&lt; 0</math> as ISW and award A1 If they write <math>- 8 \geq 0</math> then score A0 A substitution in the quadratic formula leading to - 8 inside the square root is A0. So substituting into <math>b^2 - 4ac &lt; 0</math> leading to <math>- 8 &lt; 0</math> can score M1A1.</p> <p>Only award marks for use of the discriminant in part (c)</p>	



Question Number	Scheme	Marks
<p>5.</p> <p>(a)</p> $a_2 = (\sqrt{4+3}) = \sqrt{7}$ $a_3 = \sqrt{\text{"their"} 7+3} = \sqrt{10}$ <p>(b)</p> $a_4 = \sqrt{10+3} (= \sqrt{13})$ $a_5 = \sqrt{13+3} = 4 *$		<p>B1</p> <p>B1ft (2)</p> <p>M1</p> <p>A1 cso (2)</p> <p style="text-align: right;"><b>4</b></p>
<b>Notes</b>		
<p>(a)</p> <p>(b)</p> <p>ALT</p> <p><math>\pm\sqrt{\quad}</math></p>	<p>1<sup>st</sup> B1 for <math>\sqrt{7}</math> only</p> <p>2<sup>nd</sup> B1ft follow through their "7" in correct formula provided they have <math>\sqrt{n}</math>, where <math>n</math> is an integer.</p> <p>M1 for an attempt to find <math>a_4</math>. Should see <math>\sqrt{\text{"their"}(a_3)^2 + 3}</math>. Must see evidence for M1.</p> <p><math>a_4 = \sqrt{13}</math> provided this follows from their <math>a_3</math> working or answer is sufficient</p> <p>A1cso for a correct solution (M1 explicit) must include the = 4. Ending at <math>\sqrt{16}</math> only is A0 and ending with <math>\pm 4</math> is A0. Ignore any incorrect statements that are not used e.g. common difference = <math>\sqrt{3}</math></p> <p><u>Listing</u>: A <u>full</u> list: <math>2 (= \sqrt{4})</math>, <math>\sqrt{7}</math>, <math>\sqrt{10}</math>, <math>\sqrt{13}</math>, <math>\sqrt{16} = 4</math> is fine for M1A1</p> <p><u>Formula</u>: Some may state (or use) <math>a_n = \sqrt{3n+1}</math> leading to <math>a_5 = \sqrt{3 \times 5 + 1} = 4</math>. This will get marks in (a) [if correct values are seen] and can score the M1 in (b) if <math>a_n = \sqrt{3n+1}</math> or <math>a_4 = \sqrt{13}</math> are seen.</p> <p>If <math>\pm\sqrt{\quad}</math> appear any where ignore in part (a) and withhold the final A mark only</p>	

6.

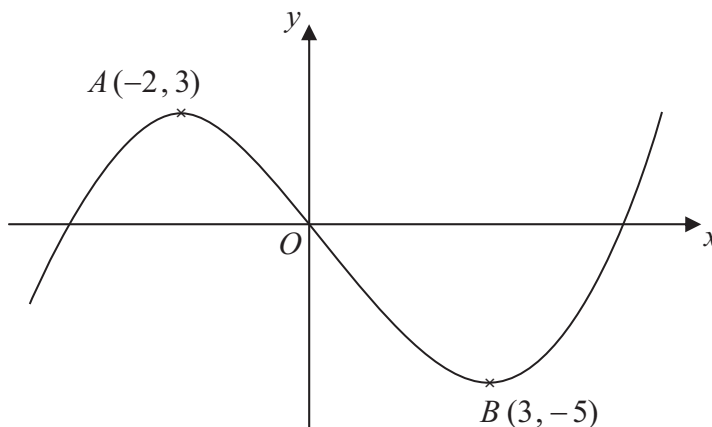


Figure 1

Figure 1 shows a sketch of the curve with equation  $y = f(x)$ . The curve has a maximum point  $A$  at  $(-2, 3)$  and a minimum point  $B$  at  $(3, -5)$ .

On separate diagrams sketch the curve with equation

(a)  $y = f(x+3)$  (3)

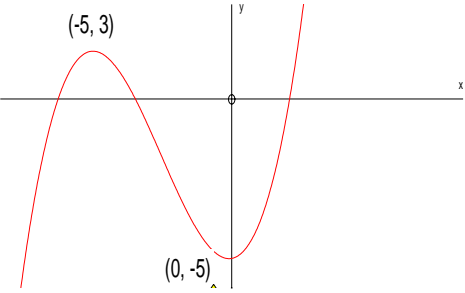
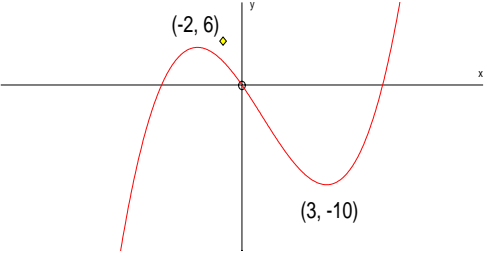
(b)  $y = 2f(x)$  (3)

On each diagram show clearly the coordinates of the maximum and minimum points.

The graph of  $y = f(x)+a$  has a minimum at  $(3, 0)$ , where  $a$  is a constant.

(c) Write down the value of  $a$ . (1)



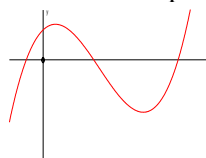
Question Number	Scheme	Marks
6.  (a)	 <p>Horizontal translation of <math>\pm 3</math></p> <p><math>(-5, 3)</math> marked on sketch <b>or in text</b></p> <p><math>(0, -5)</math> and min intentionally on y-axis Condone <math>(-5, 0)</math> if correctly placed on negative y-axis</p>	M1 B1 A1 (3)
(b)	 <p>Correct shape and intentionally through <math>(0,0)</math> between the max and min</p> <p><math>(-2, 6)</math> marked on graph <b>or in text</b></p> <p><math>(3, -10)</math> marked on graph <b>or in text</b></p>	B1 B1 B1 (3)
(c)	$(a = ) \underline{5}$	B1 (1)

**Notes**

Turning points (not on axes) should have both co-ordinates given in form  $(x,y)$ .  
Do not accept points marked on axes e.g.  $-5$  on  $x$ -axis and  $3$  on  $y$ -axis is not sufficient.  
For repeated offenders apply this penalty **once only** at first offence and condone elsewhere.

In (a) and (b) no graphs means no marks.

In (a) and (b) the ends of the graphs do not need to cross the axes provided max and min are clear



(a)	<p>M1 for a horizontal translation of <math>\pm 3</math> so accept coordinates of <math>(1, 3)</math> <u>or</u> <math>(6, -5)</math> seen. i.e max in 1<sup>st</sup> quad <u>and</u> [Horizontal translation to the left should have a min <u>on</u> the <math>y</math>-axis]</p> <p>A1 If curve passes through <math>(0,0)</math> then M0 (and A0) but they could score the B1 mark. for minimum clearly on negative <math>y</math>-axis and at least <math>-5</math> marked on <math>y</math>-axis. Allow this mark if the minimum is very close and the point <math>(0, -5)</math> clearly indicated</p>
(b)	<p>1<sup>st</sup> B1 Ignore coordinates for this mark Coordinates or points on sketch override coordinates given in the text. Condone <math>(y, x)</math> confusion for points on axes only. So <math>(-5,0)</math> for <math>(0, -5)</math> is OK if the point is marked correctly but <math>(3,10)</math> is B0 even if in 4<sup>th</sup> quadrant.</p>
(c)	<b>This may be at the bottom of a page or in the question...make sure you scroll up and down!</b>



Question Number	Scheme	Marks
7.	$\frac{3x^2 + 2}{x} = 3x + 2x^{-1}$ $(y' =) 24x^2, -2x^{-\frac{1}{2}}, +3 - 2x^{-2}$ $\left[ 24x^2 - 2x^{-\frac{1}{2}} + 3 - 2x^{-2} \right]$	M1 A1 M1 A1 A1A1 <p style="text-align: right;"><b>6</b></p>
<b>Notes</b>		
<p>1<sup>st</sup> M1 for attempting to divide (one term correct)</p> <p>1<sup>st</sup> A1 for both terms correct on the same line, accept <math>3x^1</math> for <math>3x</math> or <math>\frac{2}{x}</math> for <math>2x^{-1}</math></p> <p>These first two marks may be implied by a correct differentiation at the end.</p> <p>2<sup>nd</sup> M1 for an attempt to differentiate <math>x^n \rightarrow x^{n-1}</math> for at least one term of their expression</p> <p>“Differentiating” <math>\frac{3x^2 + 2}{x}</math> and getting <math>\frac{6x}{1}</math> is M0</p> <p>2<sup>nd</sup> A1 for <math>24x^2</math> only</p> <p>3<sup>rd</sup> A1 for <math>-2x^{-\frac{1}{2}}</math> allow <math>\frac{-2}{\sqrt{x}}</math>. Must be simplified to this, not e.g. <math>\frac{-4}{2}x^{-\frac{1}{2}}</math></p> <p>4<sup>th</sup> A1 for <math>3 - 2x^{-2}</math> allow <math>\frac{-2}{x^2}</math>. Both terms needed. Condone <math>3 + (-2)x^{-2}</math></p> <p>If “+c” is included then they lose this final mark</p> <p>They do not need one line with all terms correct for full marks. Award marks when first seen in this question and apply ISW.</p> <p>Condone a mixed line of some differentiation and some division e.g. <math>24x^2 - 4x^{\frac{1}{2}} + 3x + 2x^{-1}</math> can score 1<sup>st</sup> M1A1 and 2<sup>nd</sup> M1A1</p>		
Quotient /Product Rule	$\frac{x(6x) - (3x^2 + 2) \times 1}{x^2}$ or $6x(x^{-1}) + (3x^2 + 2)(-x^{-2})$  $\frac{3x^2 - 2}{x^2}$ or $3 - \frac{2}{x^2}$ (o.e.)	1 <sup>st</sup> M1 for an attempt: $\frac{P-Q}{x^2}$ or $R + (-S)$ with one of $P, Q$ or $R, S$ correct. 1 <sup>st</sup> A1 for a correct expression  4 <sup>th</sup> A1 same rules as above





Question Number	Scheme	Marks
<p>8.</p> <p>(a)</p> <p>(b)</p> <p>(c)</p> <p>(d)</p>	$m_{AB} = \frac{4-0}{7-2} \left( = \frac{4}{5} \right)$ <p>Equation of AB is: <math>y-0 = \frac{4}{5}(x-2)</math> or <math>y-4 = \frac{4}{5}(x-7)</math> (o.e.)</p> $\underline{4x - 5y - 8 = 0} \text{ (o.e.)}$ $(AB =) \sqrt{(7-2)^2 + (4-0)^2}$ $= \sqrt{41}$ <p>Using isos triangle with <math>AB = AC</math> then <math>t = 2 \times y_A = 2 \times 4 = 8</math></p> <p>Area of triangle = <math>\frac{1}{2}t \times (7-2)</math></p> $= \underline{20}$	<p>M1</p> <p>M1</p> <p>A1 (3)</p> <p>M1</p> <p>A1 (2)</p> <p>B1 (1)</p> <p>M1</p> <p>A1 (2)</p> <p><b>8</b></p>
<b>Notes</b>		
<p>(a)</p> <p>(b)</p> <p>(c)</p> <p>(d)</p> <p>DET</p>	<p><b>Apply the usual rules for quoting formulae here.</b></p> <p>For a correctly quoted formula with some correct substitution award M1</p> <p>If no formula is quoted then a fully correct expression is needed for the M mark</p> <p>1<sup>st</sup> M1 for attempt at gradient of AB. Some correct substitution in correct formula.</p> <p>2<sup>nd</sup> M1 for an attempt at equation of AB. Follow through their gradient, not e.g. <math>-\frac{1}{m}</math></p> <p>Using <math>y = mx + c</math> scores this mark when <math>c</math> is found.</p> <p>Use of <math>\frac{y-y_1}{y_2-y_1} = \frac{x-x_1}{x_2-x_1}</math> scores 1<sup>st</sup> M1 for denominator, 2<sup>nd</sup> M1 for use of a correct point</p> <p>A1 requires integer form but allow <math>5y + 8 = 4x</math> etc. Must have an “=” or A0</p> <p>M1 for an expression for AB or <math>AB^2</math>. Ignore what is “left” of the equals sign</p> <p>B1 for <math>t = 8</math>. May be implied by correct coordinates (2, 8) or the value appearing in (d)</p> <p>M1 for an expression for the area of the triangle, follow through their <math>t (\neq 0)</math> but must have the (7-2) or 5 and the <math>\frac{1}{2}</math>.</p> <p>e.g. <math>\begin{matrix} 2 &amp; 7 &amp; 2 &amp; 2 \\ 0 &amp; 4 &amp; t &amp; 0 \end{matrix}</math> Area = <math>\frac{1}{2}[8 + 7t + 0 - (0 + 8 + 2t)]</math> Must have the <math>\frac{1}{2}</math> for M1</p>	



Question Number	Scheme	Marks
9. (a)	$a + 29d = 40.75$ or $a = 40.75 - 29d$ or $29d = 40.75 - a$	M1 A1 (2)
(b)	$(S_{30}) = \frac{30}{2}(a + l)$ or $\frac{30}{2}(a + 40.75)$ or $\frac{30}{2}(2a + (30 - 1)d)$ or $15(2a + 29d)$ So $1005 = 15[a + 40.75]$ *	M1 A1 cso (2)
(c)	$67 = a + 40.75$ so <u><math>a = (\pounds) 26.25</math> or <math>2625p</math> or <math>26\frac{1}{4}</math></u> NOT $\frac{105}{4}$  $29d = 40.75 - 26.25$ $= 14.5$ so <u><math>d = (\pounds)0.50</math> or <math>0.5</math> or <math>50p</math></u> or $\frac{1}{2}$	M1 A1  M1 A1 (4)  8
<b>Notes</b>		
(a)	<p>M1 for attempt to use <math>a + (n - 1)d</math> with <math>n=30</math> to form an equation . So <math>a + (30 - 1)d =</math> any number is OK A1 as written. Must see <math>29d</math> not just <math>(30 - 1)d</math>. Ignore any floating £ signs e.g. <math>a + 29d = \pounds 40.75</math> is OK for M1A1 These two marks must be scored in (a). Some may omit (a) but get correct equation in (c) [or (b)] but we do not give the marks retrospectively.</p> <p style="text-align: center;"><b>Parts (b) and (c) may run together</b></p> <p>(b) M1 for an attempt to use an <math>S_n</math> formula with <math>n=30</math> . <b>Must see one of the printed forms.</b> (<math>S_{30} =</math> is not required) A1 cso for forming an equation with 1005 and <math>S_n</math> and simplifying to printed answer. Condone £ signs e.g. <math>15[a + \pounds 40.75] = 1005</math> is OK for A1</p> <p>(c) 1<sup>st</sup> M1 for an attempt to simplify the given linear equation for <math>a</math>. Correct processes. Must get to <math>ka = \dots</math> or <math>k = a + m</math> i.e. one step (division or subtraction) from <math>a = \dots</math> Commonly: <math>15a = 1005 - 611.25 (= 393.75)</math> 1<sup>st</sup> A1 For <math>a = 26.25</math> or <math>2625p</math> or <math>26\frac{1}{4}</math> NOT <math>\frac{105}{4}</math> or any other fraction 2<sup>nd</sup> M1 for correct attempt at a linear equation for <math>d</math>, follow through their <math>a</math> or equation in (a) Equation just has to be linear in <math>d</math>, they don't have to simplify to <math>d = \dots</math> 2<sup>nd</sup> A1 depends upon 2<sup>nd</sup> M1 and use of correct <math>a</math>. Do not penalise a second time if there were minor arithmetic errors in finding <math>a</math> provided <math>a = 26.25</math> (o.e.) is used.  Do not accept other fractions other than <math>\frac{1}{2}</math> <b>If answer is in pence a "p" must be seen.</b></p> <p>Sim Equ Use this scheme: 1st M1A1 for <math>a</math> and 2<sup>nd</sup> M1A1 for <math>d</math>. Typically solving: <math>1005 = 30a + 435d</math> and <math>40.75 = a + 29d</math> . If they find <math>d</math> first then follow through use of their <math>d</math> when finding <math>a</math>.</p>	

Leave  
blank

10. (a) On the axes below sketch the graphs of

(i)  $y = x(4-x)$

(ii)  $y = x^2(7-x)$

showing clearly the coordinates of the points where the curves cross the coordinate axes.

(5)

(b) Show that the  $x$ -coordinates of the points of intersection of

$$y = x(4-x) \quad \text{and} \quad y = x^2(7-x)$$

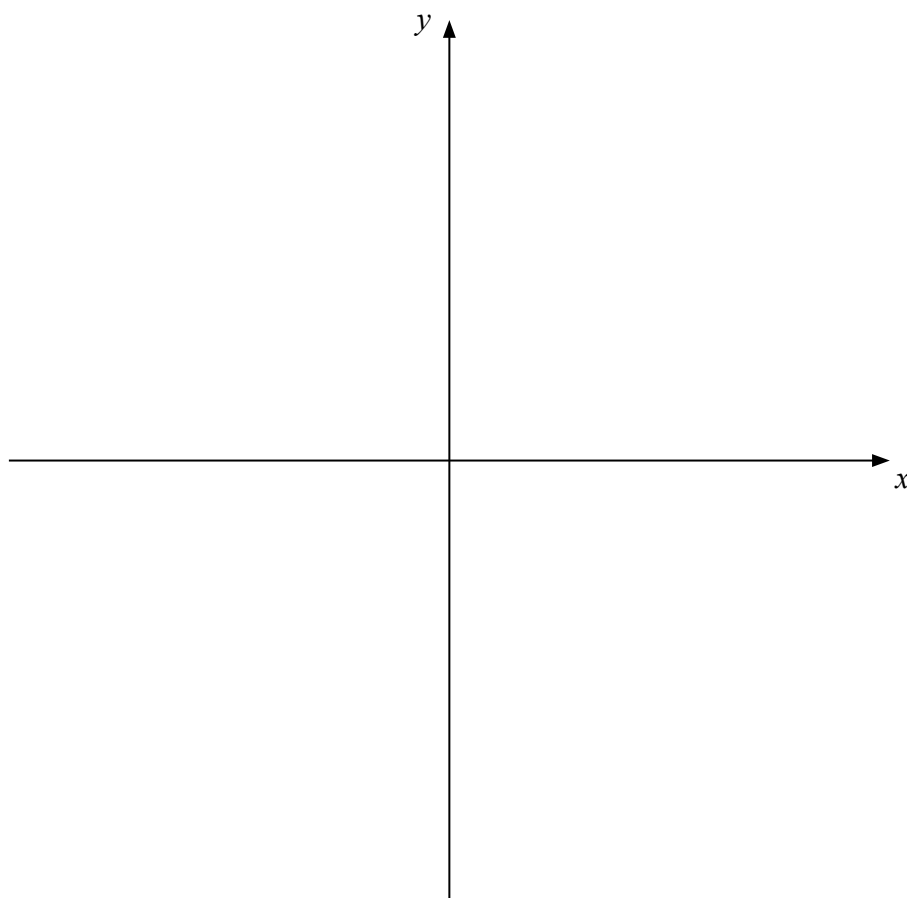
are given by the solutions to the equation  $x(x^2 - 8x + 4) = 0$

(3)

The point  $A$  lies on both of the curves and the  $x$  and  $y$  coordinates of  $A$  are both positive.

(c) Find the exact coordinates of  $A$ , leaving your answer in the form  $(p + q\sqrt{3}, r + s\sqrt{3})$ , where  $p, q, r$  and  $s$  are integers.

(7)







Question Number	Scheme	Marks
<p>11.</p> <p>(a)</p> <p>(b)</p>	$(y =) \frac{3x^2}{2} - \frac{5x^{\frac{1}{2}}}{\frac{1}{2}} - 2x \quad (+c)$ $f(4) = 5 \Rightarrow 5 = \frac{3}{2} \times 16 - 10 \times 2 - 8 + c$ $\underline{c = 9}$ $\left[ f(x) = \frac{3}{2}x^2 - 10x^{\frac{1}{2}} - 2x + 9 \right]$ $m = 3 \times 4 - \frac{5}{2} - 2 \quad \left( = 7.5 \text{ or } \frac{15}{2} \right)$ <p>Equation is:</p> $y - 5 = \frac{15}{2}(x - 4)$ $\underline{2y - 15x + 50 = 0} \quad \text{o.e.}$	<p>M1A1A1</p> <p>M1</p> <p>A1 (5)</p> <p>M1</p> <p>M1A1</p> <p>A1 (4)</p> <p>(9marks)</p>
<p>(a)</p> <p>(b)</p> <p>Normal</p>	<p>1<sup>st</sup> M1 for an attempt to integrate <math>x^n \rightarrow x^{n+1}</math></p> <p>1<sup>st</sup> A1 for at least 2 correct terms in <math>x</math> (unsimplified)</p> <p>2<sup>nd</sup> A1 for all 3 terms in <math>x</math> correct (condone missing <math>+c</math> at this point). Needn't be simplified</p> <p>2<sup>nd</sup> M1 for using the point (4, 5) to form a linear equation for <math>c</math>. Must use <math>x = 4</math> and <math>y = 5</math> and have no <math>x</math> term and the function must have "changed".</p> <p>3<sup>rd</sup> A1 for <math>c = 9</math>. The final expression is not required.</p> <p>(b)</p> <p>1<sup>st</sup> M1 for an attempt to evaluate <math>f'(4)</math>. Some correct use of <math>x = 4</math> in <math>f'(x)</math> but condone slips. They must therefore have at least <math>3 \times 4</math> or <math>-\frac{5}{2}</math> and clearly be using <math>f'(x)</math> with <math>x = 4</math>. Award this mark wherever it is seen.</p> <p>2<sup>nd</sup> M1 for using their value of <math>m</math> [or their <math>-\frac{1}{m}</math>] (provided it clearly comes from using <math>x = 4</math> in <math>f'(x)</math>) to form an equation of the line through (4,5).</p> <p>Allow this mark for an attempt at a normal or tangent. Their <math>m</math> must be numerical. Use of <math>y = mx + c</math> scores this mark when <math>c</math> is found.</p> <p>1<sup>st</sup> A1 for any correct expression for the equation of the line</p> <p>2<sup>nd</sup> A1 for any correct equation with integer coefficients. An "=" is required. e.g. <math>2y = 15x - 50</math> etc as long as the equation is correct and has integer coefficients.</p> <p>Attempt at normal can score both M marks in (b) but A0A0</p>	