Paper Reference(s)

6663/01

Edexcel GCE

Core Mathematics C1

Gold Level G4

Time: 1 hour 30 minutes

Materials required for examination	**Items included with question papers**
Mathematical Formulae (Green)	Nil

Candidates may use any calculator allowed by the regulations of the Joint Council for Qualifications. Calculators must not have the facility for symbolic algebra manipulation, differentiation and integration, or have retrievable mathematical formulas stored in them.

Instructions to Candidates

Write the name of the examining body (Edexcel), your centre number, candidate number, the unit title (Core Mathematics C1), the paper reference (6663), your surname, initials and signature.

Information for Candidates

A booklet 'Mathematical Formulae and Statistical Tables' is provided.
Full marks may be obtained for answers to ALL questions.
There are 9 questions in this question paper. The total mark for this paper is 75.

Advice to Candidates

You must ensure that your answers to parts of questions are clearly labelled.
You must show sufficient working to make your methods clear to the Examiner.
Answers without working may gain no credit.

Suggested grade boundaries for this paper:

A*	A	B	C	D	E
63	55	47	40	32	25

1. Write

$$\sqrt{(75)} - \sqrt{(27)}$$

in the form $k\sqrt{x}$, where k and x are integers.

(2)

May 2010

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2. Find the set of values of x for which

(*a*) $3(x - 2) < 8 - 2x$,

(2)

(*b*) $(2x - 7)(1 + x) < 0$,

(3)

(*c*) both $3(x - 2) < 8 - 2x$ **and** $(2x - 7)(1 + x) < 0$.

(1)

May 2010

3.

$$\frac{dy}{dx} = 5x^{-\frac{1}{2}} + x\sqrt{x}, \qquad x > 0.$$

Given that $y = 35$ at $x = 4$, find y in terms of x, giving each term in its simplest form.

(7)

January 2010

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4. (*a*) Show that $x^2 + 6x + 11$ can be written as

$$(x + p)^2 + q,$$

where p and q are integers to be found.

(2)

(*b*) Sketch the curve with equation $y = x^2 + 6x + 11$, showing clearly any intersections with the coordinate axes.

(2)

(*c*) Find the value of the discriminant of $x^2 + 6x + 11$.

(2)

May 2010

5.

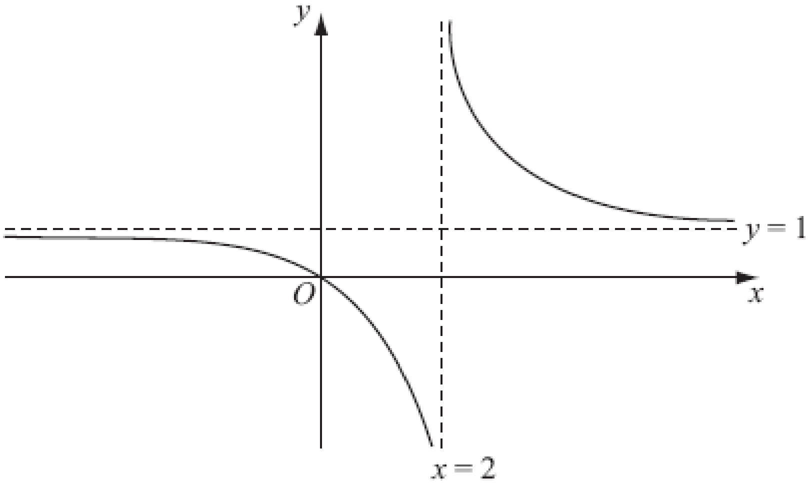

Figure 1

Figure 1 shows a sketch of the curve with equation $y = \mathrm{f}(x)$ where

$$\mathrm{f}(x) = \frac{x}{x-2}, \qquad x \neq 2.$$

The curve passes through the origin and has two asymptotes, with equations $y = 1$ and $x = 2$, as shown in Figure 1.

(*a*) In the space below, sketch the curve with equation $y = \mathrm{f}(x - 1)$ and state the equations of the asymptotes of this curve.

(3)

(*b*) Find the coordinates of the points where the curve with equation $y = \mathrm{f}(x - 1)$ crosses the coordinate axes.

(4)

January 2011

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6. A company, which is making 200 mobile phones each week, plans to increase its production.

The number of mobile phones produced is to be increased by 20 each week from 200 in week 1 to 220 in week 2, to 240 in week 3 and so on, until it is producing 600 in week N.

(*a*) Find the value of N.

(2)

The company then plans to continue to make 600 mobile phones each week.

(*b*) Find the total number of mobile phones that will be made in the first 52 weeks starting from and including week 1.

(5)

May 2013

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7. The curve C_1 has equation

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

(a) Find $\dfrac{\mathrm{d}y}{\mathrm{d}x}$.

(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)

January 2012

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8. The line L_1 has equation $4y + 3 = 2x$.

The point A $(p, 4)$ lies on L_1.

(a) Find the value of the constant p.

(1)

The line L_2 passes through the point C $(2, 4)$ and is perpendicular to L_1.

(b) Find an equation for L_2 giving your answer in the form $ax + by + c = 0$, where a, b and c are integers.

(5)

The line L_1 and the line L_2 intersect at the point D.

(c) Find the coordinates of the point D.

(3)

(d) Show that the length of CD is $\dfrac{3}{2}\sqrt{5}$.

(3)

A point B lies on L_1 and the length of $AB = \sqrt{80}$.

The point E lies on L_2 such that the length of the line CDE = 3 times the length of CD.

(e) Find the area of the quadrilateral $ACBE$.

(3)

May 2012

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9. (*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.

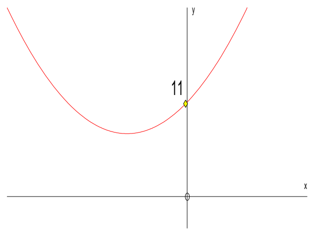
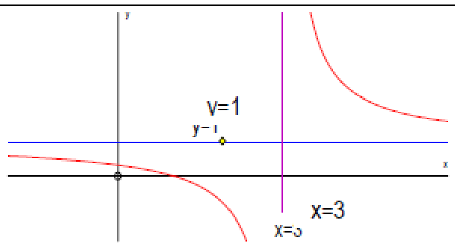
(7)

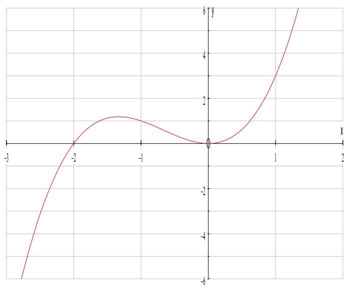
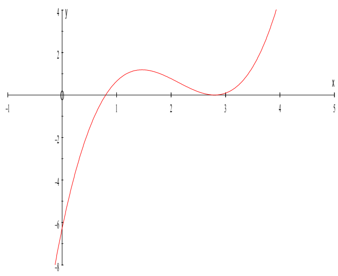
May 2010

TOTAL FOR PAPER: 75 MARKS

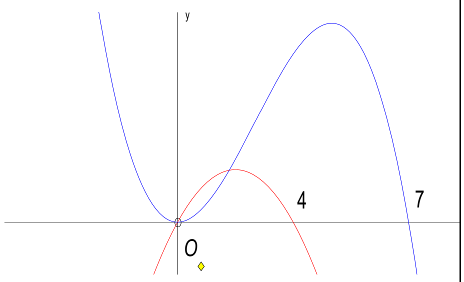
END

Question number	Scheme	Marks
1.	$\left(\sqrt{75}-\sqrt{27}\right)=5\sqrt{3}-3\sqrt{3}$	M1
	$= 2\sqrt{3}$	A1
		[2]
2 (a)	$3x-6<8-2x \rightarrow \ 5x<14$ (Accept $5x-14<0$ (o.e.))	M1
	$x<2.8$ or $\frac{14}{5}$ or $2\frac{4}{5}$ (condone $\leq$)	A1
		(2)
(b)	Critical values are $x=\frac{7}{2}$ and -1	B1
	Choosing "inside" $-1<x<\frac{7}{2}$	M1 A1
		(3)
(c)	$-1<x<2.8$	B1ft
		(1)
	Accept any exact equivalents to -1, 2.8, 3.5	**[6]**
3	$x\sqrt{x}=x^{\frac{3}{2}}$ (Seen, or implied by correct integration)	B1
	$x^{-\frac{1}{2}} \rightarrow kx^{\frac{1}{2}}$ or $x^{\frac{3}{2}} \rightarrow kx^{\frac{5}{2}}$ (k a non-zero constant)	M1
	$(y=)\ \dfrac{5x^{\frac{1}{2}}}{\frac{1}{2}}\ldots + \dfrac{x^{\frac{5}{2}}}{\frac{5}{2}}$ $(+C)$	A1 A1
	("$y=$" and " $+C$" are not required for these marks)	
	$35=\dfrac{5\times 4^{\frac{1}{2}}}{\frac{1}{2}}+\dfrac{4^{\frac{5}{2}}}{\frac{5}{2}}+C$ An equation in C is required	M1
	(see conditions below).(With their terms simplified or unsimplified).	
	$C=\frac{11}{5}$ or equivalent $2\frac{1}{5}$, 2.2	A1
	$y=10x^{\frac{1}{2}}+\dfrac{2x^{\frac{5}{2}}}{5}+\dfrac{11}{5}$ (Or equivalent <u>simplified</u>)	A1ft
	I.s.w. if necessary, e.g. $y=10x^{\frac{1}{2}}+\dfrac{2x^{\frac{5}{2}}}{5}+\dfrac{11}{5}=50x^{\frac{1}{2}}+2x^{\frac{5}{2}}+11$	
	The final A mark requires an <u>equation</u> "$y=\ldots$" with correct x terms	
		[7]

Question number	Scheme		Marks
4 (a)	$(x+3)^2+2$	or $p=3$ or $\frac{6}{2}$	B1
		$q=2$	B1
			(2)
(b)		U shape with min in 2nd quad (Must be above x-axis and not on y=axis)	B1
		U shape crossing y-axis at (0, 11) only (Condone (11,0) marked on y-axis)	B1
			(2)
(c)	$b^2-4ac=6^2-4\times11$		M1
	$= \underline{-8}$		A1
			(2)
			[6]
5 (a)		Correct shape with a single crossing of each axis	B1
		y = 1 labelled or stated	B1
		x = 3 labelled or stated	B1
			(3)
(b)	Horizontal translation so crosses the x-axis at (1, 0)		B1
	New equation is $(y=)\dfrac{x\pm1}{(x\pm1)-2}$		M1
	When $x=0$ $y=$		M1
	$=\frac{1}{3}$		A1
			(4)
			[7]

Question number	Scheme	Marks
6 (a)	$600 = 200 + (N-1)20 \Rightarrow N = ...$	M1
	$N = 21$	A1 cso
		(2)
(b)	$S = \frac{21}{2}(2\times 200 + 20\times 20)$ or $\frac{21}{2}(200+600)$ or	
	$S = \frac{20}{2}(2\times 200 + 19\times 20)$ or $\frac{20}{2}(200+580)$	M1A1
	(= 8400 or 7800)	
	$600\times(52-"N")(=18600)$	M1A1ft
	So total is 27000	A1 cao
		(5)
		[7]
7 (a)	$[\,y = x^3 + 2x^2\,]$ so $\frac{dy}{dx} = 3x^2 + 4x$	M1 A1
		(2)
(b)	 Shape 	B1
	Touching x-axis at origin	B1
	Through and not touching or stopping at -2 on x –axis. Ignore extra intersections.	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)	 Horizontal translation (touches x-axis still)	M1
	$k-2$ and k marked on positive x-axis	B1
	$k^2(2-k)$ (o.e) marked on negative y-axi	B1
		(3)
		[10]

Question number	Scheme		Marks
	$L_1:\ 4y+3=2x \Rightarrow y=\frac{1}{2}x-\frac{3}{4}$; $A(p,4)$ lies on L_1.		
8. (a)	$\{p=\}\ 9\frac{1}{2}$ or $\frac{19}{2}$ or 9.5		B1
			(1)
(b)	$\{4y+3=2x\} \Rightarrow y=\frac{2x-3}{4} \Rightarrow m(L_1)=\frac{1}{2}$ or $\frac{2}{4}$		M1 A1
	So $m(L_2)=-2$		B1ft
	$L_2:\ y-4=-2(x-2)$		M1
	$L_2:\ 2x+y-8=0$ or $L_2:\ 2x+1y-8=0$		A1
			(5)
(c)	$\{L_1=L_2 \Rightarrow\}\ 4(8-2x)+3=2x$ or $-2x+8=\frac{1}{2}x-\frac{3}{4}$		M1
	$x=3.5,\ y=1$		A1 A1 cso
			(3)
(d)	$CD^2=("3.5"-2)^2+("1"-4)^2$		"M1"
	$CD=\sqrt{("3.5"-2)^2+("1"-4)^2}$		A1 ft
	$=\sqrt{1.5^2+3^2}=1.5\sqrt{1^2+2^2}=1.5\sqrt{5}$ or $\frac{3}{2}\sqrt{5}$ **(*)**		A1 cso
			(3)
(e)	Area = triangle ABC + triangle ABE		
	$=\frac{1}{2}\times\frac{3}{2}\sqrt{5}\times\sqrt{80}+\frac{1}{2}\times 3\sqrt{5}\times\sqrt{80}$	Finding the area of any triangle	M1
	$=\frac{3}{4}\sqrt{5}\times 4\sqrt{5}+\frac{3}{2}\sqrt{5}\times 4\sqrt{5}$		
	$=\frac{3}{4}(20)+\frac{3}{2}(20)$		B1
	$=45$		A1
			(3)
			[15]

Question number	Scheme	Marks
9 (a)	 (i) $\cap$ shape (anywhere on diagram) Passing through or stopping at (0, 0) and (4,0) only(Needn't be $\cap$ shape)	B1 B1
	(ii) correct shape (-ve cubic) with a max and min drawn anywhere	B1
	Minimum or maximum at (0,0)	B1
	Passes through or stops at (7,0) but NOT touching. (7, 0) should be to right of (4,0) or B0	B1
	Condone (0,4) or (0, 7) marked correctly on *x*-axis. Don't penalise poor overlap near origin. Points must be marked on the sketch...not in the text	
		(5)
(b)	$x(4-x)=x^2(7-x)$ $(0=)x[7x-x^2-(4-x)]$	M1
	$(0=)x[7x-x^2-(4-x)]$ (o.e.)	B1ft
	$0=x(x^2-8x+4)$ *	A1 cso
		(3)
(c)	$\left(0=x^2-8x+4\Rightarrow\right)x=\dfrac{8\pm\sqrt{64-16}}{2}$ or $(x\pm4)^2-4^2+4(=0)$	M1
	$(x-4)^2=12$	A1
	$=\dfrac{8\pm4\sqrt{3}}{2}$ or $(x-4)=\pm2\sqrt{3}$	B1
	$x=4\pm2\sqrt{3}$	A1
	From sketch *A* is $x=4-2\sqrt{3}$	M1
	So $y=(4-2\sqrt{3})(4-[4-2\sqrt{3}])$ (dependent on 1st M1)	M1
	$\underline{=-12+8\sqrt{3}}$	A1
		(7)
		[15]

Examiner reports

Question 1

This was a successful starter to the paper with very few candidates failing to attempt it and many securing both marks. The $\sqrt{27}$ was usually written as $3\sqrt{3}$ but $5\sqrt{5}$ and $3\sqrt{5}$ were common errors for $\sqrt{75}$. The most common error though was to subtract 27 from 75 and then try and simplify $\sqrt{48}$ which showed a disappointing lack of understanding.

Question 2

Most handled the linear inequality in part (a) very well with only occasional errors in rearranging terms. The responses to part (b) though were less encouraging. It was surprising how many multiplied out the brackets and then tried factorising again (often incorrectly) or used the formula to find the critical values rather than simply writing them down as was intended. Those who found the critical values did not always go on to solve the inequality and those who did often gave their answer as $x < -1$, $x < 3.5$. Those who sketched a graph of the function were usually more successful in establishing the correct interval.

Part (c) was answered well by many of those who had correct solutions to parts (a) and (b) and some successfully followed through their incorrect answers to gain the mark here. Some did not seem to realise that the intersection of the two intervals was required and simply restated their previous answers making no attempt to combine them. Drawing a number line was helpful for some candidates.

Question 3

In this question the main problem for candidates was the integration of $x\sqrt{x}$, for which a common result was $\frac{x^2}{2} \times \frac{2x^{\frac{3}{2}}}{3}$. Those who replaced $x\sqrt{x}$ by $x^{\frac{3}{2}}$ generally made good progress, although the fractional indices tended to cause problems. Some differentiated instead of integrating. Most candidates used the given point (4, 35) in an attempt to find the value of the integration constant, but mistakes in calculation were very common. A significant minority of candidates failed to include the integration constant or failed to use the value of y in their working, and for those the last three marks in the question were unavailable.

Question 4

Part (a) was answered well with many scoring both marks. Some gave $q = 20$ from adding 11 + 9 instead of subtracting but most understood the principle of completing the square.

Quite a number of candidates struggled with the sketch in part (b). Most had the correct shape but the minimum was invariably in the wrong position: on the y-axis at (0, 11) or on the x-axis at (–3, 0) were common errors but the intercept at (0, 11) was more often correct.

Some candidates did not know what the discriminant was. Some confused it with the derivative, others knew it was something to do with the quadratic formula and simply applied the formula to the original equation. The correct formula was used by many candidates but a few faltered over the arithmetic with "36 – 44 = –12" being quite common.

Few candidates seemed to spot the connections between the parts in this question: (a) was intended to help them with the sketch in part (b) and a negative discriminant in (c) confirmed that their sketch did not cross the x-axis. Candidates should be encouraged to identify these connections.

Question 5
In part (a) there were many well drawn correct graphs with the new asymptotes clearly labelled. Where asymptotes were correct the most common error lay in the position of the left hand branch of the curve, which was either drawn through the origin or crossed the negative axes. Most candidates recognised a translation and all manner of one unit translations, including movement in both x and y directions at once, were seen.

The first mark in part (b) was gained by many for marking the required point on the x-axis. A number of candidates stopped at this point. Others tried substituting $x = 0$ into the original equation. Better candidates obtained the y-intercept by evaluating f(–1) and usually scored full marks (with only a few leaving their answer as "$\frac{1}{3}$" without indicating anywhere that this was the y coordinate of the intercept). Those that attempted to find an algebraic expression for f(x – 1) often scored the first M1, but a number of these did not make sensible use of it (i.e. did not substitute $x = 0$) and so did not score the second M1. M0M1A0 was reasonably common, often awarded for using $x = 0$ in f(x) – 1.

Some horrendous algebra was seen by those struggling to find the y intercept in this part and even attempts to solve $(x - 1) = x/(x - 2)$ were tried in some cases.

Question 6
In part (a), those who knew the formula and how to apply it usually achieved $N = 21$, although poor manipulation sometimes led to $N = 19$. Some candidates relied on a listing method.

Many did not appreciate the demand in part (b) and simply used $n = 52$ in a sum formula. Others found the sum of the first 21 terms then treated the other 31 terms as the sum of an AP with $a = 600$ and $d = 600$. In a few cases an inconsistent value of k was used. 600×31 sometimes caused problems on this non-calculator paper with long multiplication methods employed.

Question 7
Although full marks for this question were rare most were able to gain some marks.

Part (a) was answered very well with only occasional errors in multiplying out being seen.

In part (b) most drew a cubic curve and many realised that it touched the x-axis at (0, 0) and cut the axis at $x = -2$. Some failed to realise that the repeated root meant that there should be a turning point at the origin and drew a curve which crossed the x-axis at 3 places.

In part (c) most candidates were able to substitute their x values into their derivative and find the gradient of the curve at the required points. Some failed to identify the connection with part (a) and simply tried to find the gradient between two points. The final part proved challenging but a few excellent sketches were seen. Many did not identify the connection with part (b) and those who did sometimes translated vertically as well as horizontally so that the new curve touched the x-axis at a maximum not a minimum. Finding the coordinates of the points of intersection in terms of k proved too difficult for most with the y-intercept proving particularly troublesome.

Question 8

This question proved discriminating across all abilities with about a quarter of the candidature gaining at least 12 out of the 15 marks available. A significant number of candidates gave up on this question before they reached part (e).

Part (a) was well answered by the majority of candidates. After the substitution $y = 4$, most were able to obtain $p = \frac{19}{2}$, although some simplified this to 8.5.

Again, part (b) was well answered with many candidates rearranging $4y + 3 = 2x$ into the form $y = mx + c$, in order to find the gradient of L_1. Occasional use of two points on L_1 was seen as an alternative approach to finding the gradient of L_1, whilst some felt it necessary (normally successfully) to differentiate their L_1 after rearranging. Most candidates were able to use the perpendicular gradient rule to write down the gradient of L_2 and use this gradient to find an equation of L_2. Methods of approach were roughly equally divided between those using $y - y_1 = m(x - x_1)$ or $y = mx + c$. The majority of candidates were able to simplify their equation into a correct form of $ax + by + c = 0$, although some rearranged $y - 4 = -2(x - 2)$ incorrectly to give $y + 2x = 0$. Common errors in this part included candidates incorrectly finding the gradient of L_1 by finding the gradient between A and C or stating the gradient as 2 from looking at the coefficient of x in $4y + 3 = 2x$.

In part (c), a large number of those with a correct equation of L_2 found the correct coordinates of D, with a few, fortunately, using their correct un-simplified version of L_2 rather than their incorrect rearrangement. The majority of candidates without a correct part (b) were able to demonstrate that they could solve the equation for L_1 and L_2 simultaneously and received some credit for this. There were a number of candidates who equated their equations for L_1 and L_2 to give $4y + 3 - 2x = 2x + y - 8$. Some manipulated this into $4x - 3y - 11 = 0$ and then gave up; whilst others continued to set $x = 0$ to find a value for y and similarly set $y = 0$ to find a value for x.

In part (d), it was pleasing to see many candidates able to make a good attempt at finding the distance between the points C and D. Some drew diagrams and others quoted a correct formula. Relatively few candidates got mixed up when determining the differences in the x-values and the differences in the y-values although a few used the incorrect formulae such as $\sqrt{(x_1 + x_2)^2 + (y_1 + y_2)^2}$ or $\sqrt{(x_1 - x_2)^2 - (y_1 - y_2)^2}$. Some candidates lost the final mark in this part by being unable to correctly manipulate fractions and surds whilst others did not provide sufficient working to arrive at the answer given on the paper.

Part (e) was the most challenging question on the paper with the majority of candidates not attempting it and many of those that did were only able to offer incomplete solutions. A significant number of candidates did not draw a clear diagram which is essential in understanding the nature of this problem. Those that were successful usually summed up the area of two relevant triangles (usually triangle ABC and triangle ABE) or found half the product of AB and CE, although a significant number of candidates used the incorrect method of finding the product of AB and CE. A few candidates used other more elaborate methods to find the correct area of 45. Some candidates attempted to find lengths of various lines without any apparent purpose and gave no indication of finding an area. A small number thought quadrilateral $ACBE$ was a trapezium.

Question 9

The majority sketched a quadratic and a cubic curve in part (a) but not always with the correct features. The quadratic was often U shaped and although the intercepts at (0, 0) and (4, 0) were mostly correct, sometimes the curve passes through (–4, 0) and (4, 0). The cubic was sometimes a positive cubic and whilst it often passes through (0, 0) and (7, 0) the turning point was not always at the origin and the intercept was sometimes at (–7, 0).

Part (b) caused few problems with most candidates scoring full marks here.

Most could start part (c) and the quadratic formula was usually used to solve their equation. Although many simplified $\sqrt{48}$ to $4\sqrt{3}$ several candidates failed to divide by 2 correctly and gave their answers as $x = 4 \pm 4\sqrt{3}$. Most realised they needed to find the *y*-coordinate as well and usually they substituted their value of *x* into the quadratic equation to find *y*, though some chose the much less friendly cubic equation instead.

The selection of the correct solution defeated all but the best candidates. Most successful solutions involved checking the *y* coordinates for both $x = 4 + 2\sqrt{3}$ and $x = 4 - 2\sqrt{3}$ and, if the calculations were correct, selecting the one that gave a positive *y* coordinate. Only a rare minority realised that the required point would have an *x* coordinate in the interval (0, 4) and therefore only the $x = 4 - 2\sqrt{3}$ case need be considered.

Statistics for C1 Practice Paper Gold Level G4

Qu	Max score	Modal score	Mean %	Mean score for students achieving grade: ALL	A*	A	B	C	D	E	U
1	2		81	1.62	1.98	1.91	1.79	1.70	1.59	1.49	1.11
2	6		69	4.13	5.81	5.47	4.77	4.27	3.73	3.26	2.33
3	7		57	4.01		6.60	5.45	4.75	3.45	2.96	1.48
4	6		65	3.88	5.57	5.24	4.57	4.05	3.62	3.17	2.15
5	7		59	4.11	6.83	6.30	5.11	4.36	3.71	3.22	2.11
6	7	7	58	4.04	6.46	6.04	5.01	4.28	3.71	3.17	2.09
7	10		59	5.92	9.41	8.64	7.25	6.46	5.45	4.92	3.05
8	15		55	8.23	13.73	12.01	10.48	9.06	7.57	5.98	2.73
9	15		52	7.81	14.05	12.45	10.29	8.40	6.41	4.53	2.09
	75		**58.33**	**43.75**	**63.84**	**64.66**	**54.72**	**47.33**	**39.24**	**32.70**	**19.14**