Paper Reference(s)

6663/01

Edexcel GCE

Core Mathematics C1
Silver Level S2

Time: 1 hour 30 minutes

Materials required for examination papers	**Items included with question**
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 11 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
71	62	53	44	36	28

1. Simplify

(a) $(3\sqrt{7})^2$

(1)

(b) $(8 + \sqrt{5})(2 - \sqrt{5})$

(3)

June 2009

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2. Find

$$\int \left(10x^4 - 4x - \frac{3}{\sqrt{x}}\right) \mathrm{d}x,$$

giving each term in its simplest form.

(4)

May 2013

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3. Find the set of values of x for which

(a) $4x - 5 > 15 - x$,

(2)

(b) $x(x - 4) > 12$.

(4)

January 2012

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4. A sequence u_1, u_2, u_3, ..., satisfies

$$u_{n+1} = 2u_n - 1, \quad n \geq 1.$$

Given that $u_2 = 9$,

(a) find the value of u_3 and the value of u_4 ,

(2)

(b) evaluate $\sum_{r=1}^{4} u_r$.

(3)

January 2013

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5. A sequence a_1, a_2, a_3, …, is defined by

$$a_1 = k,$$

$$a_{n+1} = 5a_n + 3, \quad n \geq 1,$$

where k is a positive integer.

(*a*) Write down an expression for a_2 in terms of k.

(1)

(*b*) Show that $a_3 = 25k + 18$.

(2)

(*c*) (i) Find $\sum_{r=1}^{4} a_r$ in terms of k, in its simplest form.

(ii) Show that $\sum_{r=1}^{4} a_r$ is divisible by 6.

(4)

May 2011

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6. The curve C has equation $y = \frac{3}{x}$ and the line l has equation $y = 2x + 5$.

(*a*) Sketch the graphs of C and l, indicating clearly the coordinates of any intersections with the axes.

(3)

(*b*) Find the coordinates of the points of intersection of C and l.

(6)

June 2008

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7. A curve with equation $y = \mathrm{f}(x)$ passes through the point (2, 10). Given that

$$\mathrm{f}'(x) = 3x^2 - 3x + 5,$$

find the value of f(1).

(5)

January 2012

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8. (*a*) Find an equation of the line joining $A(7, 4)$ and $B(2, 0)$, giving your answer in the form $ax + by + c = 0$, where a, b and c are integers.

(3)

(*b*) Find the length of AB, leaving your answer in surd form.

(2)

The point C has coordinates $(2, t)$, where $t > 0$, and $AC = AB$.

(*c*) Find the value of t.

(1)

(*d*) Find the area of triangle ABC.

(2)

May 2010

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9. The curve C has equation $y = \mathrm{f}(x)$, $x > 0$, and $\mathrm{f}'(x) = 4x - 6\sqrt{x} + \dfrac{8}{x^2}$.

Given that the point $P(4, 1)$ lies on C,

(*a*) find $\mathrm{f}(x)$ and simplify your answer.

(6)

(*b*) Find an equation of the normal to C at the point $P(4, 1)$.

(4)

January 2008

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10. (*a*) Sketch the graphs of

(i) $y = x(x + 2)(3 - x)$,

(ii) $y = -\dfrac{2}{x}$.

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

(6)

(*b*) Using your sketch state, giving a reason, the number of real solutions to the equation

$$x(x + 2)(3 - x) + \frac{2}{x} = 0.$$

(2)

January 2011

11.

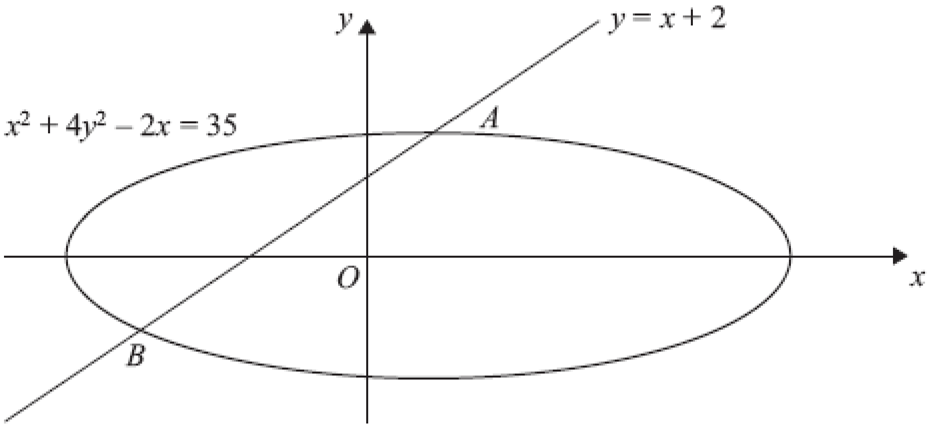


Figure 1

The line $y = x + 2$ meets the curve $x^2 + 4y^2 - 2x = 35$ at the points A and B as shown in Figure 1.

(a) Find the coordinates of A and the coordinates of B.

(6)

(b) Find the distance AB in the form $r\sqrt{2}$, where r is a rational number.

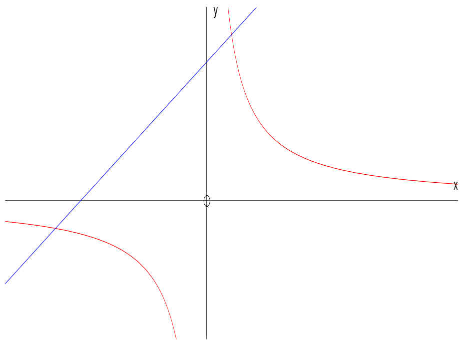
(3)

May 2013 (R)

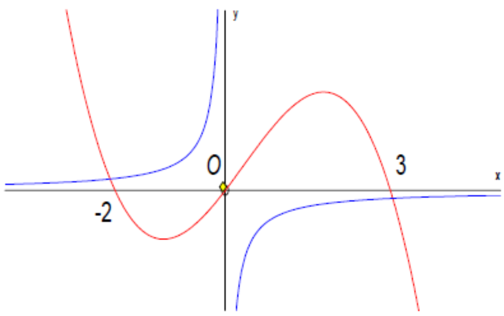
TOTAL FOR PAPER: 75 MARKS

END

Question Number	Scheme	Marks
1. (a)	$(3\sqrt{7})^2 = 63$	B1
		(1)
(b)	$(8+\sqrt{5})(2-\sqrt{5}) = 16-5+2\sqrt{5}-8\sqrt{5}$	M1
	$= 11, \ -6\sqrt{5}$	A1, A1
		(3)
		[4]
2	$(\int =) \frac{10x^5}{5} - \frac{4x^2}{2}, - \frac{3x^{\frac{1}{2}}}{\frac{1}{2}}$	M1 A1, A1
	$= \underline{2x^5 - 2x^2 - 6x^{\frac{1}{2}} + c}$	A1
		[4]
3. (a)	$5x > 20$	M1
	$\underline{\boldsymbol{x > 4}}$	A1 (2)
(b)	$x^2 - 4x - 12 = 0$	
	$(x+2)(x-6)$ [= 0]	M1
	$x = 6, \ -2$	A1
	$x < -2 \ , x > 6$	M1, A1ft (4)
		[6]
4. (a)	$u_2 = 9, \ u_{n+1} = 2u_n - 1, \ \ n \ldots 1$	
	$u_3 = 2u_2 - 1 = 2(9) - 1 \quad (= 17)$ $\qquad u_3 = 2(9) - 1.$	M1
	$u_4 = 2u_3 - 1 = 2(17) - 1 = 33$ $\qquad$ Can be implied by $u_3 = 17$	
	Both $u_3 = 17$ and $u_4 = 33$	A1
		(2)
(b)	$\sum_{r=1}^{4} u_r = u_1 + u_2 + u_3 + u_4$	
	$(u_1) = 5$	B1
	$\sum_{r=1}^{4} u_r = "5" + 9 + "17" + "33" = 64$	M1 A1
		(3)
		[5]

Question Number	Scheme	Marks
5. (a)	$(a_2 =)\ 5k+3$	B1
		(1)
(b)	$(a_3 =)\ 5(5k+3)+3$	M1
	$= 25k+18$ (*)	A1 cso
		(2)
(c)(i)	$a_4 = 5(25k+18)+3 \quad (=125k+93)$	M1
	$\sum_{r=1}^{4} a_r = k+(5k+3)+(25k+18)+(125k+93)$	M1
	$= 156k+114$	A1 cao
(ii)	$= 6(26k+19)$ (or explain each term is divisible by 6)	A1 ft
		(4)
		[7]
6. (a)		B1 M1 A1
		(3)
(b)	$2x+5=\frac{3}{x}$	B1
	$2x^2+5x-3[=0]$ or $2x^2+5x=3$	A1
	$(2x-1)(x+3)\,[=0]$	M1
	$x=-3$ or $\frac{1}{2}$	A1
	$y=\frac{3}{-3}$ or $2\times(-3)+5$ or $y=\frac{3}{\frac{1}{2}}$ or $2\times\left(\frac{1}{2}\right)+5$	M1
	Points are $(-3,-1)$ and $(\frac{1}{2},6)$ (correct pairings)	A1ft
		(6)
		[9]

Question Number	Scheme	Marks
7.	$\left[\mathrm{f}(x)=\right]\dfrac{3x^3}{3}-\dfrac{3x^2}{2}+5x\left[+c\right]$ or $\left\{x^3-\dfrac{3}{2}x^2+5x(+c)\right\}$	M1A1
	$10 = 8 - 6 + 10 + c$	M1
	$c = -2$	A1
	$\mathrm{f}(1) = 1-\dfrac{3}{2}+5 \quad "-2" = \underline{\dfrac{5}{2}}$ (o.e.)	A1ft
		[5]
8. (a)	$m_{AB}=\dfrac{4-0}{7-2}\quad\left(=\dfrac{4}{5}\right)$	M1
	Equation of AB is: $y-0=\dfrac{4}{5}(x-2)$ or $y-4=\dfrac{4}{5}(x-7)$ (o.e.)	M1
	$\underline{4x - 5y - 8 = 0}$ (o.e.)	A1
		(3)
(b)	$(AB=)\sqrt{(7-2)^2+(4-0)^2}$	M1
	$=\sqrt{41}$	A1
		(2)
(c)	Using isos triangle with $AB = AC$ then $t = 2\times y_A=2\times 4=8$	B1
		(1)
(d)	Area of triangle = $\frac{1}{2}t\times(7-2)$	M1
	$= \underline{20}$	A1
		(2)
		[8]
9. (a)	$4x\to kx^2$ or $6\sqrt{x}\to kx^{\frac{3}{2}}$ or $\dfrac{8}{x^2}\to kx^{-1}$	M1
	$\mathrm{f}(x)=2x^2,\quad -4x^{\frac{3}{2}},\quad -8x^{-1}\quad (+\,C)$	A1A1A1
	At $x = 4, y = 1$: $1=(2\times16)-\left(4\times4^{\frac{3}{2}}\right)-\left(8\times4^{-1}\right)+C$	M1
	$C = 3$	A1
		(6)
(b)	$\mathrm{f}'(4)=16-(6\times2)+\dfrac{8}{16}=\dfrac{9}{2}(=m)$	M1
	Gradient of normal is $-\dfrac{2}{9}\left(=-\dfrac{1}{m}\right)$	M1
	Eqn. of normal: $y-1=-\dfrac{2}{9}(x-4)$	M1 A1
		(4)
		[10]

Question Number	Scheme	Marks
10. (a)	 (i) correct shape (-ve cubic)	B1
	Crossing at (–2, 0)	B1
	Through the origin	B1
	Crossing at (3, 0)	B1
	(ii) 2 branches in correct quadrants not crossing axes	B1
	One intersection with cubic on each branch	B1
		(6)
(b)	"2" solutions	B1ft
	Since only "2" intersections	dB1ft
		(2) **[8]**
11. (a)	$y = x + 2 \Rightarrow x^2 + 4(x+2)^2 - 2x = 35$	M1
	Alternative: $\dfrac{2x - x^2 + 35}{4} = (x+2)^2$ or $\sqrt{\dfrac{2x - x^2 + 35}{4}} = (x+2)$	
	$5x^2 + 14x - 19 = 0$	M1
	$(5x+19)(x-1) = 0 \Rightarrow x = ..$	dM1
	$x = -\dfrac{19}{5}, x = 1$	A1 for both
	$y = -\dfrac{9}{5}, y = 3$	M1
	Coordinates are $(-\dfrac{19}{5}, -\dfrac{9}{5})$ and (1, 3)	A1
		(6)
(b)	$d^2 = (1 - -\dfrac{19}{5})^2 + (3 - -\dfrac{9}{5})^2$ or $d = \sqrt{(1 - -\dfrac{19}{5})^2 + (3 - -\dfrac{9}{5})^2}$	M1A1ft
	$d = \dfrac{24}{5}\sqrt{2}$	A1cao
		(3) **[9]**

Examiner reports

Question 1

Some candidates could not square the surd terms correctly but nearly everyone attempted this question and most scored something.

In part (a) some failed to square the 3 and an answer of 21 was fairly common, others realised that the expression equalled 9×7 but then gave the answer as 56. A few misread the question and proceeded to expand $\left(3+\sqrt{7}\right)^2$. In part (b) most scored a mark for attempting to expand the brackets but some struggled here occasionally adding 8 + 2 instead of multiplying. Those with a correct expansion sometimes lost marks for careless errors, $-8\sqrt{5}+2\sqrt{5}=6\sqrt{5}$, and a small number showed how fragile their understanding of these mathematical quantities was by falsely simplifying a correct answer of $11-6\sqrt{5}$ to $5\sqrt{5}$.

Question 2

This provided a good source of marks for many candidates although there were a significant number of cases where a loss of marks could have been avoided. The most common errors were the omission of +*c*, writing $\frac{3}{\sqrt{x}}$ as $3x^{\frac{1}{2}}$ to give $\frac{3x^{\frac{3}{2}}}{\frac{3}{2}}$ when integrated and also some cases where 3 was divided by $\frac{1}{2}$ incorrectly.

Question 3

Part (a) was answered very well and most candidates secured both marks. There were the usual arithmetic slips leading to expressions like $3x > 20$ or $x > 5$ and there were a few candidates who thought that division by 5 meant the inequality should be reversed.

In part (b) most produced a quadratic equation with 3 terms and proceeded to solve and the correct critical values were usually obtained although 2 and 6 or –6 and 2 were sometimes seen. Some stopped at this stage and made no attempt to identify the appropriate regions. There were a number of sketches seen and these usually helped candidates to write down the correct inequalities but some lost the final mark for writing their answer as $-2 > x > 6$ or "$x < -2$ and $x > 6$".

Question 4

Errors in part (a) were few and there was good understanding of what was required here. Any mistakes that were made were usually arithmetic errors when finding u_4, e.g. 2 × 17 = 36 and then 36 – 1 = 35 or u_4 = 2 × 17 – 1 = 34.

There were few conceptual errors and it was very rare to find that this question was not attempted.

In part (b) candidates knew that they needed a value for u_1. The method mark was for an attempt to use $u_2 = 2u_1 - 1$ in order to find u_1 together with an attempt to add their first four terms. Some candidates, instead, correctly worked out that $u_1 = 5$ by working backwards through the pattern of differences that was generated between the terms and then proceeded to answer the question.

A fairly frequent wrong assumption was that $u_1 = 1$, or that $u_1 = 2u_0 - 1 = 2 \times 0 - 1 = -1$.

Most candidates understood that the notation meant that they needed to find a sum. However some tried to use formulae for sum of an arithmetic series, sometimes after finding u_1 correctly, and in some cases even after writing out a correct sum of the four terms. A minority of candidates restarted in part (b); leading to adding terms of for example 1, 3, 5 and 7. There were also unfortunately some errors in the arithmetic by those who listed the sum correctly as $5 + 9 + 17 + 33$, most commonly leading to an answer of 54, rather than 64.

Question 5

Part (a) was usually given correctly as $5k + 3$.

In part (b) the majority of candidates provided working in the form of $5(5k + 3) + 3$ and arrived at the correct printed answer in a legitimate way. A few tried substituting values for k.

Part (c) provided more discrimination. Candidates needed to find a_4 and then needed to add four terms to obtain their sum. There were a number of arithmetic errors in the additions, which was disappointing at this level. Finally showing that their answer was divisible by 6 gave a range of responses. Some had no idea what to do, others divided by 6 and one or two produced a proof by induction. Division by 6 was sufficient to earn the mark here, but again poor arithmetic caused many to lose this mark.

Question 6

Whilst many candidates gave clear and correct sketches in part (a) there were a number who failed to score all 3 marks here. The curve C caused the most problems: some thought that the 3 represented an upward translation of 3 and a few interpreted 3/0 as 0 and had C passing through the origin. Other thought C was a parabola and quite a number failed to include the branch for negative values of x. Most (but surprisingly not all) drew l as a straight line, usually with the correct gradient but they often omitted the intercept with the negative x-axis or labelled it as (2.5, 0).

In part (b) most were able to start to solve the simultaneous equations, form the correct quadratic and factorize it. Some forgot to find the corresponding y values and a few substituted their x values into their quadratic equation rather than the equation of the curve or the line.

Those who made arithmetic errors did not check their answers against their sketch in part (a) to see if they made sense but, sadly, some of those with incorrect sketches did and rejected their negative solution of x instead of amending their sketch.

Question 7

Most candidates knew they had to integrate here and this was usually carried out correctly but some omitted the $+C$ and simply substituted $x = 1$ into the integrated expression. Those who did include a constant of integration invariably went on to substitute $x = 2$ but sometimes they equated their expression to 0 rather than 10. Arithmetic slips were the most common cause of lost marks but the follow through on the final mark restricted the loss to 1 mark for many.

Question 8

Most candidates could find the gradient of the line *AB* but the usual arithmetic slips spoilt some answers: $\frac{-4}{-5} = -\frac{4}{5}$ was quite frequent. Finding the equation of the line was usually answered well too with $y = mx + c$ or $y - y_1 = m(x - x_1)$ being the favoured approaches and only a few failing to write their answer in integer form.

Part (b) was answered very well and many correct answers were seen, a few candidates quoted an incorrect formula and some made arithmetic errors e.g. 25 + 16 = 31.

Some candidates made heavy weather of part (c) adopting an algebraic approach, others tried drawing a diagram (as intended) but mistakenly thought *AC* was parallel to the *x*-axis and arrived at $t = 4$ which was a common error. Those with a correct diagram would often proceeded to a correct answer to part (d) using $\frac{1}{2}bh$ with few problems but there were a number of other successful, but less efficient, solutions using a determinant method or even the semi perimeter formula.

A common error was to treat *ABC* as a right-angled isosceles triangle and this led to $\frac{1}{2}\sqrt{41} \times \sqrt{41} = 20.5$.

Question 9

Most candidates realised that integration was required in part (a) of this question and although much of the integration was correct, mistakes in simplification were common. Not all candidates used the (4, 1) to find the constant of integration, and of those who did, many lost accuracy through mistakes in evaluation of negative and fractional quantities. Occasionally $x = 4$ was used without $y = 1$, losing the method mark. Evaluation of the constant was sometimes seen in part (b) from those who confused this constant with the constant c in $y = mx + c$. Those who used differentiation instead of integration in part (a) rarely recovered.

In part (b), while some candidates had no idea what to do, many scored well. Some, however, failed to use the given $f'(x)$ to evaluate the gradient, and others found the equation of the tangent instead of the normal.

Question 10

For part (a)(i) the majority of candidates drew a curve which was recognisably of a cubic form, although the occasional straight line and other non-cubic curves were seen. Very few candidates did not label the points where the curves crossed the axes, but it was quite common to see the curve passing through (–3, 0), (–2, 0) and the origin.

The most common error was to draw a "positive" cubic curve, not appreciating that the equation of the curve was of the form $y = -x^3 + \ldots\ldots$; even having made this error, however, many candidates were still able to gain three marks for this curve.

Most candidates seem to know that the equation in part (a)(ii) represents a rectangular hyperbola, and the majority placed the branches in the correct quadrants, although it was not uncommon to see them placed in the first and third quadrants, and occasionally in the first and second. Although the curves were sympathetically marked, it should be said that some of the sketches of the hyperbola were quite poor, some looking as though they had asymptotes at

$x = -2$ and $x = +2$, and some needing examiners to have quite an imagination to see the axes as asymptotes.

In part (b), only candidates who had correctly positioned graphs were able to gain both marks in this part; some, but by no means all of this group, clearly had a good understanding of what was being tested here and gained both marks. Candidates with an incorrect sketch were still able to gain the first mark, if their answer was compatible with their sketch, and supported with an acceptable reason. A disappointingly large number of candidates, however, did not seem to appreciate how their graphs could be used to provide the number of real roots, often giving the number of intersections with the *x*-axis. Some candidates did not refer to their sketch at all and often did quite a bit of work trying to find the actual roots.

Question 11

Given the wording of the question, most candidates chose to eliminate *y* and obtain a quadratic in *x* and could proceed to find the correct coordinates. Because of the fractions involved with one of the intersections, candidates using the quadratic formula were often less successful than those who chose to factorise.

In part (b) most could use Pythagoras' theorem correctly for their coordinates but a sizeable minority could not simplify their answer to the given form.

Statistics for C1 Practice Paper Silver Level S2

				Mean score for students achieving grade:							
Qu	**Max score**	**Modal score**	**Mean %**	**ALL**	**A***	**A**	**B**	**C**	**D**	**E**	**U**
1	4		85	3.41		3.87	3.72	3.60	3.44	3.22	2.48
2	4		83	3.33	3.95	3.82	3.68	3.54	3.4	3.22	2.53
3	6		78	4.68	5.85	5.66	5.12	4.70	4.32	4.16	3.39
4	5		79	3.95	5.00	4.65	4.34	3.94	3.73	3.36	2.53
5	7		79	5.53	6.87	6.73	6.39	6.07	5.69	5.10	3.16
6	9		73	6.57		8.76	8.29	7.52	6.39	4.80	2.24
7	5		74	3.69	4.88	4.84	4.59	4.35	3.80	3.51	1.93
8	8		65	5.17	7.59	7.05	6.11	5.42	4.85	4.11	2.41
9	10		65	6.52		9.61	8.69	7.72	6.38	5.35	2.91
10	8		63	5.05	7.80	7.26	6.49	5.57	4.77	4.05	2.53
11	9		82	7.38	8.90	8.65	7.80	7.39	6.50	5.68	3.00
	75		**74**	**55.28**		**70.90**	**65.22**	**59.82**	**53.27**	**46.56**	**29.11**