Paper Reference(s)

6663/01

Edexcel GCE

Core Mathematics C1

Bronze Level B3

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
72	64	55	47	39	30

1. Find

$$\int \left(6x^2 + \frac{2}{x^2} + 5\right) dx,$$

giving each term in its simplest form.

(4)

May 2012

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2. Find

$$\int (8x^3 + 6x^{\frac{1}{2}} - 5) \ dx,$$

giving each term in its simplest form.

(4)

May 2010

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3. Simplify

$$\frac{5 - \sqrt{3}}{2 + \sqrt{3}},$$

giving your answer in the form $a + b\sqrt{3}$, where a and b are integers.

(4)

January 2008

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4. A girl saves money over a period of 200 weeks. She saves 5p in Week 1, 7p in Week 2, 9p in Week 3, and so on until Week 200. Her weekly savings form an arithmetic sequence.

(*a*) Find the amount she saves in Week 200.

(3)

(*b*) Calculate her total savings over the complete 200 week period.

(3)

May 2007

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5. A sequence of positive numbers is defined by

$$a_{n+1} = \sqrt{(a_n^2 + 3)}, \quad n \geq 1,$$

$$a_1 = 2.$$

(*a*) Find a_2 and a_3, leaving your answers in surd form.

(2)

(*b*) Show that $a_5 = 4$.

(2)

May 2010

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6. The straight line L_1 passes through the points (–1, 3) and (11, 12).

(*a*) Find an equation for L_1 in the form $ax + by + c = 0$, where a, b and c are integers.

(4)

The line L_2 has equation $3y + 4x - 30 = 0$.

(*b*) Find the coordinates of the point of intersection of L_1 and L_2 .

(3)

May 2013

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7. Sue is training for a marathon. Her training includes a run every Saturday starting with a run of 5 km on the first Saturday. Each Saturday she increases the length of her run from the previous Saturday by 2 km.

(*a*) Show that on the 4th Saturday of training she runs 11 km.

(1)

(*b*) Find an expression, in terms of n, for the length of her training run on the nth Saturday.

(2)

(*c*) Show that the total distance she runs on Saturdays in n weeks of training is $n(n + 4)$ km.

(3)

On the nth Saturday Sue runs 43 km.

(*d*) Find the value of n.

(2)

(*e*) Find the total distance, in km, Sue runs on Saturdays in n weeks of training.

(2)

June 2008

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8. A sequence $a_1,\ a_2,\ a_3, \ldots$ is defined by

$$a_1 = k,$$

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

where k is a positive integer.

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

(1)

(b) Show that $a_3 = 9k + 20$.

(2)

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

(ii) Show that $\sum_{r=1}^{4} a_r$ is divisible by 10.

(4)

May 2007

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9. The curve C with equation $y = \mathrm{f}(x)$ passes through the point (5, 65).

Given that $\mathrm{f}'(x) = 6x^2 - 10x - 12$,

(a) use integration to find $\mathrm{f}(x)$.

(4)

(b) Hence show that $\mathrm{f}(x) = x(2x + 3)(x - 4)$.

(2)

(c) Sketch C, showing the coordinates of the points where C crosses the x-axis.

(3)

May 2007

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10. The curve C has equation

$$y = (x + 3)(x - 1)^2.$$

(a) Sketch C, showing clearly the coordinates of the points where the curve meets the coordinate axes.

(4)

(b) Show that the equation of C can be written in the form

$$y = x^3 + x^2 - 5x + k,$$

where k is a positive integer, and state the value of k.

(2)

There are two points on C where the gradient of the tangent to C is equal to 3.

(c) Find the x-coordinates of these two points.

(6)

January 2008

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11. The gradient of a curve C is given by $\frac{\mathrm{d}y}{\mathrm{d}x} = \frac{(x^2 + 3)^2}{x^2}$, $x \neq 0$.

(a) Show that $\frac{\mathrm{d}y}{\mathrm{d}x} = x^2 + 6 + 9x^{-2}$.

(2)

The point (3, 20) lies on C.

(b) Find an equation for the curve C in the form $y = \mathrm{f}(x)$.

(6)

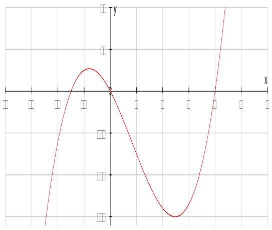
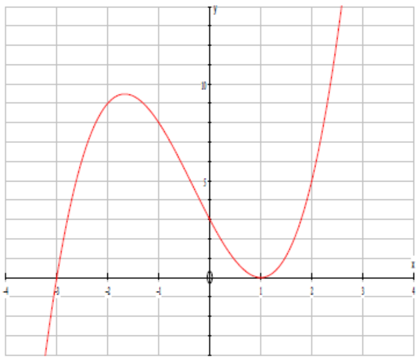
June 2008

TOTAL FOR PAPER: 75 MARKS

END

Question Number	Scheme	Marks
1.	$\left\{\int\left(6x^2+\frac{2}{x^2}+5\right)\mathrm{d}x\right\} = \frac{6x^3}{3}+\frac{2x^{-1}}{-1}+5x\,(+c)$	M1 A1
	$= 2x^3 - 2x^{-1}\,;+5x+c$	A1; A1
		[4]
2.	$\frac{8x^4}{4}+\frac{6x^{\frac{3}{2}}}{\frac{3}{2}}-5x+c$	M1 A1
	$= 2x^4+4x^{\frac{3}{2}},-5x+c$	A1 A1
		[4]
3.	$\frac{(5-\sqrt{3})}{(2+\sqrt{3})}\times\frac{(2-\sqrt{3})}{(2-\sqrt{3})}$	M1
	$=\frac{10-2\sqrt{3}-5\sqrt{3}+(\sqrt{3})^2}{\dots}$ $\left(=\frac{10-7\sqrt{3}+3}{\dots}\right)$	A1
	$(=13-7\sqrt{3})$ $\left(\text{Allow}\frac{13-7\sqrt{3}}{1}\right)$ 13 (a = 13)	A1
	$-7\sqrt{3}$ ($b = -7$)	A1
		[4]
4. (a)	Identify a = 5 and d = 2 (May be implied)	B1
	$(u_{200}=)\,a+(200-1)d$ $(= 5 + (200 - 1)\times 2)$	M1
	= <u>403</u>(p) or (£) <u>4.03</u>	A1 (3)
(b)	$(S_{200}=)\frac{200}{2}[2a+(200-1)d]$ or $\frac{200}{2}(a+\text{"their 403"})$	M1
	$=\frac{200}{2}[2\times5+(200-1)\times2]$ or $\frac{200}{2}(5+\text{"their 403"})$	A1
	= <u>40 800</u> or <u>£408</u>	A1 (3)
		[6]
5. (a)	$a_2=\left(\sqrt{4+3}\right)=\sqrt{7}$	B1
	$a_3=\sqrt{\text{"their 7"}+3}=\sqrt{10}$	B1ft (2)
(b)	$a_4=\sqrt{10+3}\left(=\sqrt{13}\right)$	M1
	$a_5=\sqrt{13+3}=4$ *	A1 cso (2)
		[4]

Question Number	Scheme	Marks
6.	(-1, 3) , (11, 12)	
(a)	$m = \dfrac{y_2 - y_1}{x_2 - x_1} = \dfrac{12-3}{11-(-1)}, = \dfrac{3}{4}$	M1, A1
	$y - 3 = ¾\,(x+1)$ or $y - 12 = ¾\,(x - 11)$ or $y = ¾\,x + c$ with attempt at substitution to find c	M1
	$4y - 3x - 15 = 0$	A1
		(4)
(b)	Solve equation from part (a) and L_2 simultaneously to eliminate one variable	M1
	$x = 3$ or $y = 6$	A1
	Both $x = 3$ **and** $y = 6$	A1
		(3) **[7]**
7. (a)	5, 7, 9, 11 or 5 + 2 + 2 + 2 = 11 or 5 + 6 = 11 use $a = 5$, $d = 2$, $n = 4$ and $t_4 = 5 + 3 \times 2 = 11$	B1 (1)
(b)	$t_n = a + (n-1)d$ with one of $a = 5$ or $d = 2$ correct	M1
	$= 5 + 2(n - 1)$ or $2n + 3$ or $1 + 2(n + 1)$	A1 (2)
(c)	$S_n = \dfrac{n}{2}[2 \times 5 + 2(n-1)]$ or use of $\dfrac{n}{2}(5 + \text{"their } 2n+3\text{"})$	M1 A1
	$= \{n(5 + n - 1)\} = n(n + 4)$ **(*)**	A1 cso (3)
(d)	$43 = 2n + 3$	M1
	$[n] = 20$	A1 (2)
(e)	$S_{20} = 20 \times 24, = \underline{480}$ (km)	M1 A1 (2) **[10]**
8. (a)	$(a_2 =)3k + 5$ [must be seen in part (a) or labelled $a_2 =$]	B1 (1)
(b)	$(a_3 =)3(3k + 5) + 5$	M1
	$= 9k + 20$	A1cso (2)
(c)(i)	$a_4 = 3(9k + 20) + 5$ $(= 27k + 65)$	M1
	$\sum_{r=1}^{4} a_r = k + (3k + 5) + (9k + 20) + (27k + 65)$	M1
(c)(ii)	$= 40k + 90$	A1
	$= 10(4k + 9)$ (or explain why divisible by 10)	A1ft (4)
		[7]

Question Number	Scheme	Marks
9. (a)	$\mathrm{f}(x) = \dfrac{6x^3}{3} - \dfrac{10x^2}{2} - 12x \ (+C)$	M1 A1
	$x = 5$: $\quad 250 - 125 - 60 + C = 65 \qquad C = 0$	M1 A1 (4)
(b)	$x(2x^2 - 5x - 12)$ or $(2x^2 + 3x)(x-4)$ or $(2x+3)(x^2 - 4x)$	M1
	$= x(2x+3)(x-4)$ (*)	A1cso (2)
(c)	 Shape	B1
	Through origin	B1
	$\left(-\dfrac{3}{2}, 0\right)$ and $(4,0)$	B1 (3)
		[9]
10. (a)	 Shape  (drawn anywhere)	B1
	Minimum at (1, 0) (perhaps labelled 1 on x-axis)	B1
	(–3,0) (or –3 shown on −ve x-axis)	B1
	(0, 3) (or 3 shown on +ve y-axis)	B1
	N.B. The max. can be anywhere.	(4)
(b)	$y = (x+3)(x^2 - 2x + 1)$ Marks can be awarded if	M1
	$= x^3 + x^2 - 5x + 3 \quad (k = 3)$ this is seen in part (a)	A1cso (2)
(c)	$\dfrac{dy}{dx} = 3x^2 + 2x - 5$	M1 A1
	$3x^2 + 2x - 5 = 3$ or $3x^2 + 2x - 8 = 0$	M1
	$(3x-4)(x+2) = 0 \qquad x = \ldots$	M1
	$x = \dfrac{4}{3}$ (or exact equiv.) , $x = -2$	A1, A1 (6)
		[12]

Question Number	Scheme	Marks
11. (a)	$\left(x^2+3\right)^2 = x^4+3x^2+3x^2+3^2$	M1
	$\dfrac{\left(x^2+3\right)^2}{x^2} = \dfrac{x^4+6x^2+9}{x^2} = x^2+6+9x^{-2}$ **(*)**	A1 cso (2)
(b)	$y = \dfrac{x^3}{3}+6x+\dfrac{9}{-1}x^{-1}\left(+c\right)$	M1 A1 A1
	$20 = \dfrac{27}{3}+6\times3-\dfrac{9}{3}+c$	M1
	$c = -4$	A1
	$[y =]\dfrac{x^3}{3}+6x-9x^{-1}-4$	A1 ft (6)
		[8]

Examiner reports

Question 1

About three-quarters of the candidature achieved all 4 marks in this question.

While most candidates were able to integrate both $6x^2$ and 5 correctly, a significant minority struggled to integrate $\frac{2}{x^2}$ correctly, giving incorrect answers such as $\frac{2x^{-3}}{3}$ or $-\frac{1}{2x}$ or $4x^{-1}$ or $4x^{-3}$.

Incorrect simplification of either $\frac{6x^3}{3}$ to $3x^3$ or $-2x^{-1}$ to $-\frac{1}{2x}$; or not simplifying $+ -2x^{-1}$ to $-2x^{-1}$ and the omission of the constant of integration were also other common errors.

It was pleasing to see very few candidates who differentiated all three terms.

Question 2

This question was answered very well. Most knew and applied the integration rule successfully although the simplification of $\frac{6}{\frac{3}{2}}$ proved too difficult for some with 9 being a common incorrect answer. Very few differentiated throughout but sometimes the 5 was "integrated" to zero although the other terms were correct. Only a few omitted the constant.

Question 3

There were many completely correct solutions to this question. The majority of candidates knew the correct method of multiplying the numerator and denominator by $(2 - \sqrt{3})$ and many were correct in the arithmetic manipulation. Some multiplied incorrectly by $(2 + \sqrt{3})$ or by $(5 + \sqrt{3})$. A number of candidates were unable to square √3 correctly and it was disappointing to see marks lost though careless arithmetic. Only a small minority of candidates had no idea of how to start.

Question 4

This question was answered well with most candidates quoting and using the appropriate arithmetic series formulae. In part (a) the majority obtained 403 and some wrote their answer as £4.03, there was the usual crop of arithmetic errors with 2 ×199 = 298 or 498 being quite common. In part (b) the sum formula was usually quoted and used correctly but again arithmetic slips (e.g. 408 × 100 = 4080 or 10 + 398 = 418 or 498) were often seen and some made errors with the units giving the answer as £40 800. There were some cases of candidates trying to use the $n\frac{(a+l)}{2}$ formula and misreading the *l* for a 1.

Question 5

This proved to be a straightforward question for most candidates who worked through it carefully and gained full marks. A few noticed that the numbers inside the square root formed an arithmetic sequence and this sometimes distracted them as they tried to use formulae for arithmetic series.

There were still some candidates who did not understand the notation and interpreted a_n as $\sqrt{n^2+3}$.

Some were confused by the nested square roots and we saw $a_3 = \sqrt{7^2+3}$ and others thought $\left(\sqrt{7}\right)^2 = 49$ but overall this question was answered well.

Question 6

In part (a) most candidates used a correct method to find the gradient of L_1. The equation of L_1 was usually found by using $y = mx + c$ or $y - y_1 = m(x - x_1)$. This was done well by the majority of candidates although there were sometimes errors in substitution and candidates should be encouraged to quote formulae before using them. Some did not convert their equation to the required form with integer coefficients. Some incorrect answers were due to failures in dealing correctly with the signs or by not multiply each term by 4 (or 12).

In solving the simultaneous equations in part (b), a variety of methods were seen with varying degrees of success. Those using substitution often made errors in the arithmetic and/or algebra. Those candidates using elimination were generally more successful. Some candidates equated the = 0 forms of the straight lines to form another equation in x and y. A common incorrect method was to substitute values into the equations, e.g. $x = 0$ or $y = 0$ or points given in part (a).

Question 7

Most gave a convincing argument in part (a) but in part (b) some merely quoted the formula for the nth term and failed to substitute values for a and d. Many simplified their answer here to $2n + 3$ and some gave the incorrect $2n + 5$. Part (c) was difficult for some and even those who started with a correct expression could not always complete the simplification with $\frac{n}{2}(8+2n)$ being simplified to $n(16 + 4n)$. Apart from the candidates who tried to solve $43 = S_n$ instead of u_n part (d) was usually answered correctly and often this was followed by a correct answer to part (e). A number of candidates though didn't appreciate that n had a value at this stage and they simply repeated their answer from part (c).

Question 8

Many of the comments made on the June 2006 paper would apply here too. Many candidates were clearly not familiar with the notation and a number used arithmetic series formulae to find the sum in part (c) although this was less common than in June 2006.

Apart from those candidates who had little idea about this topic most were able to answer parts (a) and (b) correctly. In part (c) many attempted to find a_4 using the recurrence relation and those who were not tempted into using the arithmetic series formulae often went on to attempt the sum and usually obtained $40k + 90$ which they were easily able to show was divisible by 10. Some lost marks for poor arithmetic $30k + 90$ and $40k + 80$ being some of the incorrect answers seen.

Question 9

Most candidates were able to integrate correctly to obtain $2x^3 - 5x^2 - 12x$ but many forgot to include a +C and never used the point (5, 65) to establish that C = 0. The majority of those who did attempt to find C went on to complete part (b) correctly but a few, who made arithmetic slips and had a non-zero C, were clearly stuck in part (b) although some did try and multiply out the given expression and gained some credit.

The sketch in part (c) was answered well. Few tried plotting points and there were many correct answers. Sometimes a "negative" cubic was drawn and occasionally the curve passed through (1.5, 0) instead of (–1.5, 0). There were very few quadratic or linear graphs drawn.

Question 10

For the sketch in part (a), most candidates produced a cubic graph but many failed to appreciate that the minimum was at (1, 0). Often three different intersections with the x-axis were seen. More often than not the intersections with the x-axis were labelled but the intersection at (0, 3) was frequently omitted. A sizeable minority of candidates drew a parabola. Many unnecessarily expanded the brackets for the function at this stage (perhaps gaining credit for the work required in part (b)).

The majority of candidates scored at least one mark in part (b), where the required form of the expansion was given. The best approach was to evaluate the product of two of the linear brackets and then to multiply the resulting quadratic with the third linear factor. Some tried, often unsuccessfully, to multiply out all three linear brackets at the same time. Again, as in Q7, the omission of brackets was common.

Although weaker candidates sometimes failed to produce any differentiation in part (c), others usually did well. Occasional mistakes included not equating the gradient to 3 and slips in the solution of the quadratic equation. Some candidates wasted time in unnecessarily evaluating the y coordinates of the required points.

Question 11

Part (a) was usually answered correctly although there were a few errors seen: $x^4 + 9$ for the expansion and partial or incorrect division being the common ones.

Part (b) was less well done. Some failed to realise that integration was required and others found the equation of a tangent. Those who did integrate sometimes struggled with the negative index and $9x^{-3}$ appeared. Those who successfully integrated sometimes forgot the $+c$ (and lost the final 3 marks) and others couldn't simplify $9x^{-1}$ as it later became $\frac{1}{9x}$. Simple arithmetic let down a few too with $3^3 = 9$ or $9 \times 3^{-1} = 27$ spoiling otherwise promising solutions.

Statistics for C1 Practice Paper Bronze Level B3

				Mean score for students achieving grade:							
Qu	Max score	Modal score	Mean %	ALL	A*	A	B	C	D	E	U
1	4		91	3.62	3.98	3.94	3.87	3.80	3.74	3.60	2.90
2	4		90	3.59	3.98	3.94	3.89	3.82	3.71	3.56	2.74
3	4		81	3.22		3.92	3.71	3.54	3.22	2.86	1.98
4	6		89	5.36		5.85	5.69	5.56	5.43	5.26	4.37
5	4		85	3.38	3.98	3.96	3.89	3.75	3.54	3.23	2.07
6	7		75	5.28	6.89	6.70	6.22	5.81	5.25	4.65	3.20
7	10		80	7.99		9.78	9.28	8.64	7.69	6.61	4.47
8	7		69	4.85		6.49	5.87	5.38	4.73	3.95	2.09
9	9		74	6.66		8.68	7.96	7.26	6.39	5.44	3.43
10	12		67	7.99		11.59	10.82	9.81	8.37	6.29	3.74
11	8		64	5.08		7.37	6.30	5.38	4.28	3.41	1.69
	75		**76**	**57.02**		**72.22**	**67.50**	**62.75**	**56.35**	**48.86**	**32.68**