Paper Reference(s)

6663/01

Edexcel GCE

Core Mathematics C1

Bronze Level B3

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 10 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	65	58	52	47	42

1. Find $\int (3x^2 + 4x^5 - 7)\ \mathrm{d}x$.

(4)

Jan 2008

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2. Solve the simultaneous equations

$$y - 2x - 4 = 0$$

$$4x^2 + y^2 + 20x = 0$$

(7)

May 2015

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3. Find

$$\int \left(3x^2 - \frac{4}{x^2}\right) \mathrm{d}x,$$

giving each term in its simplest form.

(4)

May 2013 (R)

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4. (i) A sequence $U_1, U_2, U_3, \ldots$ is defined by

$$U_{n+2} = 2U_{n+1} - U_n, \quad n \geq 1,$$

$$U_1 = 4 \text{ and } U_2 = 4.$$

Find the value of

(*a*) U_3,

(1)

(*b*) $\sum_{n=1}^{20} U_n$.

(2)

(ii) Another sequence $V_1, V_2, V_3, \ldots$ is defined by

$$V_{n+2} = 2V_{n+1} - V_n, \quad n \geq 1,$$

$$V_1 = k \text{ and } V_2 = 2k, \text{ where } k \text{ is a constant.}$$

(*a*) Find V_3 and V_4 in terms of k.

(2)

Given that $\sum_{n=1}^{5} V_n = 165$,

(*b*) find the value of k.

(3)

May 2015

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5. (*a*) Write $\sqrt{80}$ in the form $c\sqrt{5}$, where c is a positive constant.

(1)

A rectangle R has a length of $(1 + \sqrt{5})$ cm and an area of $\sqrt{80}$ cm^2.

(*b*) Calculate the width of R in cm. Express your answer in the form $p + q\sqrt{5}$, where p and q are integers to be found.

(4)

May 2014

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6. Jill gave money to a charity over a 20-year period, from Year 1 to Year 20 inclusive. She gave £150 in Year 1, £160 in Year 2, £170 in Year 3, and son on, so that the amounts of money she gave each year formed an arithmetic sequence.

(*a*) Find the amount of money she gave in Year 10.

(2)

(*b*) Calculate the total amount of money she gave over the 20-year period.

(3)

Kevin also gave money to charity over the same 20-year period.

He gave £A in Year 1 and the amounts of money he gave each year increased, forming an arithmetic sequence with common difference £30.

The total amount of money that Kevin gave over the 20-year period was **twice** the total amount of money that Jill gave.

(*c*) Calculate the value of A.

(4)

Jan 2010

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7. A rectangular room has a width of x m.

The length of the room is 4 m longer than its width.

Given that the perimeter of the room is greater than 19.2 m,

(*a*) show that $x > 2.8$.

(3)

Given also that the area of the room is less than 21 m^2,

(*b*) (i) write down an inequality, in terms of x, for the area of the room.

(ii) Solve this inequality.

(4)

(*c*) Hence find the range of possible values for x.

(1)

May 2013 (R)

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8. $$f'(x) = \frac{(3 - x^2)^2}{x^2}, \qquad x \neq 0.$$

(*a*) Show that $f'(x) = 9x^{-2} + A + Bx^2$, where A and B are constants to be found.

(3)

(*b*) Find $f''(x)$.

(2)

Given that the point $(-3, 10)$ lies on the curve with equation $y = f(x)$,

(*c*) find $f(x)$.

(5)

May 2013

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9. A curve has equation $y = f(x)$. The point P with coordinates $(9, 0)$ lies on the curve.

Given that

$$f'(x) = \frac{x + 9}{\sqrt{x}}, \qquad x > 0,$$

(*a*) find $f(x)$.

(6)

(*b*) Find the x-coordinates of the two points on $y = f(x)$ where the gradient of the curve is equal to 10.

(4)

May 2013 (R)

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10. The curve C has equation $y = 2x^3 + kx^2 + 5x + 6$, where k is a constant.

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

(2)

The point P, where $x = -2$, lies on C.

The tangent to C at the point P is parallel to the line with equation $2y - 17x - 1 = 0$.

Find

(b) the value of k,

(4)

(c) the value of the y coordinate of P,

(2)

(d) the equation of the tangent to C at P, giving your answer in the form $ax + by + c = 0$, where a, b and c are integers.

(2)

May 2016

TOTAL FOR PAPER: 75 MARKS

END

Question Number	Scheme	Marks
1	$3x^2 \to kx^3$ or $4x^5 \to kx^6$ or $-7 \to kx$ (k a non-zero constant)	M1
	$\frac{3x^3}{3}$ or $\frac{4x^6}{6}$ (Either of these, simplified or unsimplified)	A1
	$x^3 + \frac{2x^6}{3} - 7x$ or equivalent unsimplified, such as $\frac{3x^3}{3} + \frac{4x^6}{6} - 7x^1$	A1
	$+ C$ (or any other constant, e.g. $+ K$)	B1
		[4]
2	$y = 2x + 4 \Rightarrow 4x^2 + (2x+4)^2 + 20x = 0$ **or** $2x = y - 4$ or $x = \frac{y-4}{2}$ $\Rightarrow (y-4)^2 + y^2 + 10(y-4) = 0$	M1
	$8x^2 + 36x + 16 = 0$ or $2y^2 + 2y - 24 = 0$	M1 A1
	$(4)(2x+1)(x+4) = 0 \Rightarrow x = ...$ or $(2)(y+4)(y-3) = 0 \Rightarrow y = ...$	M1
	$x = -0.5, x = -4$ or $y = -4, y = 3$	A1 cso
	Sub into $y = 2x + 4$ or Sub into $x = \frac{y-4}{2}$	M1
	$y = 3,\ y = -4$ and $x = -4,\ x = -0.5$	A1
		[7]

Question Number	Scheme	Marks
3	$\int 3x^2 - \frac{4}{x^2}\mathrm{d}x = 3\frac{x^3}{3} - 4\frac{x^{-1}}{-1}$	M1A1A1
	$= x^3 + \frac{4}{x} + c$ or $x^3 + 4x^{-1} + c$	A1
		[4]
4 (i)(a)	$U_3 = 4$	B1
		(1)
(b)	$\sum_{n=1}^{n=20} U_n = 4+4+4.........+4$ or 20×4	M1
	$= 80$	A1
		(2)
(ii)(a)	$V_3 = 3k, \quad V_4 = 4k$	B1, B1
		(2)
(b)	$\sum_{n=1}^{n=5} V_n = k+2k+3k+4k+5k = 165$	
	or	
	$\frac{1}{2}\times 5\left(2\times k + 4\times k\right) = 165$	M1
	or	
	$\frac{1}{2}\times 5\left(k+5k\right) = 165$	
	$15k = 165 \Rightarrow k = ..$	M1
	$k = 11$ cao and cso	A1
		(3)
		[8]

Question Number	Scheme		Marks
5 (a)	$80 = 5\times16$		
	$\sqrt{80} = 4\sqrt{5}$		B1
			(1)
	Method 1	Method 2	
(b)	$\dfrac{\sqrt{80}}{\sqrt{5}+1}$ or $\dfrac{c\sqrt{5}}{\sqrt{5}+1}$	$(p+q\sqrt{5})(\sqrt{5}+1)=\sqrt{80}$	B1ft
	$=\dfrac{\sqrt{80}}{\sqrt{5}+1}\times\dfrac{\sqrt{5}-1}{\sqrt{5}-1}$ or $\dfrac{\sqrt{80}}{1+\sqrt{5}}\times\dfrac{1-\sqrt{5}}{1-\sqrt{5}}$	$p\sqrt{5}+q\sqrt{5}+p+5q = 4\sqrt{5}$	M1
	$=\dfrac{20-4\sqrt{5}}{4}$ or $\dfrac{4\sqrt{5}-20}{-4}$	$p+5q=0$ $p+q=4$	A1
	$=5-\sqrt{5}$	$p=5,\ q=-1$	A1cao
			(4)
			[5]
6 (a)	$a+9d = 150+9\times10 = 240$		M1 A1
			(2)
(b)	$\frac{1}{2}n\{2a+(n-1)d\} = \frac{20}{2}\{2\times150+19\times10\},\ = 4900$		M1A1 A1
			(3)
(c)	Kevin: $\frac{1}{2}n\{2a+(n-1)d\} = \frac{20}{2}\{2A+19\times30\}$		B1
	Kevin's total = $2\times$"4900" (or "4900" = $2\times$ Kevin's total)		M1
	$\frac{20}{2}\{2A+19\times30\} = 2\times$"4900"		A1ft
	$A = 205$		A1
			(4)
			[9]

Question Number	Scheme	Marks
7 (a)	**Ignore any references to the units in this question**	
	length is '$x + 4$'	B1
	$x + x + x + 4 + x + 4 > 19.2 \Rightarrow x > ..$	M1
	$x > 2.8$ *	A1(*)
		(3)
	Mark parts (b) and (c) together	
(b)(i)	$x(x+4) < 21$	B1 Cao
(b)(ii)	$x^2 + 4x - 21 < 0$ $(x+7)(x-3) < 0 \Rightarrow x = ...$	M1
	Either $-7 < x < 3$ **or** $0 < x < 3$	M1A1
		(4)
(c)	$2.8 < x < 3$	B1ft
		(1)
		[8]
8 (a)	$(3 - x^2)^2 = 9 - 6x^2 + x^4$	M1
	$9x^{-2} + x^2$	A1
	-6	A1
		(3)
(b)	$-18x^{-3} + 2x$	M1 A1ft
		(2)
(c)	$\mathrm{f}(x) = -9x^{-1} - 6x + \dfrac{x^3}{3}(+c)$	M1A1ft
	$10 = \dfrac{-9}{-3} - 6(-3) + \dfrac{(-3)^3}{3} + c$ so $c = ...$	M1
	$c = -2$	A1 cso
	$(\mathrm{f}(x) =) -9x^{-1} - 6x + \dfrac{x^3}{3} +$ their c	A1ft
		(5)
		[10]

Question Number	Scheme	Marks
9 (a)	$\text{f}'(x) = \dfrac{x+9}{\sqrt{x}} = \dfrac{x}{\sqrt{x}} + \dfrac{9}{\sqrt{x}} = x^{\frac{1}{2}} + 9x^{-\frac{1}{2}}$	M1A1
	$\text{f}(x) = \dfrac{x^{\frac{3}{2}}}{\frac{3}{2}} + 9\dfrac{x^{\frac{1}{2}}}{\frac{1}{2}}(+c)$	M1A1
	$\dfrac{(9)^{\frac{3}{2}}}{\frac{3}{2}} + 9\dfrac{(9)^{\frac{1}{2}}}{\frac{1}{2}} + c = 0 \Rightarrow c = \ldots$	M1
	$\text{f}(x) = \dfrac{2}{3}x^{\frac{3}{2}} + 18x^{\frac{1}{2}} - 72$	A1
		(6)
(b)	$\text{f}'(x) = \dfrac{x+9}{\sqrt{x}} = 10 \Rightarrow x + 9 = 10\sqrt{x}$	M1
	$(\sqrt{x} - 9)(\sqrt{x} - 1) = 0 \Rightarrow \sqrt{x} = \ldots$	dM1
	$x = 81, x = 1$	A1, B1
		(4) **[10]**

Question Number	Scheme	Marks
10 (a)	$\left(\frac{\mathrm{d}y}{\mathrm{d}x}=\right)6x^2+2kx+5$	M1 A1
		(2)
(b)	Gradient of given line is $\frac{17}{2}$	B1
	$\left(\frac{\mathrm{d}y}{\mathrm{d}x}\right)_{x=-2}=6(-2)^2+2k(-2)+5$	M1
	$"24-4k+5"="\frac{17}{2}"\Rightarrow k=\frac{41}{8}$	dM1 A1
		(4)
(c)	$y=-16+4k-10+6=4"k"-20=\frac{1}{2}$	M1 A1
		(2)
(d)	$y-"\frac{1}{2}"="\frac{17}{2}"\left(x-^{-}2\right)\Rightarrow -17x+2y-35=0$ or $y="\frac{17}{2}"x+c\Rightarrow c=...\Rightarrow -17x+2y-35=0$ or $2y-17x=1+34\Rightarrow -17x+2y-35=0$	M1 A1
		(2)
		[10]

Examiner reports

Question 1

Candidates answered this question well, with almost all of them recognising that integration was needed. A few were unable to integrate the 7 correctly and some omitted the constant of integration, but otherwise it was common to see full marks.

Question 2

This question was generally well answered, with many candidates gaining full marks. Most correctly formed the quadratic equation $8x^2 + 36x + 16 = 0$ although there were a significant number of errors in cancelling the coefficients. The most common problem amongst candidates who were unsuccessful was to square each term in the linear equation to obtain an expression such as $y^2 + 4x^2 + 16 = 0$ and then to subtract one equation from the other. These candidates made little progress. Those candidates who were successful in finding both values for x sometimes substituted into an incorrect equation for y or failed to find the y values at all.

Question 3

Again candidates were very successful here with 83.4% scoring full marks. Not unexpectedly, the most common errors were omitting the $+c$ and incorrectly integrating the term with the negative index usually to get –3. Almost all candidates obtained the x^3 and complied with the demand to simplify their answer.

Question 4

Part (i): In part (a) almost every candidate gained the first mark for $U_3 = 4$. For the sum in (b), although most realised that every term was 4 this seemed to cause difficult in finding the sum of 20 terms and a surprising number stated that $4 \times 20 = 100$. A few correctly used the sum of arithmetic sequence with a common difference of 0 but common differences of 1 or 4 were also seen. For part (b) a small number of candidates calculated the 20th term rather than the sum of 20 terms.

Question 5

58.5% of candidates gained full marks and a further 18.5% dropped one mark, usually the last mark.

Part (a) was done well by virtually all the candidates. The correct form with $c = 4$ was expressed almost universally, with $c = 16$ seen occasionally by those who were unsuccessful.

In part (b) there were some for whom placing surd in a context seemed to prevent them from starting. Most candidates applied method 1 and started very well with the appropriate expression for the width. Many mistakes arose with the multiplying out of the terms $(1 + \sqrt{5})(1 - \sqrt{5})$ in the denominator to get $1 - 5 = 4$ instead of –4. The numerator was expanded much more successfully. Those who had managed to obtain the correct numerator and denominator then typically simplified correctly but quite a few only divided one of the terms in the numerator by the 4 or –4. The alternative method of $(p + q\sqrt{5})(1 + \sqrt{5})$ was successfully used by a minority and a few candidates achieved the correct answer either by inspection or using trial and improvement. Some errors in sign occurred at the final stage, the main error here being $\sqrt{5} - 5$, which often went undetected by candidates, despite producing a negative width.

Question 6
Most candidates interpreted the context of this question very well and it was common for full marks to be scored by those who were sufficiently competent in arithmetic series methods. Answers to parts (a) and (b) were usually correct, with most candidates opting to use the appropriate formulae and just a few resorting to writing out lists of numbers. In part (c), it was pleasing that many candidates were able to form a correct equation in *A*. Disappointing, however, were the common arithmetical mistakes such as $4100 \div 20 = 25$. Trial and improvement methods in part (c) were occasionally seen, but were almost always incomplete or incorrect.

Question 7
Part (a) was usually solved correctly although some misinterpreted the question and thought the length was four times longer than the width.

The method in (b) is well-rehearsed and most could solve the quadratic inequality and identify the correct range of values. Only a few incorrectly chose the outside region.

A significant number of candidates failed to answer part (c) and stopped at the end of part (b). Significantly, the modal mark for this question was 7 out of 8.

Question 8
Many candidates were successful in achieving the three marks in part (a) but there were also a significant number of errors in expanding the bracket. There were common slips in signs for both the middle term and the x^2 term and some candidates expanded $(3 - x^2)^2$ as $9 - x^4$ or $9 + x^4$. Even with correct expansions of the numerator there were also errors in the simplification. A common error was to obtain $-6x$ for the middle term instead of -6.

Almost all candidates could gain the method mark for part (b), with most of these candidates also gaining the accuracy mark. Many of those candidates who didn't achieve this mark usually had an extra term (either from incorrect differentiation of a constant term or from having an incorrect term in the original expansion). A minority of the candidates used integration rather than differentiation.

In part (c) most candidates knew to substitute their values of x and f(x) into their equation, although some used +3 instead of –3. Some failed to gain the mark as they didn't use a $+c$ term or try to find a constant term and some equated their derivative to 0 (instead of 10). Those who had a correct equation and substituted the correct values commonly made mistakes on evaluating the $-9x^{-1}$ (often arriving at +27) or $\frac{x^3}{3}$ while most errors came from an incorrect + or − sign somewhere in their equation. Almost all candidates who found a value of c wrote out their final answer at the end. Frequent miscopying of –6 to +6 caused loss of marks in both parts (b) and (c).

Question 9
This question was probably the least well done on the paper. Some candidates were successful with part (a) and could make no headway in (b) and others could not attempt part (a) and yet were successful in part (b).

In part (a) the main errors were splitting the algebraic fraction incorrectly and problems with integrating negative fractional powers. Some candidates also missed out the constant of integration and were unable to access the last two marks in this part. Some of those who did have a constant of integration, struggled to obtain its value correctly.

Part (b) was more discriminating and many candidates did not know where to start. Even those who eliminated the fraction, failed to spot the quadratic in $\sqrt{x}$. Some chose to square their equation although the resulting algebra was sometimes poor.

Question 10
In part (a) most candidates differentiated correctly, with occasional slips, including $6x$ as the first term or $2k$ or 2m as the second term in the answer.

In part (b) many candidates knew that the equation $2y - 17x - 1 = 0$ needed to be rearranged to find the value of the gradient, but some just stated that $m = \frac{17}{2}$ and did not use it in the rest of their solution. Instead, having correctly evaluated $29 - 4k$ as the gradient at $x = -2$, they set it = 0, producing $k = \frac{29}{4}$ as their answer. Less common errors included the gradient of the line taken as 17 or –17 and the use of gradient of a normal instead of tangent. A small minority attempted to equate the curve and the line rather than the derivative of the curve and the gradient of the line.

In part (c) many candidates were unable to correctly use $k = \frac{41}{8}$ in their attempt to evaluate y with $x = -2$. Another error was to use the substitution of $x = -2$ in the equation of the line $2y - 17x - 1 = 0$, rather than in the curve, resulting in the most common incorrect answer of $y = -\frac{33}{2}$.

In part (d) some candidates did not realise that the gradient of the tangent was what they had used in (b) and so they substituted $x = -2$ and their k back into $\frac{dy}{dx}$ from part (a), often not reaching the correct gradient of $\frac{17}{2}$.

A small minority used their k value rather than their gradient of tangent in their equation $y - y_1 = m(x - x_1)$ and a very few used a normal gradient. Just occasionally, final answers were left in non-integer form, e.g. $y = \frac{17}{2}x + \frac{35}{2}$ but most were in the required form. Within parts (c) and (d) the method marks were frequently awarded but errors in part (b) resulted in the loss of accuracy marks.

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	3.63		3.98	3.91	3.87	3.84	3.61	2.87
2	7	7	89	6.21	6.90	6.83	6.61	6.48	6.23	5.96	4.58
3	4		93	3.70	4.00	3.94	3.82	3.75	3.73	3.36	2.88
4	8	8	91	7.30	7.92	7.89	7.72	7.55	7.34	7.03	5.79
5	5		81	4.04	4.93	4.82	4.50	4.26	3.97	3.58	2.54
6	9		85	7.63		8.75	8.35	8.15	7.72	7.07	5.68
7	8		81	6.47	7.73	7.35	6.82	6.22	5.89	5.60	3.51
8	10	10	75	7.45	9.79	9.54	9.02	8.48	7.80	6.91	3.91
9	10		70	7.01	9.67	8.82	7.25	5.94	5.23	4.16	1.87
10	10	10	67	6.72	9.35	8.87	7.93	7.02	5.92	4.82	3.07
	75		**80.21**	**60.16**	**60.29**	**70.79**	**65.93**	**61.72**	**57.67**	**52.10**	**36.70**