

6663/01

**Edexcel GCE
Core Mathematics C1
Bronze Level B4**

Time: 1 hour 30 minutes

Materials required for examination papers

Mathematical Formulae (Green)

Items included with question

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	63	55	47	39	31

1. Simplify $(3 + \sqrt{5})(3 - \sqrt{5})$. (2)
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- May 2007**

2. (a) Expand and simplify $(7 + \sqrt{5})(3 - \sqrt{5})$. (3)
- (b) Express $\frac{7 + \sqrt{5}}{3 + \sqrt{5}}$ in the form $a + b\sqrt{5}$, where a and b are integers. (3)
-
- January 2010**

3. Given that $y = 2x^3 + \frac{3}{x^2}$, $x \neq 0$, find
- (a) $\frac{dy}{dx}$, (3)
- (b) $\int y \, dx$, simplifying each term. (3)
-
- June 2009**

4. A sequence x_1, x_2, x_3, \dots is defined by
- $$x_1 = 1,$$
- $$x_{n+1} = ax_n + 5, \quad n \geq 1,$$
- where a is a constant.
- (a) Write down an expression for x_2 in terms of a . (1)
- (b) Show that $x_3 = a^2 + 5a + 5$. (2)
- Given that $x_3 = 41$
- (c) find the possible values of a . (3)
-
- January 2012**

5. (a) Write $\frac{2\sqrt{x+3}}{x}$ in the form $2x^p + 3x^q$, where p and q are constants.

(2)

Given that $y = 5x - 7 + \frac{2\sqrt{x+3}}{x}$, $x > 0$,

- (b) find $\frac{dy}{dx}$, simplifying the coefficient of each term.

(4)

January 2008

6. Given that $\frac{2x^2 - x^{\frac{3}{2}}}{\sqrt{x}}$ can be written in the form $2x^p - x^q$,

- (a) write down the value of p and the value of q .

(2)

Given that $y = 5x^4 - 3 + \frac{2x^2 - x^{\frac{3}{2}}}{\sqrt{x}}$,

- (b) find $\frac{dy}{dx}$, simplifying the coefficient of each term.

(4)

January 2009

7. The curve with equation $y = f(x)$ passes through the point $(-1, 0)$.

Given that

$$f'(x) = 12x^2 - 8x + 1,$$

find $f(x)$.

(5)

January 2011

8. The equation $x^2 + (k - 3)x + (3 - 2k) = 0$, where k is a constant, has two distinct real roots.

- (a) Show that k satisfies

$$k^2 + 2k - 3 > 0.$$

(3)

- (b) Find the set of possible values of k .

(4)

January 2011

9. (a) Factorise completely $x^3 - 4x$. (3)

- (b) Sketch the curve C with equation

$$y = x^3 - 4x,$$

showing the coordinates of the points at which the curve meets the axis.

(3)

The point A with x -coordinate -1 and the point B with x -coordinate 3 lie on the curve C .

- (c) Find an equation of the line which passes through A and B , giving your answer in the form $y = mx + c$, where m and c are constants. (5)

- (d) Show that the length of AB is $k\sqrt{10}$, where k is a constant to be found.

(2)

January 2010

10. (a) Factorise completely $x^3 - 6x^2 + 9x$ (3)

- (b) Sketch the curve with equation

$$y = x^3 - 6x^2 + 9x$$

showing the coordinates of the points at which the curve meets the x -axis.

(4)

Using your answer to part (b), or otherwise,

- (c) sketch, on a separate diagram, the curve with equation

$$y = (x - 2)^3 - 6(x - 2)^2 + 9(x - 2)$$

showing the coordinates of the points at which the curve meets the x -axis.

(2)

June 2009

11. The curve C has equation $y = f(x)$, $x > 0$, where

$$\frac{dy}{dx} = 3x - \frac{5}{\sqrt{x}} - 2.$$

Given that the point $P(4, 5)$ lies on C , find

(a) $f(x)$,

(5)

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

(4)

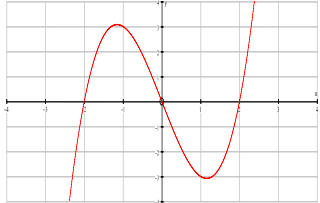

May 2010

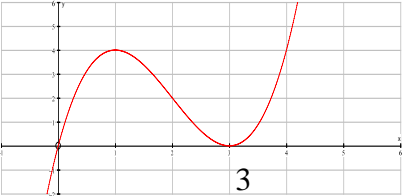

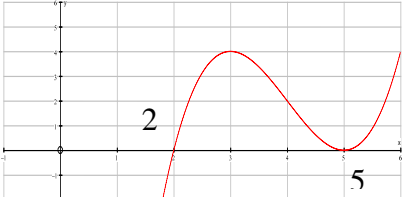
TOTAL FOR PAPER: 75 MARKS

END

Question Number	Scheme	Marks
1.	$9 - 5$ or $3^2 + 3\sqrt{5} - 3\sqrt{5} - \sqrt{5} \times \sqrt{5}$ or $3^2 - \sqrt{5} \times \sqrt{5}$ or $3^2 - (\sqrt{5})^2$ $= 4$	M1 A1 cso [2]
2. (a)	$(7 + \sqrt{5})(3 - \sqrt{5}) = 21 - 5 + 3\sqrt{5} - 7\sqrt{5}$ $= 16, -4\sqrt{5}$ (1 st A for 16, 2 nd A for $-4\sqrt{5}$)	M1 A1, A1 (3)
(b)	$\frac{7 + \sqrt{5}}{3 + \sqrt{5}} \times \frac{3 - \sqrt{5}}{3 - \sqrt{5}}$ Correct denominator without surds, i.e. $9 - 5$ or 4 $4 - \sqrt{5}$ or $4 - 1\sqrt{5}$	M1 A1 A1 (3) [6]
3. (a)	$\frac{dy}{dx} = 6x^2 - 6x^{-3}$	M1 A1 A1 (3)
(b)	$\frac{2x^4}{4} + \frac{3x^{-1}}{-1} (+ C)$ $\frac{x^4}{2} - 3x^{-1} + C$	M1 A1 A1 (3) [6]
4. (a)	$(x_2) = a + 5$	B1 (1)
(b)	$(x_3) = a^n(a+5)^n + 5$ $= a^2 + 5a + 5$ (*)	M1 A1 cso (2)
(c)	$41 = a^2 + 5a + 5 \Rightarrow a^2 + 5a - 36 (= 0)$ or $36 = a^2 + 5a$ $(a + 9)(a - 4) = 0$ $a = 4$ or -9	M1 M1 A1 (3) [6]

Question Number	Scheme	Marks
<p>5. (a)</p> <p>(b)</p>	$\left(2x^{-\frac{1}{2}} + 3x^{-1}\right)$ $p = -\frac{1}{2}, \quad q = -1$ $p = -1 \quad q = -1$ $\left(y = 5x - 7 + 2x^{-\frac{1}{2}} + 3x^{-1}\right)$ $\left(\frac{dy}{dx} = \right) \quad 5 \quad (\text{or } 5x^0) \quad (5x - 7 \text{ correctly differentiated})$ <p>Attempt to differentiate either $2x^p$ with a fractional p, giving kx^{p-1} ($k \neq 0$), (the fraction p could be in decimal form) or $3x^q$ with a negative q, giving kx^{q-1} ($k \neq 0$)</p>	<p>B1 B1</p> <p>(2)</p> <p>B1</p> <p>M1</p> <p>A1ft A1ft</p> <p>(4)</p> <p>[6]</p>
<p>6. (a)</p> <p>(b)</p>	$2x^{\frac{3}{2}} \quad \text{or} \quad p = \frac{3}{2} \quad (\text{Not } 2x\sqrt{x})$ $-x \quad \text{or} \quad -x^1 \quad \text{or} \quad q = 1$ $\left(\frac{dy}{dx} = \right) 20x^3 + 2 \times \frac{3}{2} x^{\frac{1}{2}} - 1$ $= \underline{20x^3 + 3x^{\frac{1}{2}} - 1}$	<p>B1</p> <p>B1</p> <p>(2)</p> <p>M1</p> <p>A1 A1ft</p> <p>A1ft</p> <p>(4)</p> <p>[6]</p>
<p>7.</p>	$(f(x) =) \frac{12x^3}{3} - \frac{8x^2}{2} + x(+c)$ $(f(-1) = 0 \Rightarrow) 0 = 4 \times (-1) - 4 \times 1 - 1 + c$ $c = 9$ $[f(x) = 4x^3 - 4x^2 + x + 9]$	<p>M1 A1 A1</p> <p>M1</p> <p>A1</p> <p>[5]</p>

Question Number	Scheme	Marks
8. (a)	$b^2 - 4ac = (k - 3)^2 - 4(3 - 2k)$ $k^2 - 6k + 9 - 4(3 - 2k) > 0 \quad \text{or} \quad (k - 3)^2 - 12 + 8k > 0 \quad \text{or better}$ $k^2 + 2k - 3 > 0 *$	M1 M1 A1cso (3)
8. (b)	$(k + 3)(k - 1) [= 0]$ <p>Critical values are $k = 1$ or -3 (choosing "outside" region) $k > 1$ or $k < -3$</p>	M1 A1 M1 A1 cao (4) [7]
9. (a)	$x(x^2 - 4)$ $= x(x - 2)(x + 2)$	B1 M1 A1 (3)
9. (b)	 <p>Shape  (2 turning points required)</p> <p>Through (or touching) origin</p> <p>Crossing x-axis or "stopping at x-axis" (not a turning point) at $(-2, 0)$ and $(2, 0)$.</p>	B1 B1 B1 (3)
9. (c)	<p><u>Either</u> $y = 3$ (at $x = -1$) <u>or</u> $y = 15$ (at $x = 3$)</p> <p>Gradient = $\frac{"15 - 3"}{3 - (-1)} (= 3)$</p> <p>$y - "15" = m(x - 3)$ or $y - "3" = m(x - (-1))$,</p> <p>$y - 15 = 3(x - 3)$ or the <u>correct</u> equation in <u>any</u> form,</p> <p>$y = 3x + 6$</p>	B1 M1 M1 A1 A1 (5)
9. (d)	$AB = \sqrt{("15 - 3")^2 + (3 - (-1))^2}$ $= \sqrt{160} (= \sqrt{16} \cdot \sqrt{10}) = 4\sqrt{10}$	M1 A1 (2) [13]

Question Number	Scheme	Marks
<p>10. (a)</p> <p>(b)</p> <p>(c)</p>	$x(x^2 - 6x + 9)$ $= x(x-3)(x-3)$  <p>Shape </p> <p><u>Through</u> origin (<u>not</u> touching) Touching x-axis only once touching at (3, 0), or 3 on x-axis [Must be on graph not in a table]</p>  <p>Moved horizontally (either way) (2, 0) and (5, 0), or 2 and 5 on x-axis</p>	<p>B1</p> <p>M1 A1 (3)</p> <p>B1</p> <p>B1</p> <p>B1</p> <p>B1ft (4)</p> <p>M1</p> <p>A1 (2)</p> <p>[9]</p>
<p>11. (a)</p> <p>(b)</p>	$\left(y = \frac{3x^2}{2} - \frac{5x^2}{2} - 2x + c\right)$ $f(4) = 5 \Rightarrow 5 = \frac{3}{2} \times 16 - 10 \times 2 - 8 + c$ $c = 9$ $\left[f(x) = \frac{3}{2}x^2 - 10x^{\frac{1}{2}} - 2x + 9 \right]$ $m = 3 \times 4 - \frac{5}{2} - 2 \left(= 7.5 \text{ or } \frac{15}{2} \right)$ <p>Equation is: $y - 5 = \frac{15}{2}(x - 4)$</p> $\underline{2y - 15x + 50 = 0} \quad \text{o.e.}$	<p>M1A1A1</p> <p>M1</p> <p>A1 (5)</p> <p>M1</p> <p>M1A1</p> <p>A1 (4)</p> <p>[9]</p>

Examiner reports

Question 1

This proved an easy starter for most candidates. Some identified this as a difference of two squares, and simply wrote down $9 - 5$, but most opted to multiply out and sign slips spoilt some answers with $9 + 5$ appearing quite often. Others thought that $3\sqrt{5} = 15$ and some wrote $3^2 = 6$.

Question 2

This question was answered very well, with many candidates scoring full marks. Mistakes in part (a) were usually from incorrect squaring of the $\sqrt{5}$ term, sign errors or errors in collecting the terms. In part (b), the method for rationalising the denominator was well known and most candidates, whether using their answer to part (a) or not, proceeded to a solution. A common mistake, however, was to divide only one of the terms in the numerator by 4.

Question 3

This question was answered very well with most candidates knowing and applying the rules for differentiation and integration correctly although the use of the notation for this topic, especially the integration sign, is still poor.

Most differentiated $2x^3$ correctly in part (a) and although many wrote $\frac{3}{x^2}$ as $3x^{-2}$, some still thought the derivative was $-6x^{-1}$ or $+6x^{-3}$. Similar problems arose with the integration in part (b) and some lost marks through failing to simplify their expressions and of course others forgot the $+c$.

Question 4

Most candidates answered this question well. Few failed to write down $a + 5$ or $a(1) + 5$ in part (a) and the minimal evidence of $a(a + 5) + 5$ almost always preceded the answer in part (b). A small minority of candidates still do not understand the notation in this question and their answers often contained terms in x .

Some candidates had difficulties with part (c). The correct equation was usually identified but sometimes it was not reduced to a three-term quadratic or the method of solution was incorrect. A few attempted to square root both sides and it was not uncommon to see $a + 5a = \sqrt{36}$. Some candidates obtained $a = 4$ by trial but credit will only be given for a complete solution leading to both answers.

Question 5

Most candidates were successful in finding at least one correct term from their division in part (a), but mistakes here included dividing only one term in the numerator by x and multiplying by x instead of dividing. Just a few seemed unaware that \sqrt{x} was equivalent to $x^{\frac{1}{2}}$. The vast majority who scored both marks (a) went on to score full marks in part (b). Much of the differentiation seen in part (b) was correct, but occasionally terms were not simplified. Some candidates failed to cope with the differentiation of the 'easier' part of the expression, $5x - 7$.

Question 6

Good candidates generally had no difficulty with the division in part (a) of this question, but others were often unable to cope with the required algebra and produced some very confused solutions. A common mistake was to "multiply instead of divide", giving $2x^2 \div \sqrt{x} = 2x^{\frac{5}{2}}$, and sometimes \sqrt{x} was interpreted as x^{-1} . Examiners saw a wide variety of wrong answers for p and q .

Most candidates were able to pick up at least two marks in part (b), where follow-through credit was available in many cases. While the vast majority used the answers from part (a), a few differentiated the numerator and denominator of the fraction term separately, then divided.

Question 7

This question was done well by most candidates and the actual process of integration was well practised. There were a large number of completely correct responses. Some candidates however did not realise that the constant of integration had to be found and stopped after integrating. They lost the final two marks. For those who continued the majority of errors arose because they incorrectly evaluated their expression with $x = -1$. This was due to the minus sign, which had to be cubed and squared. Some who did substitute correctly failed to realise that their expression in c needed setting equal to zero and so they made a false conclusion leading to $c = -9$.

Question 8

In part (a) most candidates appreciated the need to use $b^2 - 4ac$ and the majority of these stated that $b^2 - 4ac > 0$ is necessary for two real roots. Some candidates however only included the inequality in the final line of the answer. They should be aware that a full method is needed in a question where the answer is given. The algebraic processing in solutions was usually correct but common errors were squaring the bracket to give $k^2 + 9$ and incorrect multiplication by -4 .

In part (b), the critical values of -3 and 1 were generally found by factorisation but many candidates struggled to give the correct region; others used poor notation $1 < k < -3$. Candidates who gave their final answer in terms of x lost the final accuracy mark.

Question 9

The parts of this question could be tackled independently of each other and most candidates were able to pick up marks in one or more of the parts. In part (a), it was disappointing that so many failed to give a complete factorisation, commonly leaving the answer as $x(x^2 - 4)$. Sketches of the cubic graph in part (b) were often very good, even when the link between parts (a) and (b) was not appreciated.

A common misconception in part (c) was that the gradient of AB could be found by differentiating the equation of the curve and evaluating at either $x = 3$ or $x = -1$. Apart from this, numerical slips frequently spoiled solutions.

A significant number of candidates failed to attempt part (d), but those that did were often successful in obtaining the correct length of AB .

Question 10

It seemed clear that many candidates did not appreciate the links between the 3 parts of this question and there was much unnecessary work carried out: differentiating to find turning points and tables of values to help draw, not sketch, the curves.

Part (a) was usually answered well but not all the successful candidates started by taking out the factor of x , rather they tried to use the factor theorem to establish a first factor. Whilst techniques from C2 (or higher units) **may** be used in C1 they are not required and the “best” approach will not use them.

A correct factorisation in (a) should have made the sketch in (b) straightforward. Most drew a cubic curve (but some had a negative cubic not a positive one) and usually their curve either touched or passed through the origin. The most common non-cubic curve was a parabola passing through (0, 0) and (3,0). Part (c) looked complicated but those who spotted that they were sketching $f(x - 2)$ had few problems in securing both marks. Many candidates though embarked upon half a page or more of algebraic manipulation to no avail - this part was only worth 2 marks and a little thought may have helped them realise that such an approach was unlikely to be the correct one.

Question 11

In part (a) most integrated correctly although the fractional power caused a few problems:

some thought $\frac{5}{\sqrt{x}} = 5x^{\frac{1}{2}}$ and obtained $\frac{10}{3}x^{\frac{3}{2}}$ whilst others divided by 2 instead of $\frac{1}{2}$. The $+c$

was usually included and $x = 4$ was often substituted but sometimes the expression was set equal to 0 rather than 5.

In part (b) the majority attempted to find the gradient using $f'(4)$ and most went on to find the equation of a tangent although some had mistakes with the arithmetic. A few found the equation of a normal and a handful still did not know how to find the gradient of the tangent and used one of the coefficients from the given expression or their integration in part (a).

Statistics for C1 Practice Paper Bronze Level B4

Qu	Max score	Modal score	Mean %	ALL	A*	A	B	C	D	E	U
1	2		90	1.80		1.95	1.91	1.87	1.84	1.78	1.44
2	6		87	5.22		5.92	5.74	5.49	5.15	4.96	3.75
3	6		81	4.84		5.72	5.51	5.29	4.95	4.45	2.99
4	6		88	5.26	5.98	5.96	5.88	5.79	5.60	5.42	4.00
5	6		80	4.81		5.94	5.73	5.53	5.32	4.72	3.24
6	6		77	4.63		5.82	5.41	5.13	4.61	4.09	3.05
7	5		80	4.00	4.97	4.91	4.81	4.61	4.22	3.74	2.36
8	7		67	4.68	6.83	6.63	5.87	5.23	4.40	3.64	2.38
9	13		72	9.34		12.52	11.69	10.75	9.00	7.78	4.93
10	9		67	6.00		8.02	7.08	6.46	5.73	4.87	2.88
11	9		63	5.66	8.74	8.29	7.42	6.49	5.34	4.01	1.79
	75		75	56.24		71.68	67.05	62.64	56.16	49.46	32.81