Paper Reference(s)

6663/01

Edexcel GCE

Core Mathematics C1
Bronze Level B1

Time: 1 hour 30 minutes

Materials required for examination papers	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 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
74	66	58	50	42	34

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

(4)

January 2008

---

2. Find $\int (12x^5 - 8x^3 + 3)\ \mathrm{d}x$, giving each term in its simplest form.

(4)

January 2009

---

3. Expand and simplify $(\sqrt{7} + 2)(\sqrt{7} - 2)$.

(2)

January 2009

4.

$$y = 5x^3 - 6x^{\frac{4}{3}} + 2x - 3.$$

(*a*) Find $\frac{\mathrm{d}y}{\mathrm{d}x}$, giving each term in its simplest form.

(4)

(*b*) Find $\frac{\mathrm{d}^2y}{\mathrm{d}x^2}$.

(2)

May 2012

---

5. Find the set of values of x for which

(*a*) $2(3x + 4) > 1 - x$,

(2)

(*b*) $3x^2 + 8x - 3 < 0$.

(4)

May 2013

6.

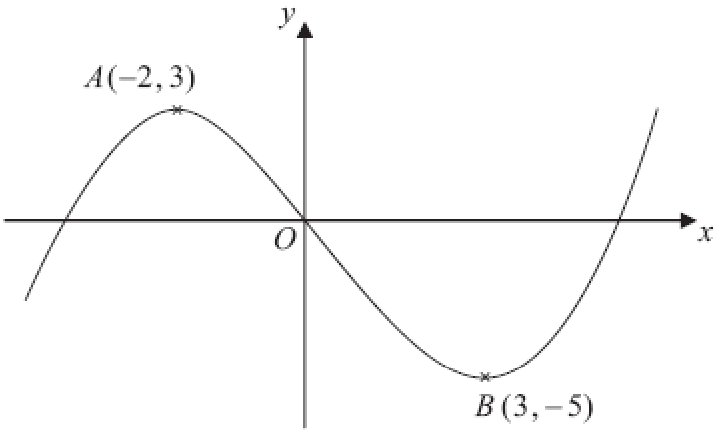


Figure 1

Figure 1 shows a sketch of the curve with equation $y = \mathrm{f}(x)$. The curve has a maximum point A at (–2, 3) and a minimum point B at (3, – 5).

On separate diagrams sketch the curve with equation

(*a*) $y = \mathrm{f}(x + 3)$,

(3)

(*b*) $y = 2\mathrm{f}(x)$.

(3)

On each diagram show clearly the coordinates of the maximum and minimum points.

The graph of $y = \mathrm{f}(x) + a$ has a minimum at (3, 0), where a is a constant.

(*c*) Write down the value of a.

(1)

May 2010

7. 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)

January 2010

8.

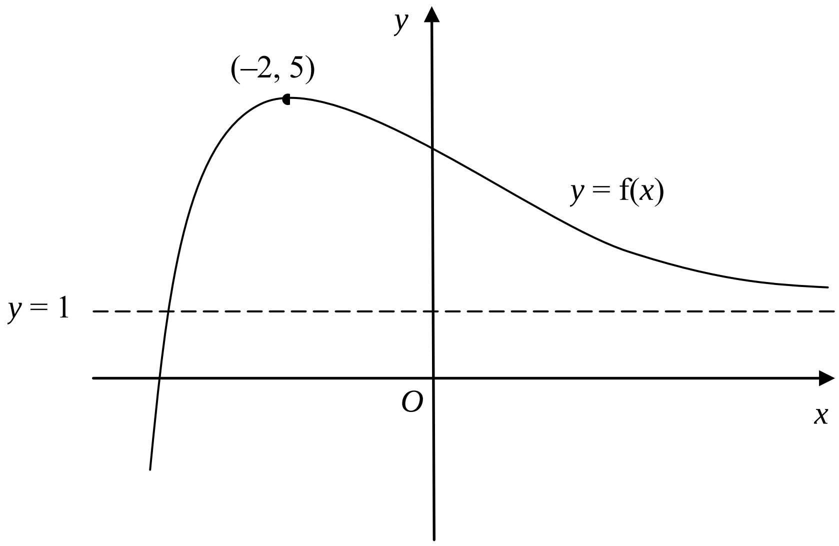


Figure 2

Figure 2 shows a sketch of part of the curve with equation $y = f(x)$.

The curve has a maximum point (–2, 5) and an asymptote $y = 1$, as shown in Figure 2.

On separate diagrams, sketch the curve with equation

(*a*) $y = f(x) + 2$,

(2)

(*b*) $y = 4f(x)$,

(2)

(c) $y = f(x + 1)$.

(3)

On each diagram, show clearly the coordinates of the maximum point and the equation of the asymptote.

January 2010

9.

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

(*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

10.

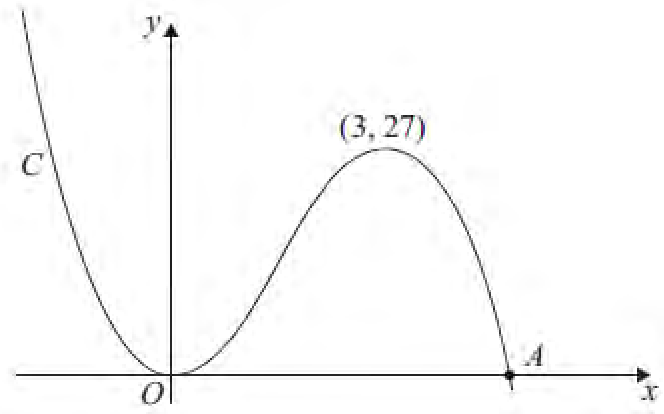


Figure 3

Figure 3 shows a sketch of the curve C with equation $y = \mathrm{f}(x)$, where

$$\mathrm{f}(x) = x^2(9 - 2x).$$

There is a minimum at the origin, a maximum at the point (3, 27) and C cuts the x-axis at the point A.

(*a*) Write down the coordinates of the point A.

(1)

(*b*) On separate diagrams sketch the curve with equation

(i) $y = \mathrm{f}(x + 3)$,

(ii) $y = \mathrm{f}(3x)$.

On each sketch you should indicate clearly the coordinates of the maximum point and any points where the curves cross or meet the coordinate axes.

(6)

The curve with equation $y = \mathrm{f}(x) + k$, where k is a constant, has a maximum point at (3, 10).

(*c*) Write down the value of k.

(1)

May 2012

11. The curve C has equation

$$y = \frac{1}{2}x^3 - 9x^{\frac{3}{2}} + \frac{8}{x} + 30, \qquad x > 0.$$

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

(4)

(b) Show that the point $P(4, -8)$ lies on C.

(2)

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

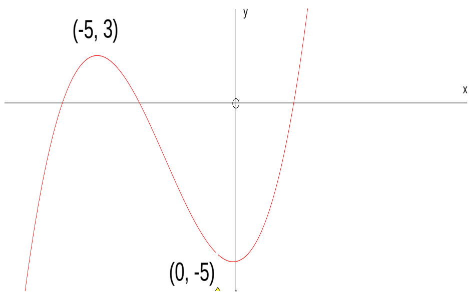
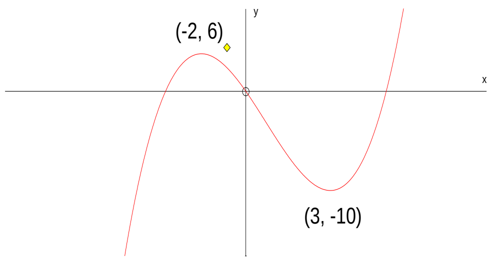
(6)

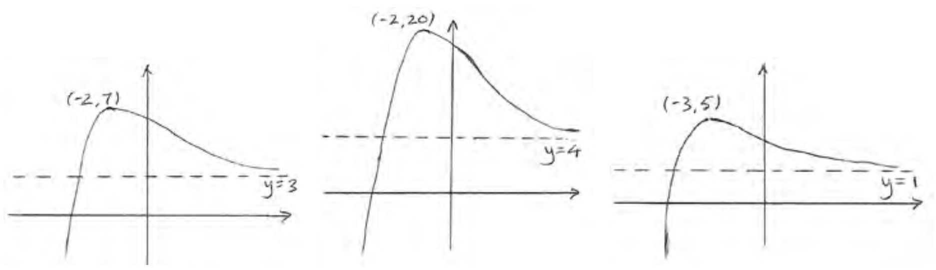
January 2011

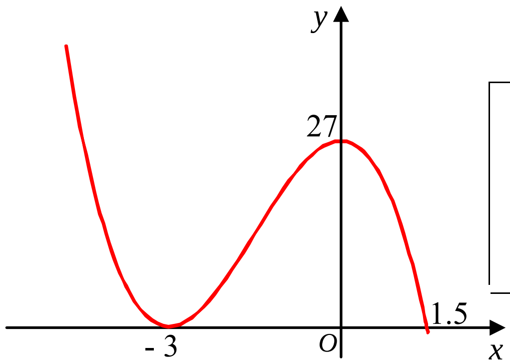
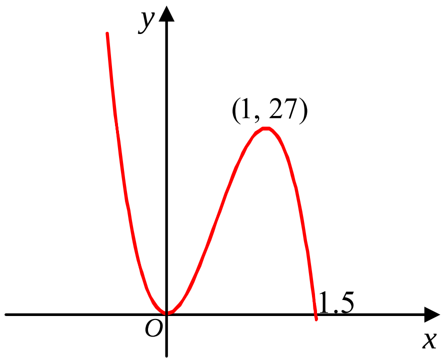
TOTAL FOR PAPER: 75 MARKS

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	$(I =)\frac{12}{6}x^6 - \frac{8}{4}x^4 + 3x + c$	M1
	$= 2x^6 - 2x^4 + 3x + c$	A1A1A1 **[4]**
3	$\sqrt{7}^2 + 2\sqrt{7} - 2\sqrt{7} - 2^2$, or 7 – 4 or an exact equivalent such as $\sqrt{49} - 2^2$	M1
	= 3	A1 **[2]**
	$y = 5x^3 - 6x^{\frac{4}{3}} + 2x - 3$	
4. (a)	$\left\{\frac{dy}{dx} =\right\} 5(3)x^2 - 6\left(\frac{4}{3}\right)x^{\frac{1}{3}} + 2$	M1
	$= 15x^2 - 8x^{\frac{1}{3}} + 2$	A1A1A1 **(4)**
(b)	$\left\{\frac{d^2y}{dx^2} =\right\} 30x - \frac{8}{3}x^{-\frac{2}{3}}$	M1 A1 **(2)** **[6]**
5. (a)	$6x + x > 1 - 8$	M1
	$x > -1$	A1 **(2)**
(b)	$(x + 3)(3x - 1)$ [= 0] $\Rightarrow x = -3$ and $\frac{1}{3}$	M1A1
	$-3 < x < \frac{1}{3}$	M1A1ft **(4)** **[6]**

Question Number	Scheme	Marks
6.		
(a)		
	Horizontal translation of ± 3	M1
	$(-5,\ 3)$ marked on sketch **or in text**	B1
	$(0,\ -5)$ and min intentionally on y-axis Condone $(-5,\ 0)$ if correctly placed on negative y-axis	A1 (3)
(b)		
	Correct shape and intentionally through (0,0) between the max and min	B1
	$(-2,\ 6)$ marked on graph **or in text**	B1
	$(3,\ -10)$ marked on graph **or in text**	B1 (3)
(c)	$(a =)\ \underline{5}$	B1 (1) **[7]**
7.	(a) $a + 9d = 150 + 9 \times 10 = 240$	M1 A1 (2)
	(b) $\frac{1}{2}n\{2a + (n-1)d\} = \frac{20}{2}\{2 \times 150 + 19 \times 10\},\ = 4900$	M1 A1, A1 (3)
	(c) Kevin: $\frac{1}{2}n\{2a + (n-1)d\} = \frac{20}{2}\{2A + 19 \times 30\}$	B1
	Kevin's total $= 2 \times$"4900" (or "4900" $= 2 \times$ Kevin's total)	M1
	$\frac{20}{2}\{2A + 19 \times 30\} = 2 \times$"4900"	A1ft
	$A = 205$	A1 (4) **[9]**

Question Number	Scheme	Marks
8.	(a) (b) (c) 	
	(a) (−2, 7), $y = 3$ (Marks are dependent upon a sketch being attempted)	B1, B1 (2)
	(b) (−2, 20), $y = 4$ (Marks are dependent upon a sketch being attempted)	B1, B1 (2)
	(c) Sketch: Horizontal translation (either way)… (There must be evidence that $y = 5$ at the max and that the asymptote is still $y = 1$) (−3, 5), $y = 1$	B1 B1, B1 (3) **[7]**
9. (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)	$\text{f}(x) = -9x^{-1}-6x+\dfrac{x^3}{3}(+c)$	M1A1ft
	$10 = \dfrac{-9}{-3}-6(-3)+\dfrac{(-3)^3}{3}+c$ so $c = ...$	M1
	$c = -2$	A1 cso
	$(\text{f}(x) =) -9x^{-1}-6x+\dfrac{x^3}{3}+$ their c	A1ft
		(5)
		[10]

Question Number	Scheme	Marks
10. (a)	{Coordinates of A are} $(4.5,\ 0)$	B1 **(1)**
(b)(i)		
	Horizontal translation	M1
	-3 and their ft 1.5 on postitive x-axis	A1 ft
	Maximum at 27 marked on the y-axis	B1 **(3)**
(ii)		
	Correct shape, minimum at $(0,\ 0)$ and a maximum within the first quadrant.	M1
	1.5 on x-axis	A1 ft
	Maximum at $(1,\ 27)$	B1 **(3)**
(c)	$\{k =\}\ -17$	B1 **(1)** **[8]**
11. (a)	$\left(\frac{\mathrm{dy}}{\mathrm{dx}} =\right) \frac{3}{2}x^2 - \frac{27}{2}x^{\frac{1}{2}} - 8x^{-2}$	M1 A1 A1 A1 **(4)**
(b)	$x = 4 \quad \Rightarrow y = \frac{1}{2}\times 64 - 9\times 2^3 + \frac{8}{4} + 30$	M1
	$= 32 - 72 + 2 + 30 \qquad = -8$	A1cso **(2)**
(c)	$x = 4 \quad \Rightarrow y' = \frac{3}{2}\times 4^2 - \frac{27}{2}\times 2 - \frac{8}{16}$	M1
	$= 24 - 27 - \frac{1}{2} \qquad = -\frac{7}{2}$	A1
	Gradient of the normal = $-1 \div$ "$-\frac{7}{2}$"	M1
	Equation of normal: $y - -8 = \frac{2}{7}(x - 4)$	M1A1ft
	$7y - 2x + 64 = 0$	A1 **(6)** **[12]**

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 answered very well, with most candidates scoring at least 3 marks out of 4. Omission of the integration constant occurred less frequently than usual and the terms were usually simplified correctly. Just a few candidates differentiated, and a few thought that the integral of x^n was $\frac{x^{n+1}}{n}$.

Question 3

Most candidates completed this question successfully, either by expanding the brackets to find four terms or by recognising the difference of squares and writing down $7-4=3$ directly. Common wrong answers included $11+4\sqrt{7}$, from $(\sqrt{7}+2)(\sqrt{7}+2)$, and 5, from $7+2\sqrt{7}-2\sqrt{7}-2$. Mistakes such as $\sqrt{7}\times 2=\sqrt{14}$ were rarely seen.

Question 4

This question was well answered with about two-thirds of the candidature achieving all 6 marks.

In part (a), a small minority of candidates struggled to deal with the fractional power when differentiating $-6x^{\frac{4}{3}}$. Some candidates incorrectly reduced the power by 1 to give a term in $x^{\frac{2}{3}}$; whilst other candidates struggled to multiply -6 by $\frac{4}{3}$ or incorrectly multiplied –6 by $\frac{1}{3}$. A few candidates did not simplify $-\frac{24}{3}x^{\frac{1}{3}}$ to give $-8x^{\frac{1}{3}}$ or integrated throughout, or added a constant to their differentiated expression.

Question 5

There were a surprising number of incorrect responses to part (a), although the majority of candidates scored both marks. Some failed to expand the brackets correctly, while others were unable to deal with collecting the like terms together (mainly as a result of the negative x term). Candidates also showed confusion about when to change the direction of the inequality, some changing the direction when multiplying by a positive number and others not changing the direction when multiplying by a negative number. Some changed from an inequality to an equality and $x=-1$ was a common incorrect answer.

In part (b) the majority of candidates correctly factorised the quadratic, but some solved this incorrectly to achieve answers of +3, $-\frac{1}{3}$ and even 1 or −1. Some candidates wrote out the solutions using inequalities, e.g. $3x-1<0$ and $x+3<0$. Some candidates failed to give the correct inequalities after finding the two correct values for x. Some candidates gave their answers as two separate inequalities (without using 'and') and quite a few gave their final answer as $-3 < x > \frac{1}{3}$. A significant number of candidates identified the solution as the 'outside' region.

Question 6

Most candidates have a good idea of the principles in these transformations (as was evident from their rough working) but sometimes their sketches did not do them justice.

In part (a) many knew that the graph underwent a translation of 3 units to the left but their minimum was in the 4th quadrant even though it was correctly labelled (0, –5).

In (b) many knew that the curve was stretched in the y direction but their curve did not pass through the origin and a mark was lost. The most common error in (a) was a translation of +3 in the x direction and in (b) we saw both $y = \mathrm{f}(\frac{1}{2}x)$ and $y = \frac{1}{2}\mathrm{f}(x)$.

Part (c) proved to be a little more difficult with candidates unable to visualise the translation and unwilling to draw themselves a diagram. There were many wrong answers of $a = \pm 3$ and sometimes $a = -5$.

Question 7

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 8

There were many good solutions to all three parts of this question. Although many candidates were able to give the coordinates of the transformed maximum points correctly, some did not understand the effect of the transformation on the asymptote. This was particularly true in part (b), where it was common to think that the asymptote $y = 1$ was unchanged in the transformation $y = 4\mathrm{f}(x)$. Almost all candidates had some success in producing sketches of the correct general shape in each part, but it was often apparent that the concept of an asymptote was not fully understood.

Question 9

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 10

This question was both well answered and discriminating with about two-thirds of the candidature gaining at least 6 of the 8 marks available and about one-third achieving full marks.

In part (a), most candidates solved f(x) = 0 to find the correct x-coordinate of $\frac{9}{2}$ for A. Some candidates, however, found $\mathrm{f}(0)$ and arrived at an incorrect value of 9. Other common incorrect values for x were 6 or 27.

In part (b), most candidates were able to give the correct shape for each of the transformed curves.

In part (i), most translated the graph of $y = \mathrm{f}(x)$ in the correct direction. Very few candidates translated $y = \mathrm{f}(x)$ to the right, and even fewer translated $y = \mathrm{f}(x)$ in a vertical direction. Some labelled the y-intercept correctly as $(0, 27)$ but erroneously drew their maximum point slightly to the right of the y-axis in the first quadrant. Most realised that the transformed curve would cut the positive x-axis at "their x in part (a) – 3". Other candidates, who gave no answer to part (a), labelled this x-intercept as $A - 3$ or some left it unlabelled. Occasionally the point $(-3, 0)$ was incorrectly labelled as $(3, 0)$ although it appeared on the negative x-axis.

In part (ii), most graphs had their minimum at the origin and their maximum within the first quadrant. Many realised that the transformed curve would cut the x-axis at $\frac{\text{their } x \text{ in part } (a)}{3}$. Other candidates, who gave no answer to part (a), labelled this intercept as $\frac{A}{3}$, whilst some left it unlabelled. Some misunderstood the given function notation and stretched $y = \mathrm{f}(x)$ in the x-direction with scale factor 3 resulting in a maximum of $(9, 27)$ and an x-intercept at $(13.5, 0)$. Very occasionally a stretch of the y-direction; or a two way stretch; or even a reflection of $y = \mathrm{f}(x)$ was seen. In a few cases there was an attempt by some candidates to make the graph pass through both $(0, 0)$ and $(0, 27)$.

A significant number of candidates wrote down $k = -17$ whilst some left this part unanswered. Some then wrote down the equation $y = \mathrm{f}(x) + k = x^2(9 - 2x) + k$, and substituted in the point $(3, 10)$ to find the correct value of k. Common incorrect answers included $k = 17$ (from $27 - 10$) or $k = 7$ (following $3 + k = 10$).

Question 11

As a last question this enabled good candidates to demonstrate an understanding of the techniques of gradients, applying problem solving and logical skills to achieve the final equation. 26% achieved full marks in this question. There were very few blank scripts or evidence of candidates who did not have time to complete the question. Usually if candidates did have difficulty, it was because they had made a mistake in answering the early part of the question. In part (a) most candidates were able to differentiate the equation correctly, although there were some problems with coefficients. Most mistakes occurred when differentiating $\frac{8}{x}$ with candidates being unable to rewrite it as $8x^{-1}$ prior to differentiation, or losing the term completely on differentiation. This term also caused candidates problems in the subsequent substitution of numbers which resulted in many strange results. Again, as in question 2, an inability to deal with fractions was seen.

In part (b), the usual approach was to substitute (4, −8) into the equation and show that –8 = –8. Cases where candidates substituted $x = 4$ mistakenly into their gradient instead of the equation of the curve C were frequent, although sometimes corrected. Substituting into fractional items proved to be too much for some candidates and consequently elementary mistakes were made. Simplification of the third term to −72 caused the most problems (many getting 54).

In part (c) there was again the occasional mistake of substitution into the wrong expression. Those candidates who correctly found the gradient of the curve, at the point P, usually went on and found the equation of the normal without any trouble.

Arithmetic was often poor and it was common to see $24-27-\frac{1}{2}=-\frac{5}{2}$ and other numerical slips. However even those candidates who had made an error initially then attempted to find a perpendicular gradient and went on to use it successfully in finding the equation of their normal. Very few used the gradient of the tangent in error. Where candidates used $y = mx + c$ the calculations for c were often numerically incorrect and followed long, complex (often messy) workings.

Presentation in this question varied from some excellent easily followed solutions to some with little coherence.

Statistics for C1 Practice Paper Bronze Level B1

Qu	Max score	Modal score	Mean %	Mean score for students achieving grade: 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	4		92	3.66		3.96	3.89	3.86	3.70	3.65	2.86
3	2		92	1.83		1.95	1.90	1.89	1.88	1.79	1.55
4	6		90	5.38	5.93	5.86	5.75	5.63	5.48	5.28	4.39
5	6		83	4.96	5.91	5.82	5.57	5.30	4.99	4.65	3.53
6	7		82	5.77	6.89	6.75	6.43	6.14	5.80	5.43	4.08
7	9		85	7.63		8.75	8.35	8.15	7.72	7.07	5.68
8	7		78	5.49		6.56	6.13	5.90	5.16	4.84	3.27
9	10		75	7.45	9.79	9.54	9.02	8.48	7.80	6.91	3.91
10	8		74	5.89	7.82	7.59	7.15	6.58	5.89	5.07	3.03
11	12		67	8.03	11.72	11.43	10.51	9.29	7.89	6.47	3.90
	75		**80**	**59.72**		**72.19**	**68.61**	**65.09**	**60.15**	**54.77**	**39.07**