Paper Reference(s)

6663/01

Edexcel GCE

Core Mathematics C1
Silver Level S1

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 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
71	62	54	46	38	30

1. Simplify

$$\frac{7+\sqrt{5}}{\sqrt{5}-1},$$

giving your answer in the form $a + b\sqrt{5}$, where a and b are integers.

(4)

May 2013

---

2. Given that $y = 2x^5 + 7 + \frac{1}{x^3}$, $x \neq 0$, find, in their simplest form,

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

(3)

(b) $\int y \;\mathrm{d}x$.

(4)

May 2011

---

3. (a) Find the value of $8^{\frac{5}{3}}$.

(2)

(b) Simplify fully $\frac{(2x^{\frac{1}{2}})^3}{4x^2}$.

(3)

May 2013

---

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

$$a_1 = 4,$$
$$a_{n+1} = k(a_n + 2), \qquad \text{for } n \geq 1$$

where k is a constant.

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

(1)

Given that $\sum_{i=1}^{3} a_i = 2$,

(b) find the two possible values of k.

(6)

May 2013

5.

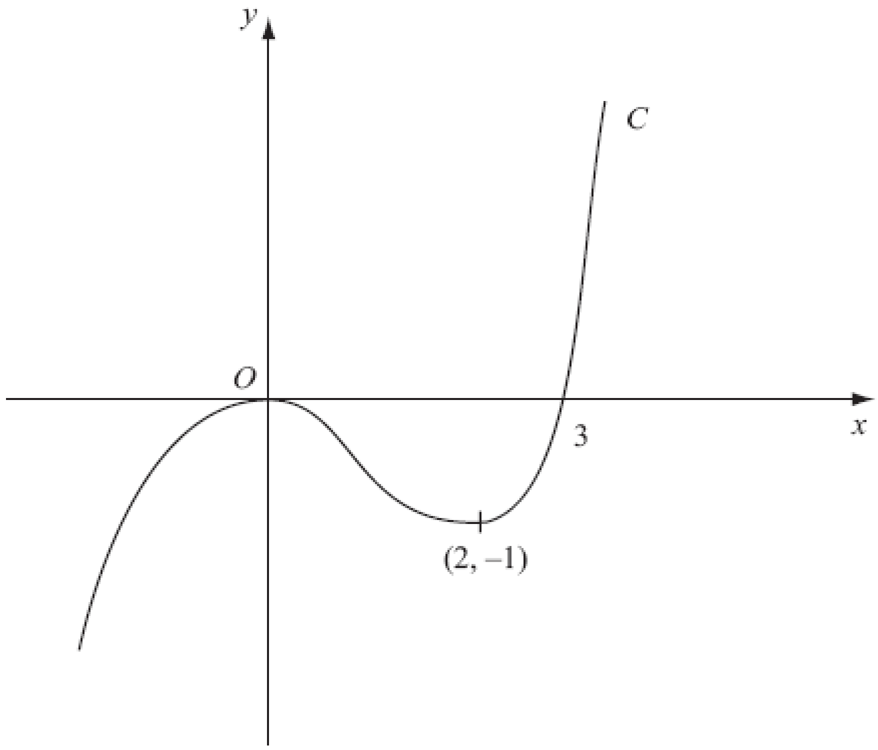


Figure 1

Figure 1 shows a sketch of the curve C with equation $y = \mathrm{f}(x)$. There is a maximum at (0, 0), a minimum at (2, –1) and C passes through (3, 0).

On separate diagrams, sketch the curve with equation

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

(3)

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

(3)

On each diagram show clearly the coordinates of the maximum point, the minimum point and any points of intersection with the x-axis.

January 2009

6. An arithmetic sequence has first term a and common difference d. The sum of the first 10 terms of the sequence is 162.

(a) Show that $10a + 45d = 162$.

(2)

Given also that the sixth term of the sequence is 17,

(b) write down a second equation in a and d,

(1)

(c) find the value of a and the value of d.

(4)

January 2011

---

7. Lewis played a game of space invaders. He scored points for each spaceship that he captured.

Lewis scored 140 points for capturing his first spaceship.

He scored 160 points for capturing his second spaceship, 180 points for capturing his third spaceship, and so on.

The number of points scored for capturing each successive spaceship formed an arithmetic sequence.

(a) Find the number of points that Lewis scored for capturing his 20th spaceship.

(2)

(b) Find the total number of points Lewis scored for capturing his first 20 spaceships.

(3)

Sian played an adventure game. She scored points for each dragon that she captured. The number of points that Sian scored for capturing each successive dragon formed an arithmetic sequence.

Sian captured n dragons and the total number of points that she scored for capturing all n dragons was 8500.

Given that Sian scored 300 points for capturing her first dragon and then 700 points for capturing her nth dragon,

(c) find the value of n.

(3)

January 2013

8.

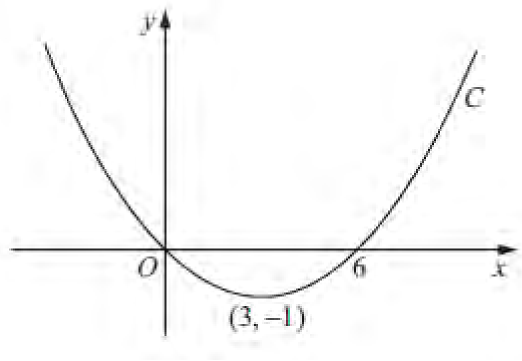


Figure 2

Figure 2 shows a sketch of the curve C with equation $y = f(x)$.
The curve C passes through the origin and through (6, 0).
The curve C has a minimum at the point (3, –1).

On separate diagrams, sketch the curve with equation

(*a*) $y = f(2x)$,
(3)

(*b*) $y = -f(x)$,
(3)

(*c*) $y = f(x + p)$, where p is a constant and $0 < p < 3$.
(4)

On each diagram show the coordinates of any points where the curve intersects the x-axis and of any minimum or maximum points.

May 2011

9. A farmer has a pay scheme to keep fruit pickers working throughout the 30 day season. He pays £a for their first day, £$(a + d)$ for their second day, £$(a + 2d)$ for their third day, and so on, thus increasing the daily payment by £d for each extra day they work.

A picker who works for all 30 days will earn £40.75 on the final day.

(a) Use this information to form an equation in a and d.

(2)

A picker who works for all 30 days will earn a total of £1005.

(b) Show that $15(a + 40.75) = 1005$.

(2)

(c) Hence find the value of a and the value of d.

(4)

May 2010

---

10. The curve C has equation $y = x^2(x - 6) + \frac{4}{x}$, $x > 0$.

The points P and Q lie on C and have x-coordinates 1 and 2 respectively.

(a) Show that the length of PQ is $\sqrt{170}$.

(4)

(b) Show that the tangents to C at P and Q are parallel.

(5)

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

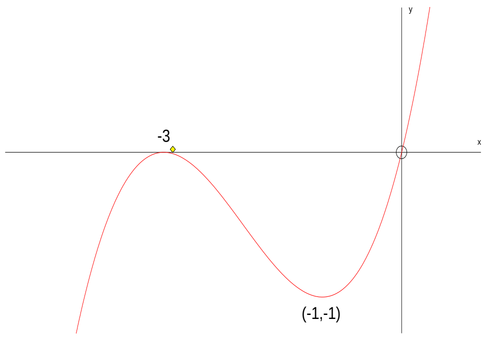
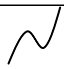
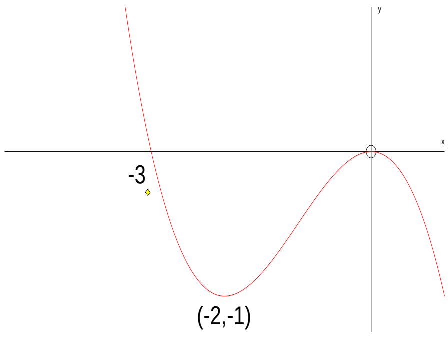
(4)

May 2007

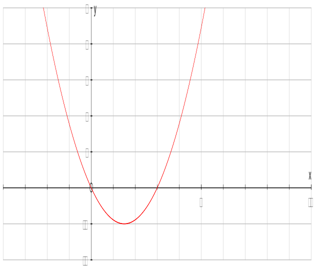
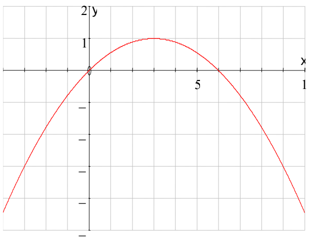
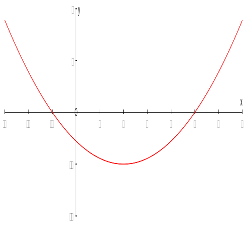
TOTAL FOR PAPER: 75 MARKS

END

Question Number	Scheme	Marks
1	$\dfrac{7+\sqrt{5}}{\sqrt{5}-1}\times\dfrac{(\sqrt{5}+1)}{(\sqrt{5}+1)}$	M1
	$=\dfrac{\cdots}{4}$	A1 cso
	$(7+\sqrt{5})(\sqrt{5}+1)=7\sqrt{5}+5+7+\sqrt{5}$	M1
	$3+2\sqrt{5}$	A1 cso
		[4]
2. (a)	$\dfrac{\mathrm{d}y}{\mathrm{d}x}=10x^4-3x^{-4}$ or $10x^4-\dfrac{3}{x^4}$	M1 A1 A1
		(3)
(b)	$\left(\int=\right)\ \dfrac{2x^6}{6}+7x+\dfrac{x^{-2}}{-2}=\dfrac{x^6}{3}+7x-\dfrac{x^{-2}}{2}$	M1 A1 A1
	$+C$	B1
		(4)
		[7]
3. (a)	$8^{\frac{1}{3}}=2$ or $8^5=32768$	M1
	$\left(8^{\frac{5}{3}}=\right)$ 32	A1 cao
		(2)
(b)	$\left(2x^{\frac{1}{2}}\right)^3=2^3x^{\frac{3}{2}}$	M1
	$\dfrac{8x^{\frac{3}{2}}}{4x^2}=2x^{-\frac{1}{2}}$ or $\dfrac{2}{\sqrt{x}}$	dM1A1
		(3)
		[5]

Question Number	Scheme	Marks
4. (a)	$(a_2 =)\ \ k(4{+}2)\ \ \ (= 6k)$	B1
		(1)
(b)	$a_3 = k(\text{their } a_2 + 2)\ \ (= 6k^2 + 2k)$	M1
	$a_1 + a_2 + a_3 = 4 + (6k) + (6k^2 + 2k)$	M1
	$4 + (6k) + (6k^2 + 2k) = 2$	A1
	Solves $6k^2 + 8k + 2 = 0$ to obtain $k =$ $(6k^2 + 8k + 2 = 2(3k+1)(k+1))$	M1
	$k = -1/3$	A1
	$k = -1$	B1
		(6)
		[7]
5. (a)	 Shape  , touching the x-axis at its maximum.	M1
	Through (0,0) & -3 marked on x-axis, or $(-3, 0)$ seen.	A1
	Allow $(0, -3)$ if marked on the x-axis.	
	Marked in the correct place, but 3, is A0.	
	Min at $(-1, -1)$	A1
		(3)
(b)	 Correct shape  (top left - bottom right)	B1
	Through -3 and max at (0, 0).	B1
	Min at $(-2, -1)$	B1
		(3)
		[6]

Question Number	Scheme	Marks
6. (a)	$S_{10} = \frac{10}{2}\left[2a+9d\right]$ or	M1
	$S_{10} = a + a + d + a + 2d + a + 3d + a + 4d + a + 5d + a + 6d + a + 7d +$	
	$a + 8d + a + 9d$	
	$162 = 10a + 45d$	A1 cso (2)
(b)	$\left(u_n = a+\left(n-1\right)d \Rightarrow\right)$ $17 = a + 5d$	B1 (1)
(c)	$10 \times (b)$ gives $10a + 50d = 170$	M1
	(a) is $10a + 45d = 162$	
	Subtract $5d = 8$ so $d = 1.6$ oe	A1
	Solving for a $a = 17 - 5d$	M1
	so $a = 9$	A1 (4) **[7]**
7. (a)	Lewis; arithmetic series, $a = 140$, $d = 20$.	
	$T_{20} = 140 + (20 - 1)(20); = 520$	M1; A1 (2)
(b)	Uses $\frac{1}{2}n(2a + (n-1)d)$	M1
	$\frac{20}{2}\left(2\times140 + (20-1)(20)\right)$	A1
	6600	A1 (3)
(c)	Sian; arithmetic series,	
	$a = 300$, $l = 700$, $S_n = 8500$	
	Attempt to use $8500 = \frac{n}{2}(a + l)$	M1
	$8500 = \frac{n}{2}\left(300 + 700\right)$	A1
	$\Rightarrow n = 17$	A1 (3) **[8]**

Question Number	Scheme	Marks
8. (a)	 Shape $\cup$ through (0, 0)	B1
	(3, 0)	B1
	(1.5, –1)	B1
		(3)
(b)	 Shape $\cap$	B1
	(0, 0) and (6, 0)	B1
	(3, 1)	B1
		(3)
(c)	 Shape $\cup$, <u>not</u> through (0, 0)	M1
	Minimum in 4$^{\text{th}}$ quadrant	A1
	$(-p, 0)$ and $(6-p, 0)$	B1
	$(3-p, -1)$	B1
		(4)
		[10]
9. (a)	$a+29d=40.75$ or $a=40.75-29d$ or $29d=40.75-a$	M1 A1
		(2)
(b)	$(S_{30})=\dfrac{30}{2}(a+l)$ or $\dfrac{30}{2}(a+40.75)$ or $\dfrac{30}{2}(2a+(30-1)d)$ or $15(2a+29d)$	M1
	So $1005=15[a+40.75]$ *	A1 cso
		(2)
(c)	$67=a+40.75$ so <u>$a=$ (£) 26.25 or 2625p</u>	M1 A1
	$29d=40.75-26.25$	M1
	$=14.5$ so <u>$d=$ (£)0.50 or 0.5 or 50p</u>	A1
		(4)
		[8]

Question Number	Scheme	Marks
10. (a)	$x=1:\ y=-5+4=-1,\qquad x=2:\ y=-16+2=-14$	B1 B1
	$PQ=\sqrt{(2-1)^2+(-14-(-1))^2}=\sqrt{170}$ (*)	M1 A1cso
		(4)
(b)	$y=x^3-6x^2+4x^{-1}$	M1
	$\frac{dy}{dx}=3x^2-12x-4x^{-2}$	M1 A1
	$x=1:\ \frac{dy}{dx}=3-12-4=-13$	M1
	$x=2:\ \frac{dy}{dx}=12-24-1=-13$ $\therefore$ Parallel	A1
		(5)
(c)	Finding gradient of normal $\left(m=\frac{1}{13}\right)$	M1
	$y--1=\frac{1}{13}(x-1)$	M1 A1ft
	$\underline{x-13y-14=0}$ o.e.	A1cso
		(4)
		[13]

Examiner reports

Question 1

Full marks were scored by the majority of candidates. Wrong methods involved the use of an incorrect multiplier; for example (√5 – 1)/(√5 – 1), (√5 – 1)/(√5 + 1) and (7 – √5)/√5 + 1) were all seen. There were also problems in calculating the denominator (6 was a common answer). Some candidates failed to understand how to cancel through the 4 from the denominator, cancelling only one term in the numerator; e.g. (12 + 8√5)/4 became 3 + 8√5 or 12 + 2√5. Errors were also seen in multiplying out the numerator and not all candidates found four terms. Arithmetical errors led to 7 + 5 = 11 or 13 and 7√5 + √5 = 6√5.

Question 2

In part (a) differentiation was completed successfully by most candidates. A common error was not dealing correctly with the negative power. Other slips included $+-3x^{-4}$ not being simplified to $-3x^{-4}$, and a constant of *integration* being included in the answer.

Most of the integrations were also correct in part (b) although fewer gained full marks in this part than in part (a) due to problems with the final simplification. The most common errors were forgetting the constant of integration, not simplifying the coefficient $\frac{2}{6}$ to $\frac{1}{3}$ and not resolving the $+-\frac{1}{2}x^{-2}$ to a single – sign.

The term 7 integrating to $7x$ was missed out entirely on quite a few occasions. Candidates who went straight to a simplified form often incurred errors, while those who wrote down the unsimplified form first were often more successful. It was surprisingly common to see candidates integrating the result of part (a) instead of integrating the original expression.

Question 3

On the whole part (a) was well answered, with almost all candidates going straight to $2^5 = 32$. A few attempted 8^5 first, but even when this was evaluated correctly, further progress was rare. Some candidates evaluated 2^5 incorrectly, usually reaching either 64 or 10.

In part (b), failure to apply the power to both elements of the numerator was common. The majority of candidates could score the first mark for 2^3 or $x^{\frac{3}{2}}$ but it was relatively rare to see both correct. Most of these candidates then continued to both divide their coefficients and subtract their powers of x thereby gaining the next mark but as relatively few got the numerator correct, the final mark evaded many.

Common errors in the numerator were $8x^{\frac{7}{2}}$ leading to a final answer of $2x^{\frac{3}{2}}$ and $8x^{\frac{1}{8}}$ leading to a final answer of $2x^{-\frac{15}{8}}$. Some candidates wrote the fraction as $8x^{\frac{3}{2}}(4x^{-2})$ and proceeded to multiply 8 by 4, forgetting that the 4 should also have a power of -1.

Question 4

In part (a), most candidates came up with $6k$, but quite a few stopped at $k(4 + 2)$ or $4k + 2k$ but scored the mark for the unsimplified form. Common incorrect answers were $8k$ and $4k + 2$. Some candidates used 2 instead of 4 as the first value.

Generally part (b) was answered well. The most common error here was to restart using $a_1 = 2$. Several candidates found the correct sum of terms, but equated to zero instead of 2. A surprising number of candidates achieved the correct 3TQ, factorised this correctly, but failed to solve it correctly. A common incorrect answer here was $+\frac{1}{3}$. Attempts to apply an Arithmetic Progression sum formula were seen but were less common than in previous series.

Question 5

There were many good solutions to both parts of this question. In part (a) most candidates translated the curve parallel to the *x*-axis, although occasionally the translation was of $+3$ rather than -3 units, taking the curve "to the right". A common mistake in part (b) was to sketch $y = -\mathrm{f}(x)$ instead of $y = \mathrm{f}(-x)$, reflecting in the *x*-axis instead of the *y*-axis.

Just a few candidates failed to show the coordinates of the turning points or intersections with the *x*-axis, or carelessly omitted a minus sign from a coordinate.

Question 6

There were many excellent, well presented solutions with 55% gaining full marks. The majority gained full marks for (a) using the S_n formula. The formula was not always stated and candidates should take care to show sufficient method in ‘show that’ questions. A minority worked from first principles, writing out all of the terms and adding them but did not get the credit if they missed out terms.

Common incorrect equations seen in (b) were: $6a + 15d = 17$ (from finding the sum of 6 terms), $a + 16d = 17$ and $a + 6d = 17$. In some cases, 17 and $(a + 5d)$ were seen but not equated.

In part (c), the elimination method was favoured, but some careless arithmetical errors were made. Sometimes $\frac{8}{5}$ was changed to an incorrect decimal, e.g. 1.4, which meant that their value for *a* was incorrect (if they found *d* first). There were several algebraic mistakes in part (c), such as $5d = 8$ then $d = \frac{5}{8}$.

A few candidates omitted to calculate a second variable.

Question 7

Generally this question proved to be accessible to all candidates and they processed the information that was given in context well. Candidates demonstrated the appropriate formulae effectively and were able to apply them successfully. The majority of candidates gained full marks in Q7(a) and Q7(b) although Q7(c) was more challenging.

The vast majority of candidates used the *n*th term formula correctly in Q7(a). A minority substituted a first term of 160 rather than using 140 and there were a few who made errors in the processing of 19×20, with answers such as 180 and 360 emerging. Some listed all 20 terms in order to find the 20th term.

In Q7(b) the majority of candidates quoted and applied the sum of *n* terms formula correctly. It was easier to use the formula $S_n = \frac{n}{2}(a + l)$ with their answer to Q7(a) as l, but the other formula worked well too. The calculation of the correct expression $\frac{20}{2} \times 660$ sometimes resulted in a wrong answer. A few candidates listed the 20 terms and added them, sometimes successfully, though this was time consuming.

For Q7(c) the easier method was to use the formula $S_n = \frac{n}{2}(a + 1)$, as this led directly to the answer. Those who tried to combine both $S = \frac{1}{2}n(2a + (n - 1)d)$ and $l = a + (n - 1)d$ needed to eliminate d, to make progress. Many mistakenly thought that d was 400 or 700. There were some elegant solutions obtained by substituting $(n - 1)d = 400$ and there were some lengthy solutions which led to a quadratic yielding 2 solutions (1 and 17).

In many solutions errors were seen at the final stage of the arithmetic when the correct $8500 = \frac{n}{2}(300 + 700)$ was followed by a wrong answer. This answer was sometimes the fraction $n = 4\frac{1}{4}$ instead of the correct $n = 17$ with many candidates dividing by 2 instead of multiplying by 2, when making n subject of the formula.

Question 8

Part (a) was done well with many candidates gaining full marks. The most common mistake was stretching the curve by a scale factor 2 in the x direction rather than scale factor $\frac{1}{2}$. The other less common mistake was not putting on the graph the coordinates of the minimum point.

Many candidates scored full marks for part (b). The most common mistake was reflecting the curve in the y-axis instead of the x-axis. Others rotated the graph about the origin through 180° and again some candidates did not put down the coordinates of their turning point.

Fewer candidates scored full marks for part (c), than for part (a) or part (b). Many put in numerical values for p, normally 1, or 2, or both, scoring the first two marks for the correct shape and position of the curve. Some used $p = 3$ (not in the given range) and did not gain credit.

Most candidates translated the curve correctly to the left although a few translated the curve to the right or even up or down. A sizeable minority obtained the correct coordinates in terms of p. There were a number of candidates who tried to describe the family of curves and sketched the upper and lower boundary curves. They usually had difficulty explaining their answer clearly and often gained a single mark here as they rarely gave the coordinates of the turning point nor the points where the curves crossed the x-axis.

Question 9

Part (a) was often answered correctly but some quoted $a + 29d$ but failed to use the value of 40.75 to form an equation. Most scored well in part (b) but some failed to give sufficient working to earn both marks in this "show that" question. A successful solution requires the candidates to show us clearly their starting point (which formula they are using) and then the values of any variables in this formula. Those using $\frac{n}{2}(a+l)$ in particular needed to make it clear what value of n they were using. Candidates might also consider that a two mark question will usually require 2 steps of working to secure the marks.

Many students had a correct strategy for finding a and d but not always a sensible strategy for doing so without a calculator. Starting from the given equation in part (b) the "sensible" approach is to divide both sides by 15 and then subtract 40.75 even this though proved challenging for some with errors such as $\frac{1005}{15} = 61$ and $67 - 40.75 = 27.25$ spoiling a promising solution. Those who chose the more difficult expansion of the bracket in part (b) often got lost in the ensuing arithmetic. A number of candidates failed to spot that $\frac{14.5}{29} = \frac{1}{2}$ and lost the final mark.

It was encouraging though to see most candidates using the given formulae to try and solve this problem; there were very few attempting a trial and improvement or listing approach.

Question 10

A number of candidates did not attempt this question or only tackled part of it. In part (a) the y-coordinates were usually correct and the distance formula was often quoted and usually used correctly to obtain PQ, although some drew a diagram and used Pythagoras' theorem. Most of the attempts at part (b) gained the first two method marks but the negative index was not handled well and errors in the derivative were sometimes seen. Those with a correct derivative were usually able to establish the result in part (b). Some candidates thought that they needed to find the equations of the tangents at P and Q in order to show that the tangents were parallel and this wasted valuable time. It was unfortunate that the gradient of PQ was also equal to – 13 and a number of candidates did not attempt to use any calculus but simply used this gradient to find the tangents and tackle part (c). Errors in the arithmetic sometimes led to the abandonment of the question at this point which was a pity as some marks could have been earned in part (c). Those who did attempt part (c) were usually aware of the perpendicular gradient rule and used it correctly to find the equation of the normal at P. Mistakes in rearranging the equation sometimes led to the loss of the final mark but there were a good number of fully correct solutions to this part and indeed the question as a whole.

Statistics for C1 Practice Paper Silver Level S1

Qu	Max score	Modal score	Mean %	Mean score for students achieving grade: ALL	A*	A	B	C	D	E	U
1	4		89	3.54	3.95	3.95	3.84	3.76	3.66	3.51	2.77
2	7		86	5.99	6.90	6.76	6.56	6.39	6.12	5.79	4.42
3	5		80	3.98	4.9	4.74	4.48	4.24	3.95	3.69	2.85
4	7		81	5.67	6.93	6.89	6.64	6.38	5.97	5.41	3.30
5	6		80	4.79		5.69	5.25	4.90	4.44	3.98	2.71
6	7		74	5.16	6.93	6.85	6.68	6.39	5.67	5.15	3.46
7	8		77	6.17	7.92	7.55	6.78	6.42	6.06	5.43	4.47
8	10		68	6.82	9.69	8.94	8.05	7.21	6.52	5.75	4.06
9	8		66	5.28	7.63	7.25	6.44	5.70	4.93	4.15	2.42
10	13		64	8.32		12.48	11.38	9.65	7.32	5.09	2.00
	75		**74**	**55.72**		**71.10**	**66.10**	**61.04**	**54.64**	**47.95**	**32.46**