Paper Reference(s)

6663/01

Edexcel GCE

Core Mathematics C1

Silver Level S2

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 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	64	57	50	44	38

1. Factorise fully $25x - 9x^3$.

(3)

May 2014 (R)

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

(*a*) $\frac{dy}{dx}$,

(3)

(*b*) $\int y \; dx$.

(4)

May 2011

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3. (*a*) Evaluate $81^{\frac{3}{2}}$

(2)

(*b*) Simplify fully $x^2\left(4x^{-\frac{1}{2}}\right)^2$

(2)

May 2014 (R)

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4. A sequence $u_1, u_2, u_3, \ldots$, satisfies

$$u_{n+1} = 2u_n - 1, \quad n \geq 1.$$

Given that $u_2 = 9$,

(*a*) find the value of u_3 and the value of u_4,

(2)

(*b*) evaluate $\sum_{r=1}^{4} u_r$.

(3)

Jan 2013

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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)

Jan 2008

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6. 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)

Jan 2013

7.

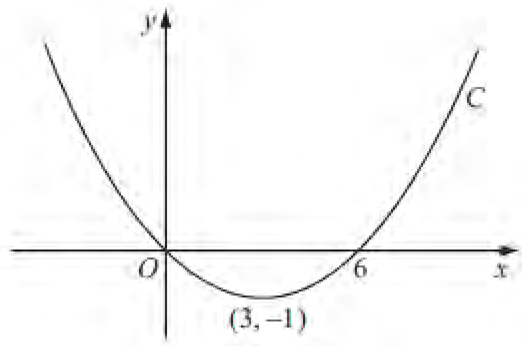

Figure 1

Figure 1 shows a sketch of the curve C with equation $y = \mathrm{f}(x)$.
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*) $y = \mathrm{f}(2x)$,
(3)

(*b*) $y = -\mathrm{f}(x)$,
(3)

(*c*) $y = \mathrm{f}(x + p)$, 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

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8. The line L_1 has equation $2y - 3x - k = 0$, where k is a constant.

Given that the point $A(1, 4)$ lies on L_1, find

(*a*) the value of k,

(1)

(*b*) the gradient of L_1.

(2)

The line L_2 passes through A and is perpendicular to L_1.

(*c*) Find an equation of L_2 giving your answer in the form $ax + by + c = 0$, where a, b and c are integers.

(4)

The line L_2 crosses the x-axis at the point B.

(*d*) Find the coordinates of B.

(2)

(*e*) Find the exact length of AB.

(2)

Jan 2011

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9. 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)

Jan 2008

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10. The line l_1 has equation $y = 3x + 2$ and the line l_2 has equation $3x + 2y - 8 = 0$.

(*a*) Find the gradient of the line l_2.

(2)

The point of intersection of l_1 and l_2 is *P*.

(*b*) Find the coordinates of *P*.

(3)

The lines l_1 and l_2 cross the line $y = 1$ at the points *A* and *B* respectively.

(*c*) Find the area of triangle *ABP*.

(4)

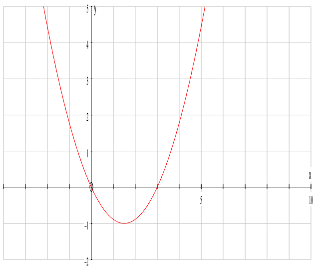
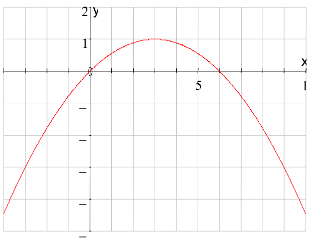
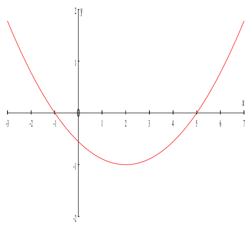
May 2007

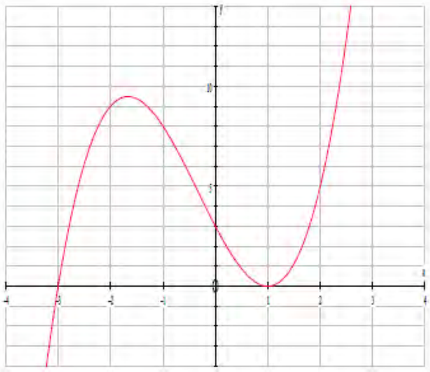
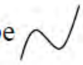
TOTAL FOR PAPER: 75 MARKS

END

Question Number	Scheme		Marks
1.	$25x-9x^3 = x(25-9x^2)$		B1
	$(25-9x^2)$=(5+3x)(5-3x)		M1
	$25x-9x^3 = x(5+3x)(5-3x)$		A1
			[3]
2 (a)	$\frac{dy}{dx} = 10x^4 - 3x^{-4}$ or $10x^4 - \frac{3}{x^4}$		M1 A1 A1
			(3)
(b)	$\left(\int =\right) \frac{2x^6}{6} + 7x + \frac{x^{-2}}{-2} = \frac{x^6}{3} + 7x - \frac{x^{-2}}{2}$		M1 A1 A1
	$+C$		B1
			(4)
			[7]
3(a)	$81^{\frac{3}{2}} = (81^{\frac{1}{2}})^3 = 9^3$ or $81^{\frac{3}{2}} = (81^3)^{\frac{1}{2}} = (531441)^{\frac{1}{2}}$		M1
	=729		A1
			(2)
(b)	$(4x^{-\frac{1}{2}})^2 = 16x^{-\frac{2}{2}}$ or $\frac{16}{x}$ or equivalent		M1
	$x^2(4x^{-\frac{1}{2}})^2 = 16x$		A1
			(2)
			[4]
4 (a)	$u_2 = 9,\ u_{n+1} = 2u_n - 1,\ n \ldots 1$		
	$u_3 = 2u_2 - 1 = 2(9) - 1 \quad (=17)$	$u_3 = 2(9) - 1.$	M1
	$u_4 = 2u_3 - 1 = 2(17) - 1 = 33$	Can be implied by $u_3 = 17$	
	Both $u_3 = 17$ and $u_4 = 33$		A1
			(2)
(b)	$\sum_{r=1}^{4} u_r = u_1 + u_2 + u_3 + u_4$		
	$(u_1) = 5$	$(u_1) = 5$	B1
	$\sum_{r=1}^{4} u_r = "5" + 9 + "17" + "33" = 6$	Adds their first four terms obtained legitimately (see notes below)	M1
		64	A1
			(3)
			[5]

Question Number	Scheme	Marks
5 (a)	$\left(2x^{-\frac{1}{2}} + 3x^{-1}\right)$ $\quad p = -\frac{1}{2}, \quad q = -1$	B1 B1
		(2)
(b)	$\left(y = 5x - 7 + 2x^{-\frac{1}{2}} + 3x^{-1}\right)$	
	$\left(\frac{dy}{dx} = \right)$ $\quad 5 \quad (\text{or } 5x^0)$ $\quad$ ($5x - 7$ correctly differentiated)	B1
	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} $(k \neq 0)$.	M1
	$\left(-\frac{1}{2} \times 2x^{-\frac{3}{2}} - 1 \times 3x^{-2} = \right)$ $\quad -x^{-\frac{3}{2}}, \; -3x^{-2}$	A1ft A1ft
		(4) [6]
6	Lewis; arithmetic series, $a = 140$, $d = 20$.	
(a)	$T_{20} = 140 + (20 - 1)(20); = 520$ OR $120 + (20)(20)$ Or lists 20 terms to get to 520	M1 A1
		(2)
(b)	Method 1 **Either:** Uses $\frac{1}{2}n(2a + (n-1)d)$ / Method 2 **Or:** Uses $\frac{1}{2}n(a + l)$	M1
	$\frac{20}{2}(2 \times 140 + (20 - 1)(20))$ / $\frac{20}{2}(140 + \text{"520"})$ ft 520	A1
	6600	A1
		(3)
(c)	Sian; arithmetic series, $a = 300$, $l = 700$, $S_n = 8500$	
	Either: Attempt to use $8500 = \frac{n}{2}(a + l)$ / **Or:** May use both $8500 = \frac{1}{2}n(2a + (n-1)d)$ and $l = a + (n-1)d$ **and eliminate** d	M1
	$8500 = \frac{n}{2}(300 + 700)$ / $8500 = \frac{n}{2}(600 + 400)$	A1
	$\Rightarrow n = 17$	A1
		(3) [8]

Question Number	Scheme	Marks
7 (a)		
	Shape ∪ through (0, 0)	B1
	(3, 0)	B1
	(1.5, −1)	B1 **(3)**
(b)		
	Shape ∩	B1
	(0, 0) and (6, 0)	B1
	(3, 1)	B1 **(3)**
(c)		
	Shape ∪ , not through (0, 0)	M1
	Minimum in 4th quadrant	A1
	(−p, 0) and (6 − p, 0)	B1
	(3 − p, −1)	B1 **(4)** **[10]**
8 (a)	(8 – 3 – k) = 0) so $k = 5$	B1 **(1)**
(b)	$2y = 3x + k$	M1
	$y = \frac{3}{2}x + \ldots$ and so $m = \frac{3}{2}$ o.e.	A1 **(2)**
(c)	Perpendicular gradient $= -\frac{2}{3}$	B1ft
	Equation of line is: $y - 4 = -\frac{2}{3}(x-1)$	M1A1ft
	$\underline{3y + 2x - 14 = 0}$ o.e.	A1 **(4)**
(d)	$y = 0, \Rightarrow B(7,0)$ or $\underline{x = 7}$ $x = 7$ or $-\frac{c}{a}$	M1A1ft **(2)**
(e)	$AB^2 = (7-1)^2 + (4-0)^2$	M1
	$AB = \sqrt{52}$ or $2\sqrt{13}$	A1 **(2)** **[11]**

Question Number	Scheme	Marks
9 (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)	$y = (x+3)(x^2 - 2x + 1)$	M1
	$= x^3 + x^2 - 5x + 3$ $(k = 3)$ [Marks can be awarded if this is seen in part (a)]	A1 cso
		(2)
(c)	$\dfrac{dy}{dx} = 3x^2 + 2x - 5$	M1 A1
	$3x^2 + 2x - 5 = 3$ or $3x^2 + 2x - 8 = 0$	M1
	$(3x-4)(x+2) = 0$ $x = \ldots$	M1
	$x = \dfrac{4}{3}$ (or exact equiv.) , $x = -2$	A1 A1
		(6) **[12]**
10 (a)	$y = -\dfrac{3}{2}x(+4)$ Gradient $= -\dfrac{3}{2}$	M1 A1
		(2)
(b)	$3x + 2 = -\dfrac{3}{2}x + 4$ $x = \ldots, \dfrac{4}{9}$	M1 A1
	$y = 3\left(\dfrac{4}{9}\right) + 2 = \dfrac{10}{3}$ $\left(= 3\dfrac{1}{3}\right)$	A1
		(3)
(c)	Where $y = 1$, $l_1 : x_A = -\dfrac{1}{3}$ $l_2 : x_B = 2$ M: Attempt one of these	M1 A1
	Area $= \dfrac{1}{2}(x_B - x_A)(y_P - 1)$	M1
	$= \dfrac{1}{2} \times \dfrac{7}{3} \times \dfrac{7}{3} = \dfrac{49}{18} = 2\dfrac{13}{18}$ o.e.	A1
		(4) **[9]**

Examiner reports

Question 1
This question was generally very well answered. Most gave the answer in the form given in the main scheme. Some students only took out the *x* term then stopped and others lost two marks as their first line was $x(9x^2 - 25)$ with wrong signs. It was very unusual to see anyone misunderstanding the instruction to factorise and continuing their answer by 'solving' to $x = \ldots$. This was a good opening question.

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 7*x* 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
This question was generally done well. In part (a) the common mistakes were not evaluating 9^3 or 3^6 or incorrectly evaluating 9^3. Some evaluated 81^3 first, then struggled to find the square root on this non calculator examination.
In part (b) some stated incorrectly that $\left(x^{-0.5}\right)^2 = x^{1.5}$ or that $16x^{-1} = \frac{1}{16x}$.

Others stated that $\left(x^{-0.5}\right)^2 = x^{0.25}$ or $x^{0.25}$. Another common error was not squaring the 4 at the start of the bracket and only dealing with the *x* term.

Question 4

Errors in Q4(a) were few and there was good understanding of what was required here. Any mistakes that were made were usually arithmetic errors when finding u_4, e.g. 2 × 17 = 36 and then 36 – 1 = 35 or u_4 = 2 × 17 – 1 = 34.

There were few conceptual errors and it was very rare to find that this question was not attempted.

In Q4(b) candidates knew that they needed a value for u_1. The method mark was for an attempt to use $u_2 = 2u_1 - 1$ in order to find u_1 together with an attempt to add their first four terms. Some candidates, instead, correctly worked out that u_1 = 5 by working backwards through the pattern of differences that was generated between the terms and then proceeded to answer the question.

A fairly frequent wrong assumption was that u_1= 1, or that $u_1 = 2u_0 - 1 = 2 \times 0 - 1 = -1$.

Most candidates understood that the notation meant that they needed to find a sum. However some tried to use formulae for sum of an arithmetic series, sometimes after finding u_1 correctly, and in some cases even after writing out a correct sum of the four terms. A minority of candidates restarted in Q4(b); leading to adding terms of for example 1, 3, 5 and 7. There were also unfortunately some errors in the arithmetic by those who listed the sum correctly as 5 + 9 + 17 + 33, most commonly leading to an answer of 54, rather than 64.

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

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 nth 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 7

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 8

Part (a) was done well by the majority of candidates. Most were able to obtain $k = 5$ after the substitution of the coordinates for A.

To find the gradient in part (b) most candidates realised that they needed to rearrange the equation of the line into the form $y = mx + c$, and the vast majority were able to do this accurately, with only a few getting mixed up with signs. Unsurprisingly, those candidates that attempted differentiation on the given equation without first rearranging to $y = mx + c$ were generally unsuccessful in determining the gradient. A significant number of candidates found a second point on the line and used the two points to find the gradient. Many candidates gave their answer as 1.5 which sometimes caused them problems when finding the negative reciprocal in part (c). Common incorrect gradients were 3 and $\frac{3x}{2}$.

Part (c) was done quite well. Most candidates were able to write down an expression for the negative reciprocal. It was pleasing to see so many of them writing down the correct form, i.e. $\frac{1}{m}$ before attempting to work it out. The most common error here was the 'half remembered' negative reciprocal leading to $\frac{2}{3}$ or $-\frac{3}{2}$. Many of the candidates who failed to obtain the correct gradient in part (b) were able to score the majority of the marks here. Most candidates were able to use the negative reciprocal gradient to write down an expression for equation of L_2. Methods of approach were roughly equally divided between those using $y - y_1 = m(x - x_1)$ and $y = mx + c$. Those using the former method were generally more successful in scoring the first accuracy mark. Only the better candidates were able to simplify their equation into the correct form.

In part (d), many candidates were able to substitute $y = 0$ into their equation to find the coordinates of B. By far the most common mistake (from about 20% of the candidates) was to substitute $x = 0$ into their equation. The next most common error here was to substitute $y = 0$ correctly but then not being able to solve their equation for x.

In part (e), it was pleasing to see so many candidates able to make a good attempt at finding the distance between the points A and B. Many drew diagrams and many quoted the formula. Relatively few candidates this session got mixed up when determining the differences in the x values and the differences in the y values. However, candidates should still be advised to draw a diagram or to quote the formula before attempting to work out the differences. The correct answer of $\sqrt{52}$ was frequently seen with 38% of candidates scoring full marks on this question.

Question 9

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 10

The most popular approach to part (a) was to rearrange the equation into the form $y = mx + c$ and this quickly gave them the gradient of – 1.5. The examiners were only interested in the value of m for the accuracy mark which was fortunate for some as errors in finding c were quite frequent, these were usually penalised in part (b). Some tried differentiating for part (a), with mixed success, and others found two points on the line and used the gradient formula.

Part (b) was a straightforward 3 marks for many candidates but a large number lost out due to errors in rearranging their equation in part (a) or simply trying to solve a simple linear equation. A more serious error, that was seen quite often, was to equate the two equations as $3x + 2 = 3x + 2y - 8$. In part (c) the x-coordinates of A and B were usually found correctly although sign errors or poor division spoilt some attempts. The area of the triangle once again caused many problems. Some candidates drew a simple diagram which was clearly a great help but the usual crop of errors were seen. Assuming that angle APB was a right angle and finding AP and PB was quite common. Others used AB as the base, as intended, but thought that the height of the triangle went from the midpoint of AB to P. Some were nearly correct but failed to subtract 1 from the y-coordinate of P. Those who were successful sometimes split the triangle into two using a vertical line through P and thus made the arithmetic more difficult.

Statistics for C1 Practice Paper Silver Level S2

Qu	Max score	Modal score	Mean %	Mean score for students achieving grade: ALL	A*	A	B	C	D	E	U
1	3		89.7	2.69	3.00	2.93	2.80	2.66	2.56	2.26	1.70
2	7		86	5.99	6.90	6.76	6.56	6.39	6.12	5.79	4.42
3	4		84.8	3.39	3.87	3.77	3.31	3.22	3.27	2.97	2.27
4	5	5	79	3.95	5.00	4.65	4.34	3.94	3.73	3.36	2.53
5	6		80	4.81		5.94	5.73	5.53	5.32	4.72	3.24
6	8	8	77	6.17	7.92	7.55	6.78	6.42	6.06	5.43	4.47
7	10		68	6.82	9.69	8.94	8.05	7.21	6.52	5.75	4.06
8	11		73	8.07	10.89	10.70	10.22	9.62	8.59	7.34	4.49
9	12		67	7.99		11.59	10.82	9.81	8.37	6.29	3.74
10	9		61	5.50		7.99	6.87	5.98	4.94	3.91	1.95
	75		**73.84**	**55.38**	**47.27**	**70.82**	**65.48**	**60.78**	**55.48**	**47.82**	**32.87**