Paper Reference(s)

6663/01

Edexcel GCE

Core Mathematics C1
Silver Level S3

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 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
68	60	52	44	37	30

1. Write

$$\sqrt{(75)} - \sqrt{(27)}$$

in the form $k\sqrt{x}$, where k and x are integers.

(2)

May 2010

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2. (*a*) Simplify

$$\sqrt{32} + \sqrt{18},$$

giving your answer in the form $a\sqrt{2}$, where a is an integer.

(2)

(*b*) Simplify

$$\frac{\sqrt{32} + \sqrt{18}}{3 + \sqrt{2}},$$

giving your answer in the form $b\sqrt{2} + c$, where b and c are integers.

(4)

January 2012

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3. Find

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

giving each term in its simplest form.

(4)

May 2013 (R)

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4. The point $A(-6, 4)$ and the point $B(8, -3)$ lie on the line L.

(*a*) Find an equation for L in the form $ax + by + c = 0$, where a, b and c are integers.

(4)

(*b*) Find the distance AB, giving your answer in the form $k\sqrt{5}$, where k is an integer.

(3)

January 2008

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5. The line l_1 has equation $y = -2x + 3$.

The line l_2 is perpendicular to l_1 and passes through the point (5, 6).

(*a*) Find an equation for l_2 in the form $ax + by + c = 0$, where a, b and c are integers.

(3)

The line l_2 crosses the x-axis at the point A and the y-axis at the point B.

(*b*) Find the x-coordinate of A and the y-coordinate of B.

(2)

Given that O is the origin,

(*c*) find the area of the triangle OAB.

(2)

January 2013

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6. The curve C has equation

$$y = \frac{(x+3)(x-8)}{x}, \quad x > 0.$$

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

(4)

(*b*) Find an equation of the tangent to C at the point where $x = 2$.

(4)

January 2010

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7. A sequence is given by

$$x_1 = 1,$$

$$x_{n+1} = x_n(p + x_n),$$

where p is a constant ($p \neq 0$).

(*a*) Find x_2 in terms of p.

(1)

(*b*) Show that $x_3 = 1 + 3p + 2p^2$.

(2)

Given that $x_3 = 1$,

(*c*) find the value of p,

(3)

(*d*) write down the value of x_{2008}.

(2)

January 2008

8.

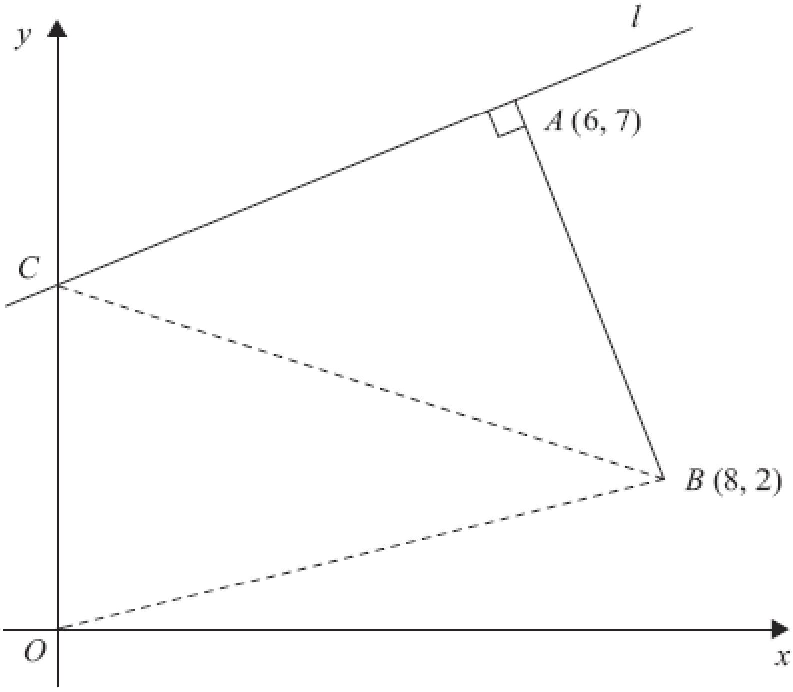

Figure 1

The points A and B have coordinates (6, 7) and (8, 2) respectively.

The line l passes through the point A and is perpendicular to the line AB, as shown in Figure 1.

(a) Find an equation for l in the form $ax + by + c = 0$, where a, b and c are integers.

(4)

Given that l intersects the y-axis at the point C, find

(b) the coordinates of C,

(2)

(c) the area of ΔOCB, where O is the origin.

(2)

June 2009

9. A company offers two salary schemes for a 10-year period, Year 1 to Year 10 inclusive.

Scheme 1: Salary in Year 1 is £P.
Salary increases by £($2T$) each year, forming an arithmetic sequence.

Scheme 2: Salary in Year 1 is £(P + 1800).
Salary increases by £T each year, forming an arithmetic sequence.

(*a*) Show that the total earned under Salary Scheme 1 for the 10-year period is

$$£(10P + 90T).$$

(2)

For the 10-year period, the total earned is the same for both salary schemes.

(*b*) Find the value of T.

(4)

For this value of T, the salary in Year 10 under Salary Scheme 2 is £29 850.

(*c*) Find the value of P.

(3)

January 2012

10.

$$4x^2 + 8x + 3 \equiv a(x + b)^2 + c.$$

(*a*) Find the values of the constants a, b and c.

(3)

(*b*) Sketch the curve with equation $y = 4x^2 + 8x + 3$, showing clearly the coordinates of any points where the curve crosses the coordinate axes.

(4)

January 2013

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11. 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

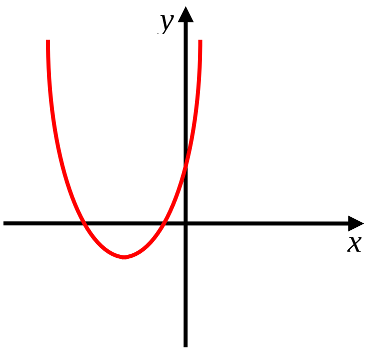
TOTAL FOR PAPER: 75 MARKS

END

Question Number	Scheme	Marks
1.	$\left(\sqrt{75}-\sqrt{27}\right)=5\sqrt{3}-3\sqrt{3}$	M1
	$=2\sqrt{3}$	A1
		[2]
2. (a)	$\sqrt{32}=4\sqrt{2}$ or $\sqrt{18}=3\sqrt{2}$	B1
	$\left(\sqrt{32}+\sqrt{18}=\right)$ $\underline{7\sqrt{2}}$	B1 (2)
(b)	$\times\dfrac{3-\sqrt{2}}{3-\sqrt{2}}$ <u>or</u> $\times\dfrac{-3+\sqrt{2}}{-3+\sqrt{2}}$ seen	M1
	$\left[\dfrac{\sqrt{32}+\sqrt{18}}{3+\sqrt{2}}\times\dfrac{3-\sqrt{2}}{3-\sqrt{2}}=\right]$ $\dfrac{a\sqrt{2}\left(3-\sqrt{2}\right)}{[9-2]}$ $\rightarrow$ $\dfrac{3a\sqrt{2}-2a}{[9-2]}$ (or better)	M1
	$=\underline{3\sqrt{2},-2}$	A1, A1
		(4)
		[6]
3.	$\int 3x^2-\dfrac{4}{x^2}\mathrm{d}x=3\dfrac{x^3}{3}-4\dfrac{x^{-1}}{-1}$	M1,A1, A1
	$=x^3+\dfrac{4}{x}+c$ or $x^3+4x^{-1}+c$	A1
		[4]
4. (a)	$m=\dfrac{4-(-3)}{-6-8}$ or $\dfrac{-3-4}{8-(-6)}$ $=\dfrac{7}{-14}$ or $\dfrac{-7}{14}$ $\left(=-\dfrac{1}{2}\right)$	M1, A1
	Equation: $y-4=-\dfrac{1}{2}(x-(-6))$ or $y-(-3)=-\dfrac{1}{2}(x-8)$	M1
	$x+2y-2=0$	A1
		(4)
(b)	$(-6-8)^2+(4-(-3))^2$	M1
	14^2+7^2 or $(-14)^2+7^2$ or $14^2+(-7)^2$	A1
	$AB=\sqrt{14^2+7^2}$ or $\sqrt{7^2(2^2+1^2)}$ or $\sqrt{245}$	
	$7\sqrt{5}$	A1 cso
		(3)
		[7]

Question Number	Scheme	Marks
5. (a)	Gradient of l_2 is $\frac{1}{2}$ or 0.5 or $\frac{-1}{-2}$	B1
	Either $y-6="\tfrac{1}{2}"(x-5)$	
	or $y="\tfrac{1}{2}"x+c$ and $6="\tfrac{1}{2}"(5)+c \Rightarrow c=("\tfrac{7}{2}")$.	M1
	$x-2y+7=0$ or $-x+2y-7=0$	
	or $k(x-2y+7)=0$ with ***k* an integer**	A1
		(3)
(b)	Puts $x = 0$, or $y = 0$ in **their** equation and solves to find appropriate co-ordinate	M1
	x-coordinate of A is -7 and y-coordinate of B is $\frac{7}{2}$.	A1 cao
		(2)
(c)	Area $OAB=\frac{1}{2}(7)\left(\frac{7}{2}\right)=\frac{49}{4}$ (units)^2	M1
	$\frac{49}{4}$	A1 cso
		(2) **[7]**
6.	(a) $y=\dfrac{x^2-5x-24}{x}=x-5-24x^{-1}$ (oe, e.g. $x+3-8-\dfrac{24}{x}$)	M1 A1
	$\dfrac{dy}{dx}=1+24x^{-2}$ or $\dfrac{dy}{dx}=1+\dfrac{24}{x^2}$	M1 A1
		(4)
	(b) $x=2$: $y=-15$	B1
	$\left(\dfrac{dy}{dx}=\right)$ $1+\dfrac{24}{4}=7$	B1ft
	$y+15=7(x-2)$ (or equiv., e.g. $y=7x-29$)	
	Allow $\dfrac{y+15}{x-2}=7$	M1 A1
		(4) **[8]**

Question Number	Scheme	Marks
7. (a)	$1(p+1)$ or $p+1$	B1
		(1)
(b)	$((a))(p+(a))$ [(a) must be a function of p] $[(p+1)(p+p+1)]$	M1
	$= 1 + 3p + 2p^2$	A1 cso
		(2)
(c)	$1 + 3p + 2p^2 = 1$	M1
	$p(2p+3) = 0$ $p = \ldots$	M1
	$p = -\frac{3}{2}$	A1
		(3)
(d)	Noting that even terms are the same.	M1
	$x_{2008} = -\frac{1}{2}$	A1
		(2)
		[8]
8. (a)	AB: $m = \frac{2-7}{8-6}$, $\left(= -\frac{5}{2}\right)$	B1
	Using $m_1 m_2 = -1$: $m_2 = \frac{2}{5}$	M1
	$y - 7 = \frac{2}{5}(x-6)$, $2x - 5y + 23 = 0$	M1, A1
	(o.e. with integer coefficients)	
		(4)
(b)	Using $x = 0$ in the answer to (a), $y = \frac{23}{5}$ or 4.6	M1 A1ft
		(2)
(c)	Area of triangle = $\frac{1}{2} \times 8 \times \frac{23}{5} = \frac{92}{5}$ (o.e) e.g. $\left(18\frac{2}{5},\ 18.4,\ \frac{184}{10}\right)$	M1 A1
		(2)
		[8]

Question Number	Scheme	Marks
9. (a)	$S_{10} = \frac{10}{2}[2P + 9 \times 2T]$ <u>or</u> $\frac{10}{2}(P + [P + 18T])$	M1
	e.g. $5[2P + 18T]$ $= (£)\ (10P + 90T)$ <u>or</u> $(£)\ 10P + 90T$ **(*)**	A1cso
		(2)
(b)	Scheme 2: $S_{10} = \frac{10}{2}[2(P + 1800) + 9T] = \{10P + 18000 + 45T\}$	M1A1
	$10P + 90T = 10P + 18000 + 45T$	M1
	$90T = 18000 + 45T$	
	$T = 400$ (only)	A1
		(4)
(c)	Scheme 2, Year 10 salary: $[a + (n-1)d =](P + 1800) + 9T$	B1ft
	$P + 1800 + \text{“}3600\text{”} = 29850$	M1
	$P = (£)$ <u>24450</u>	A1
		(3) **[9]**
10. (a)	This may be done by completion of square or by expansion and comparing coefficients	
	$a = 4$	B1
	$b = 1$	B1
	All three of $a = 4$, $b = 1$ and $c = -1$	B1
		(3)
(b)	 U shaped quadratic graph.	M1
	The curve is correctly positioned with the minimum in the third quadrant. It crosses x axis twice on negative x axis and y axis once on positive y axis.	A1
	Curve cuts y-axis at $(\{0\}, 3)$ only	B1
	Curve cuts x-axis at $(-\frac{3}{2}, \{0\})$ and $(-\frac{1}{2}, \{0\})$.	B1
		(4) **[7]**

Question Number	Scheme	Marks
11. (a)	$y = -\frac{3}{2}x(+4)$ Gradient $= -\frac{3}{2}$	M1 A1
		(2)
(b)	$3x + 2 = -\frac{3}{2}x + 4$ $x = \ldots,\ \underline{\frac{4}{9}}$	M1A1
	$y = 3\left(\frac{4}{9}\right) + 2 = \frac{10}{3}$ $\left(= 3\frac{1}{3}\right)$	A1
		(3)
(c)	Where $y = 1$, $l_1 : x_A = -\frac{1}{3}$ $l_2 : x_B = 2$	M1 A1
	Area $= \frac{1}{2}(x_B - x_A)(y_P - 1)$	M1
	$= \frac{1}{2} \times \frac{7}{3} \times \frac{7}{3} = \frac{49}{18} = 2\frac{13}{18}$ o.e.	A1
		(4)
		[9]

Examiner reports

Question 1

This was a successful starter to the paper with very few candidates failing to attempt it and many securing both marks. The $\sqrt{27}$ was usually written as $3\sqrt{3}$ but $5\sqrt{5}$ and $3\sqrt{5}$ were common errors for $\sqrt{75}$. The most common error though was to subtract 27 from 75 and then try and simplify $\sqrt{48}$ which showed a disappointing lack of understanding.

Question 2

Most candidates answered this question very well, part (a) in particular was often correct. The most common error here was to write $\sqrt{32} + \sqrt{18} = \sqrt{50} = 5\sqrt{2}$ whilst a few found $4\sqrt{2}$ and $3\sqrt{2}$ but couldn't add them together correctly.

In part (b) the majority started well but some failed to use their answer to part (a) and made errors in multiplying out and simplifying $(\sqrt{32} + \sqrt{18})(3 - \sqrt{2})$. Those who used their answer from part (a) usually fared much better but a minority expanded the numerator $7\sqrt{2}(3 - \sqrt{2})$ to get 4 terms, treating the $7\sqrt{2}$ as though it were $7 + \sqrt{2}$. The denominator was usually simplified to 7 although 5 and even 1 were sometimes seen. Sadly, a number who arrived at $\frac{21\sqrt{2}-14}{7}$ were unable to cancel down correctly to reach the required form.

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

In part (a), it was good to see many candidates quoting a formula for the gradient and so earning a method mark even if they made an arithmetic slip. Careless simplification of the gradient, for example $\frac{-7}{14} = -2$, was sometimes seen. Many candidates also quoted and used a correct formula for the equation of the straight line, but the requirement for the final answer to be in the form $ax + by + c = 0$, with integer values of a, b and c, was overlooked by many. Others, particularly those starting with $y = mx + c$, made arithmetic errors and thus lost the final mark.

In part (b), most candidates knew the formula for the distance between two points but it was not always quoted. Despite occasional confusion with minus signs the correct answer was often seen, although there were sometimes mistakes in squaring 14 and problems in simplifying $\sqrt{245}$.

Question 5

Q5 was an accessible question enabling all but the very weakest candidates to attempt full solutions to all three parts. It was pleasing to see the large number of students who were able to achieve full marks for all parts of this coordinate geometry question.

In part (a) the majority identified the correct gradient, with only a small minority getting the sign wrong or using 2 or –2 instead of $\frac{1}{2}$. Most candidates used the equation $(y - y_1) = m(x - x_1)$ to set up the equation of the line and usually obtained a correct un-simplified equation. Candidates who used the $y = mx + c$ method were more likely to make errors. A majority got the equation into the required form, but others did not read the question carefully and omitted this step, or gave non-integer coefficients. For some this was the only mark they lost in this question.

In part (b) most attempted to put $x = 0$ to get y and $y = 0$ to get x and, provided they had got the correct gradient in part (a), they were usually successful. Some solved $x + 7 = 0$ incorrectly getting $x = 7$ for A. A very small number of candidates (usually ones that got part (a) incorrect) substituted $x = 5$ and $y = 6$ into their equation by mistake. There were also instances of answers such as $A = –7$, $B = 3.5$, and in some cases an answer was given which combined the coordinates in the form (–7, 3.5).

In part (c) most drew the triangle on a grid and were then successful in using the correct method to get the area of the triangle even if their answer was not correct. Common errors were in multiplying 7 by 7 and getting 14 or failing to manipulate fractions correctly resulting in an answer of $\frac{49}{2}$. Other common mistakes were in finding the hypotenuse of the triangle rather than the area of the triangle or in having a negative value for the area. A significant number attempted to use the determinant method yet from these; few were successful as the products involving zeros frequently led to errors. It was pleasing to see diagrams drawn to help with part (c).

Question 6

This was a successful question for many candidates, although for some the required division by x in part (a) proved too difficult. Sometimes the numerator was multiplied by x, or x^{-1} was added to the numerator. Occasionally the numerator and denominator were differentiated separately.

In part (b), most candidates substituted $x = 2$ into their $\frac{dy}{dx}$, but in finding the equation of the tangent numerical mistakes were common and there was sometimes confusion between the value of $\frac{dy}{dx}$ and the value of y.

Question 7

Although just a few candidates failed to understand the idea of the recurrence relation, most managed to complete the first two parts successfully. A major concern in part (b), however, was the widespread lack of brackets in the algebraic expressions. It was usually possible for examiners to interpret candidates' intentions generously, but there needs to be a greater awareness that, for example, $1 + p(1 + 2p)$ is not an acceptable alternative to $(1 + p)(1 + 2p)$.

The given answer to part (b) enabled the vast majority of candidates to start part (c) correctly, but the main problem with this part was in solving $2p^2 + 3p = 0$, which proved surprisingly difficult for some. Attempts to complete the square usually failed, while the quadratic formula method, although generally more successful, often suffered from mistakes related to the fact that *c* was zero. Those who did manage to factorise the expression sometimes gave the answer $p = \frac{3}{2}$ instead of $p = -\frac{3}{2}$. It was clear that candidates would have been much happier solving a 3-term quadratic equation. Those who trivialised the question by giving only the zero solution (despite the condition $p > 0$) scored no further marks in the question.

Part (d) proved challenging for many candidates. Some used the solution $p = 0$ and some tried to make use of the sum formula for an arithmetic series. Few candidates were successful, but those who wrote out the first few terms were more likely to spot the 'oscillatory' nature of the sequence. Good candidates stated that even terms were all equal to $-\frac{1}{2}$ and therefore the 2008th term was $-\frac{1}{2}$. Quite a large number of candidates were able to express x_{2008} in terms of x_{2007}, but those who simply substituted 2007 into one of their expressions often wasted time in tedious arithmetic that led to a very large answer.

Question 8

Most candidates had clearly learnt the coordinate geometry formulae and were able to give a correct expression for the gradient of *AB* although some had *x* and *y* the wrong way round. The perpendicular gradient rule was well known too and the majority of candidates used this successfully to find the gradient of *l*. Many went on to find a correct expression for the equation of *l* (although some used the point *B* here instead of *A*) but the final mark in part (a) was often lost as candidates struggled to write their equation in the required form. In part (b) most substituted $x = 0$ into their equation and the examiners followed through their working for the coordinates of *C*, only a few used $y = 0$ here.

Part (c) caused the usual problems and a variety of approaches (many unsuccessful) were tried. Those who identified *OC* as the base and 8 as the height usually had little problem in gaining the marks. Some candidates felt uneasy using a height that wasn't a side of their triangle and split the triangle into two then adding the areas, others used a trapezium minus a triangle or a determinant approach. A few attempted to find *OB* and *BC* using Pythagoras' theorem in the vain hope of using the $\frac{1}{2}ab\sin C$ formula.

Question 9

There were few mistakes in part (a) with nearly 90% of candidates scoring the two marks. A few tried listing the terms and some failed to show sufficient working by simply preceding the printed answer with $10(P + 9T)$ and giving no indication that a correct arithmetic series had been identified and used. Most were able to apply the sum formula to scheme 2 correctly in part (b) however many were careless or omitted one or more brackets so that when they attempted to multiply out their expression they frequently failed to multiply the $9T$ by 5 or the 1800 by 2. Part (c) caused the most problems with many candidates using S_{10} instead of u_{10} and gaining no marks. There were however many fully correct solutions to this question and nearly a quarter of the candidates gained full marks.

Question 10

Many candidates were successful in answering part (a). The favoured method was completion of the square. Most got $a = 4$ and $b = 1$, but in obtaining the answer for c, errors were seen of dividing the correct answer –1 by 4. About a third of responses were completely correct, and others had errors arising from the factor 4, leaving the remainder having other errors. There were far more errors in finding the value for c than in finding the value for b. The most common incorrect answers for b were 4 and 2 and the most common incorrect answers for c were –13, 2 and $-\frac{1}{4}$. Two other methods were far less common than completing the square. These were 'expanding $a(x + b)^2 + c$ and equating coefficients' and 'trial and error'. Many candidates had success with the expansion method.

Part (b) was mostly answered well. The curve was mainly positioned the right way up and in the right place. The quality of graphs could have been better in many cases but few 'V' shapes were seen. Sometimes it was difficult to read the fractional coordinates as the candidates were writing them too small and too near their curve. A few candidates tried to use their answers from part (a) to help them draw the graph in part (b). This was not always successful as many had made errors in part (a) and others did not use the information correctly. Most candidates worked from the equation $y = 4x^2 + 8x + 3$ instead. Few of the answers seen did not include a graph, a very small minority drew an upside down U graph and a minority of candidates drew a cubic curve or a line. Other errors in the graph drawing included having the minimum above the x-axis, or on the x-axis, or on the y-axis. Almost all candidates correctly marked the y-intercept at (0, 3).

Question 11

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 S3

				Mean score for students achieving grade:							
Qu	Max score	Modal score	Mean %	ALL	A*	A	B	C	D	E	U
1	2		81	1.62	1.98	1.91	1.79	1.70	1.59	1.49	1.11
2	6		77	4.60	5.92	5.79	5.35	4.92	4.59	4.14	2.97
3	4		93	3.70	4.00	3.94	3.82	3.75	3.73	3.36	2.88
4	7		74	5.16		6.82	6.40	5.94	5.37	4.67	3.23
5	7		76	5.29	6.89	6.73	6.31	5.95	5.37	4.84	3.08
6	8		64	5.12		7.65	6.99	6.09	4.60	3.96	2.10
7	8		66	5.24		7.59	6.64	5.92	5.46	4.79	3.11
8	8		62	4.96		7.31	6.49	5.64	4.52	3.24	1.33
9	9		61	5.51	8.67	8.05	7.06	6.27	5.48	4.68	2.64
10	7		60	4.22	6.85	6.03	4.89	4.28	3.74	3.32	2.26
11	9		61	5.50		7.99	6.87	5.98	4.94	3.91	1.95
	75		**68**	**50.92**		**69.81**	**62.61**	**56.44**	**49.39**	**42.40**	**26.66**