Paper Reference(s)

6663/01

Edexcel GCE

Core Mathematics C1
Silver Level S5

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 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
68	60	52	44	37	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

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2. (*a*) Find the value of $8^{\frac{4}{3}}$.

(2)

(*b*) Simplify $\dfrac{15x^{\frac{4}{3}}}{3x}$.

(2)

May 2007

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3. Find the set of values of x for which

(*a*) $3x - 7 > 3 - x$,

(2)

(*b*) $x^2 - 9x \leq 36$,

(4)

(*c*) **both** $3x - 7 > 3 - x$ **and** $x^2 - 9x \leq 36$.

(1)

May 2014

4.

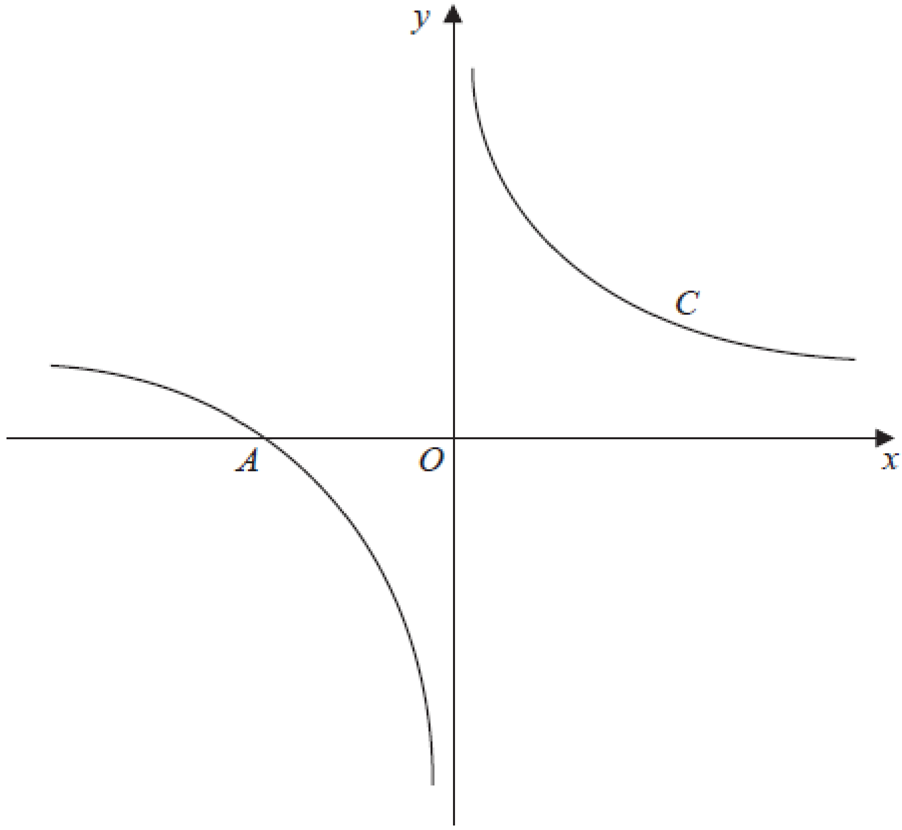

Figure 1

Figure 1 shows a sketch of the curve C with equation

$$y = \frac{1}{x} + 1, \qquad x \neq 0.$$

The curve C crosses the x-axis at the point A.

(a) State the x-coordinate of the point A.

(1)

The curve D has equation $y = x^2(x - 2)$, for all real values of x.

(b) On a copy of Figure 1, sketch a graph of curve D. Show the coordinates of each point where the curve D crosses the coordinate axes.

(3)

(c) Using your sketch, state, giving a reason, the number of real solutions to the equation

$$x^2(x - 2) = \frac{1}{x} + 1.$$

(1)

May 2014

5. A sequence a_1, a_2, a_3, …, is defined by

$$a_1 = k,$$

$$a_{n+1} = 5a_n + 3, \quad n \geq 1,$$

where k is a positive integer.

(*a*) Write down an expression for a_2 in terms of k.

(1)

(*b*) Show that $a_3 = 25k + 18$.

(2)

(*c*) (i) Find $\sum_{r=1}^{4} a_r$ in terms of k, in its simplest form.

(ii) Show that $\sum_{r=1}^{4} a_r$ is divisible by 6.

(4)

May 2011

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6. The curve C has equation $y = \frac{3}{x}$ and the line l has equation $y = 2x + 5$.

(*a*) Sketch the graphs of C and l, indicating clearly the coordinates of any intersections with the axes.

(3)

(*b*) Find the coordinates of the points of intersection of C and l.

(6)

June 2008

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7. (*a*) Find an equation of the line joining $A(7, 4)$ and $B(2, 0)$, giving your answer in the form $ax + by + c = 0$, where a, b and c are integers.

(3)

(*b*) Find the length of AB, leaving your answer in surd form.

(2)

The point C has coordinates $(2, t)$, where $t > 0$, and $AC = AB$.

(*c*) Find the value of t.

(1)

(*d*) Find the area of triangle ABC.

(2)

May 2010

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8. 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

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9. The curve C has equation $y = \text{f}(x)$, $x > 0$, and $\text{f}'(x) = 4x - 6\sqrt{x} + \dfrac{8}{x^2}$.

Given that the point $P(4, 1)$ lies on C,

(a) find f(x) and simplify your answer.

(6)

(b) Find an equation of the normal to C at the point $P(4, 1)$.

(4)

January 2008

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10. The curve C has equation

$$y = 9 - 4x - \frac{8}{x}, \quad x > 0.$$

The point P on C has x-coordinate equal to 2.

(a) Show that the equation of the tangent to C at the point P is $y = 1 - 2x$.

(6)

(b) Find an equation of the normal to C at the point P.

(3)

The tangent at P meets the x-axis at A and the normal at P meets the x-axis at B.

(c) Find the area of the triangle APB.

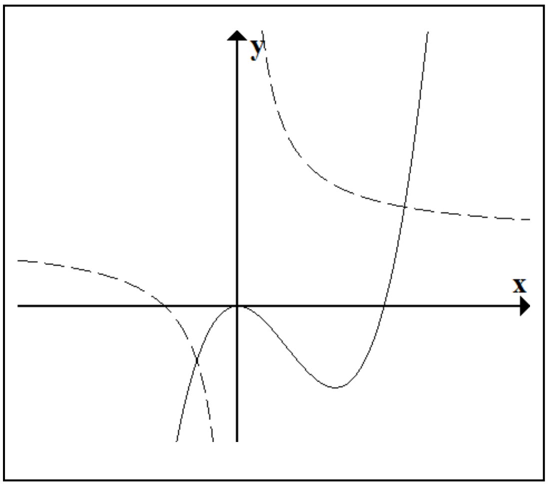
(4)

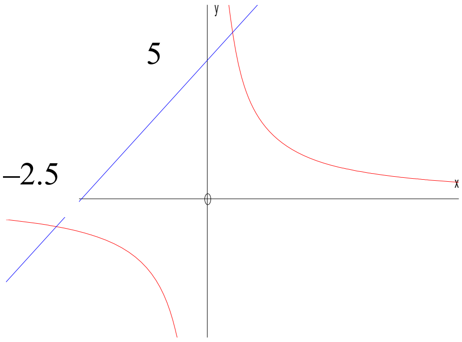
January 2009

TOTAL FOR PAPER: 75 MARKS

END

Question number	Scheme	Marks
1	$\frac{7+\sqrt{5}}{\sqrt{5}-1} \times \frac{(\sqrt{5}+1)}{(\sqrt{5}+1)}$	M1
	$= \frac{\dots}{4}$	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)	Attempt $\sqrt[3]{8}$ or $\sqrt[3]{(8^4)}$	M1
	$= \underline{16}$	A1
		(2)
	$5x^{\frac{1}{3}}$	B1 B1
		(2)
		[4]
3 (a)	$3x-7>3-x$	
	$4x>10$	M1
	$x>2.5,\quad x>\frac{5}{2},\quad \frac{5}{2}<x$ o.e.	A1
		(2)
(b)	Obtain $x^2-9x-36$ and attempt to solve $x^2-9x-36=0$	
	e.g. $(x-12)(x+3)=0$ so $x=$, or $x=\frac{9\pm\sqrt{81+144}}{2}$	M1
	12, –3	A1
	$-3 \le x \le 12$	M1 A1
		(4)
(c)	$2.5<x\le 12$	A1cso
		(1)
		[7]

Question number	Scheme	Marks
4 (a)	-1 accept $(-1, 0)$	B1
		(1)
(b)	 Shape	B1
	Touches at (0, 0)	B1
	Crosses at (2, 0) **only**	B1
		(3)
(c)	2 solutions as **curves** cross twice	B1ft
		(1)
		[5]
5 (a)	$(a_2 =)\ 5k+3$	B1
		(1)
(b)	$(a_3 =)\ 5(5k+3)+3$	M1
	$= 25k+18$ (*)	A1 cso
		(2)
(c)(i)	$a_4 = 5(25k+18)+3 \quad (=125k+93)$	M1
	$\sum_{r=1}^{4} a_r = k+(5k+3)+(25k+18)+(125k+93)$	M1
	$= 156k+114$	A1 cao
(ii)	$= 6(26k+19)$ (or explain each term is divisible by 6)	A1 ft
		(4)
		[7]

Question number	Scheme	Marks
6 (a)	 	B1 M1 A1 **(3)**
(b)	$2x+5=\frac{3}{x}$ $2x^2+5x-3\,[=0]$ or $2x^2+5x=3$ $(2x-1)(x+3)\,[=0]$ $x=-3$ or $\frac{1}{2}$ $y=\frac{3}{-3}$ or $2\times(-3)+5$ or $y=\frac{3}{\frac{1}{2}}$ or $2\times\left(\frac{1}{2}\right)+5$ Points are $\underline{(-3,-1) \text{ and } (\frac{1}{2},6)}$ (correct pairings)	M1 A1 M1 A1 M1 A1ft **(6)** **[9]**
7 (a)	$m_{AB}=\frac{4-0}{7-2}\ \left(=\frac{4}{5}\right)$ Equation of AB is: $y-0=\frac{4}{5}(x-2)$ or $y-4=\frac{4}{5}(x-7)$ (o.e.) $\underline{4x-5y-8=0}$ (o.e.)	M1 M1 A1 **(3)**
(b)	$(AB=)\sqrt{(7-2)^2+(4-0)^2}$ $=\sqrt{41}$	M1 A1 **(2)**
(c)	Using isos triangle with $AB = AC$ then $t=2\times y_A=2\times 4=8$	B1 **(1)**
(d)	Area of triangle $=\frac{1}{2}t\times(7-2)$ $=\underline{20}$	M1 A1 **(2)** **[8]**

Question number	Scheme	Marks
8 (a)	$a+29d=40.75$ or $a=40.75-29d$ or $29d=40.75-a$	M1 A1 **(2)**
(b)	$(S_{30})=\frac{30}{2}(a+l)$ or $\frac{30}{2}(a+40.75)$ or $\frac{30}{2}(2a+(30-1)d)$ or $15(2a+29d)$	M1
	So $1005=15[a+40.75]$ *	A1 cso **(2)**
(c)	$67=a+40.75$ so $\underline{a=(£)\ 26.25 \text{ or } 2625\text{p or } 26\tfrac{1}{4}}$ NOT $\frac{105}{4}$	M1 A1
	$29d=40.75-26.25$	M1
	$=14.5$ so $\underline{d=(£)0.50 \text{ or } 0.5 \text{ or } 50\text{p}}$ or $\frac{1}{2}$	A1 **(4)** **[8]**
9 (a)	$4x\to kx^2$ or $6\sqrt{x}\to kx^{3/2}$ or $\frac{8}{x^2}\to kx^{-1}$ (k a non-zero constant)	M1
	$f(x)=2x^2,\ -4x^{3/2},\ -8x^{-1}$ $(+C)$ ($+C$ not required)	A1A1A1
	At $x=4, y=1$: $1=(2\times16)-\left(4\times4^{3/2}\right)-\left(8\times4^{-1}\right)+C$ Must be in part (a)	M1
	$C=3$	A1 **(6)**
(b)	$f'(4)=16-(6\times2)+\frac{8}{16}=\frac{9}{2}\ (=m)$ [M: Attempt $f'(4)$ with the given f'. Must be in part (b)]	M1
	Gradient of normal is $-\frac{2}{9}\left(=-\frac{1}{m}\right)$ [M: Attempt perp. grad. rule. Dependent on the use of their $f'(x)$]	M1
	Eqn. of normal: $y-1=-\frac{2}{9}(x-4)$ (or any equiv. form, e.g. $\frac{y-1}{x-4}=-\frac{2}{9}$)	M1 A1
	Typical answers for A1: $\left(y=-\frac{2}{9}x+\frac{17}{9}\right)$ $(2x+9y-17=0)$ $(y=-0.\dot{2}x+1.\dot{8})$	**(4)**
	Final answer: gradient $-\frac{1}{(9/2)}$ or $-\frac{1}{4.5}$ is A0 (but all M marks are available).	**[10]**

Question number	Scheme	Marks
10 (a)	$\left(\frac{dy}{dx}=\right)-4+8x^{-2}$ (4 or $8x^{-2}$ for M1… sign can be wrong)	M1 A1
	$x=2 \Rightarrow \quad m=-4+2=-2$	M1
	$y=9-8-\frac{8}{2}=-3$	B1
	The first 4 marks <u>could</u> be earned in part (b)	
	Equation of tangent is: $y+3=-2(x-2) \rightarrow \quad y=1-2x$ (*)	M1 A1cso
		(6)
(b)	Gradient of normal = $\frac{1}{2}$	B1ft
	Equation is: $\frac{y+3}{x-2}=\frac{1}{2}$ or better equivalent, e.g. $y=\frac{1}{2}x-4$	M1 A1
		(3)
(c)	$(A:)\ \frac{1}{2}, \qquad (B:)\ 8$	B1 B1
	Area of triangle is: $\frac{1}{2}(x_B \pm x_A)\times y_P$	
	with values for all of x_B, x_A and y_P	M1
	$\frac{1}{2}\left(8-\frac{1}{2}\right)\times 3 = \frac{45}{4}$ or 11.25	A1
		(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 $(\sqrt{5} - 1)/(\sqrt{5} - 1)$, $(\sqrt{5} - 1)/(\sqrt{5} + 1)$ and $(7 - \sqrt{5})/\sqrt{5} + 1)$ 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. $(12 + 8\sqrt{5})/4$ became $3 + 8\sqrt{5}$ or $12 + 2\sqrt{5}$. 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 $7\sqrt{5} + \sqrt{5} = 6\sqrt{5}$.

Question 2

There were many correct responses to both parts of this question. In part (a) some reached $\sqrt[3]{4096}$ but could not simplify this expression but most managed $\sqrt[3]{8} = 2$ and usually went on to give the final answer of 16. A few attempted $\left(\sqrt[4]{8}\right)^3$ but most interpreted the notation correctly. Part (b) revealed a variety of responses from those whose grasp of the basic rules of algebra is poor. Most simplified the numerical term to 5 but often they seemed to think the x terms "disappeared" and answers of $5^{\frac{1}{3}}$ or $5^{\frac{4}{3}}$ were common. Dealing with the x term proved quite a challenge for some and $(5x)^{\frac{4}{3}}$ was a common error. Some candidates tried to "simplify" a correct answer, replacing $5x^{\frac{1}{3}}$ with $\sqrt[3]{5x}$. On this occasion the examiners ignored this subsequent working but such a misunderstanding of the mathematical notation used in AS level mathematics is a legitimate area to be tested in future.

Question 3

In this question 45% of candidates gained full marks with a further 25% dropping just one or two marks.

In part (a) most candidates scored full marks, though a small number changed the direction of the inequality. Other errors were mistakes in the rearranging (ending up with $2x > 10$ or $4x > -4$).

In part (b) most students correctly rearranged the inequality and got the first two marks for the critical values $x = -3$ and $x = 12$ by factorising and solving correctly. Only a few students erroneously gave $x = -12$ and $x = 3$. Some students used the quadratic formula to find these values, and mistakes substituting were made here. A large number made the 'usual' mistake of simply leaving $x \leq -3$ and $x \leq 12$ as their answer, whilst some of those who realised that they needed the inside region did enough to gain the method mark, but not the accuracy mark as a result of incorrect notation. Some students picked the inside region correctly but then wrote $-3 < x < 12$ with strict inequalities.

In part (c) the mark was gained only if students had worked correctly through the rest of the problem. As a result this was the least commonly gained mark and relied on accurate work and good understanding. Students generally realised the required method and often used a number line to correctly identify the region following their previous work, though many missed the subtlety of the 'strictly greater than' for the $\frac{5}{2}$.

Question 4
In this graph question 65.5% of the candidates gained full marks or dropped just one mark.

In part (a), most candidates achieved –1 for x or wrote (–1, 0). Sometimes the –1 was found in the body of the question text.

In part (b) many graphs were well drawn; most candidates realised that it was a cubic graph and drew the correct shape. Negative cubic curves were quite common and there were also a few quadratic and hyperbolic graphs. Where the cubic was correct the commonest error was a curve crossing at (0, 0) and turning at (2, 0). Cubic curves crossing the x-axis 3 times were also quite common. A few candidates produced cubic graphs with a single point of inflexion at the origin.

Part (c) appeared to be the least well-answered part of the question. Several students wrote down the correct number of solutions but did not give a reason. Others wrongly gave a reason related to the number of times the graph crossed the x-axis instead of to the number of times the two curves crossed. Several candidates also tried to solve the resulting equation. There was some confusion between the words 'intersection' and 'intercept'.

Question 5
Part (a) was usually given correctly as $5k + 3$.

In part (b) the majority of candidates provided working in the form of $5(5k + 3) + 3$ and arrived at the correct printed answer in a legitimate way. A few tried substituting values for k.

Part (c) provided more discrimination. Candidates needed to find a_4 and then needed to add four terms to obtain their sum. There were a number of arithmetic errors in the additions, which was disappointing at this level. Finally showing that their answer was divisible by 6 gave a range of responses. Some had no idea what to do, others divided by 6 and one or two produced a proof by induction. Division by 6 was sufficient to earn the mark here, but again poor arithmetic caused many to lose this mark.

Question 6
Whilst many candidates gave clear and correct sketches in part (a) there were a number who failed to score all 3 marks here. The curve C caused the most problems: some thought that the 3 represented an upward translation of 3 and a few interpreted 3/0 as 0 and had C passing through the origin. Other thought C was a parabola and quite a number failed to include the branch for negative values of x. Most (but surprisingly not all) drew l as a straight line, usually with the correct gradient but they often omitted the intercept with the negative x-axis or labelled it as (2.5, 0).

In part (b) most were able to start to solve the simultaneous equations, form the correct quadratic and factorize it. Some forgot to find the corresponding y values and a few substituted their x values into their quadratic equation rather than the equation of the curve or the line.

Those who made arithmetic errors did not check their answers against their sketch in part (a) to see if they made sense but, sadly, some of those with incorrect sketches did and rejected their negative solution of x instead of amending their sketch.

Question 7

Most candidates could find the gradient of the line *AB* but the usual arithmetic slips spoilt some answers: $\frac{-4}{-5} = -\frac{4}{5}$ was quite frequent. Finding the equation of the line was usually answered well too with $y = mx + c$ or $y - y_1 = m(x - x_1)$ being the favoured approaches and only a few failing to write their answer in integer form.

Part (b) was answered very well and many correct answers were seen, a few candidates quoted an incorrect formula and some made arithmetic errors e.g. 25 + 16 = 31.

Some candidates made heavy weather of part (c) adopting an algebraic approach, others tried drawing a diagram (as intended) but mistakenly thought *AC* was parallel to the *x*-axis and arrived at $t = 4$ which was a common error. Those with a correct diagram would often proceeded to a correct answer to part (d) using $\frac{1}{2}bh$ with few problems but there were a number of other successful, but less efficient, solutions using a determinant method or even the semi perimeter formula.

A common error was to treat *ABC* as a right-angled isosceles triangle and this led to $\frac{1}{2}\sqrt{41} \times \sqrt{41} = 20.5$.

Question 8

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 9

Most candidates realised that integration was required in part (a) of this question and although much of the integration was correct, mistakes in simplification were common. Not all candidates used the (4, 1) to find the constant of integration, and of those who did, many lost accuracy through mistakes in evaluation of negative and fractional quantities. Occasionally $x = 4$ was used without $y = 1$, losing the method mark. Evaluation of the constant was sometimes seen in part (b) from those who confused this constant with the constant c in $y = mx + c$. Those who used differentiation instead of integration in part (a) rarely recovered.

In part (b), while some candidates had no idea what to do, many scored well. Some, however, failed to use the given $f'(x)$ to evaluate the gradient, and others found the equation of the tangent instead of the normal.

Question 10

Responses to this question varied considerably, ranging from completely correct, clear and concise to completely blank. Most candidates who realised the need to differentiate in part (a) were able to make good progress, although there were occasionally slips such as sign errors in the differentiation. A few lost marks by using the given equation of the tangent to find the *y*-coordinate of *P*. Those who used no differentiation at all were limited to only one mark out of six in part (a). Even candidates who were unsuccessful in establishing the equation of the tangent were sometimes able to score full marks for the normal in part (b).

Finding the area of triangle *APB* in part (c) proved rather more challenging. Some candidates had difficulty in identifying which triangle was required, with diagrams suggesting intersections with the *y*-axis instead of the *x*-axis. The area calculation was sometimes made more difficult by using the right angle between the tangent and the normal, i.e. $\frac{1}{2}(AP \times BP)$, rather than using *AB* as a base.

Statistics for C1 Practice Paper Silver Level S5

Qu	Max score	Modal score	Mean %	Mean score for students achieving grade: ALL	A*	A	B	C	D	E	U
1	4	4	89	3.54	3.95	3.95	3.84	3.76	3.66	3.51	2.77
2	4		78	3.13		3.85	3.58	3.33	3.03	2.68	1.91
3	7		79	5.50	6.82	6.59	6.04	5.64	5.22	4.81	3.72
4	5		75	3.75	4.85	4.71	4.36	4.02	3.64	3.16	1.96
5	7		79	5.53	6.87	6.73	6.39	6.07	5.69	5.10	3.16
6	9		73	6.57		8.76	8.29	7.52	6.39	4.80	2.24
7	8		65	5.17	7.59	7.05	6.11	5.42	4.85	4.11	2.41
8	8		66	5.28	7.63	7.25	6.44	5.70	4.93	4.15	2.42
9	10		65	6.52		9.61	8.69	7.72	6.38	5.35	2.91
10	13		53	6.87		12.10	10.04	7.86	5.14	3.56	1.35
	75		**69.15**	**51.86**	**37.71**	**70.60**	**63.78**	**57.04**	**48.93**	**41.23**	**24.85**