Paper Reference(s)

**6663/01**

# Edexcel GCE

## Core Mathematics C1
## Silver Level S1

## 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 |
|---|---|---|---|---|---|
| 71 | 64 | 58 | 51 | 45 | 39 |

**1.** Find

$$\int \left(6x^2 + \frac{2}{x^2} + 5\right) \mathrm{d}x,$$

giving each term in its simplest form.

**(4)**

**May 2012**

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**2.** Simplify

$$\frac{5 - \sqrt{3}}{2 + \sqrt{3}},$$

giving your answer in the form $a + b\sqrt{3}$, where $a$ and $b$ are integers.

**(4)**

**Jan 2008**

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**3.** A sequence $x_1, x_2, x_3, \ldots$ is defined by

$$x_1 = 1,$$

$$x_{n+1} = a x_n + 5, \qquad n \geq 1,$$

where $a$ is a constant.

($a$) Write down an expression for $x_2$ in terms of $a$.

**(1)**

($b$) Show that $x_3 = a^2 + 5a + 5$.

**(2)**

Given that $x_3 = 41$

($c$) find the possible values of $a$.

**(3)**

**Jan 2012**

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**4.** A boy saves some money over a period of 60 weeks. He saves 10p in week 1, 15p in week 2, 20p in week 3 and so on until week 60. His weekly savings form an arithmetic sequence.

(*a*) Find how much he saves in week 15.

**(2)**

(*b*) Calculate the total amount he saves over the 60 week period.

**(3)**

The boy's sister also saves some money each week over a period of $m$ weeks. She saves 10p in week 1, 20p in week 2, 30p in week 3 and so on so that her weekly savings form an arithmetic sequence. She saves a total of £63 in the $m$ weeks.

(*c*) Show that

$$m(m + 1) = 35 \times 36.$$

**(4)**

(*d*) Hence write down the value of $m$.

**(1)**

**May 2012**

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**5.** Given that $\dfrac{2x^2 - x^{\frac{3}{2}}}{\sqrt{x}}$ can be written in the form $2x^p - x^q$,

(*a*) write down the value of $p$ and the value of $q$.

**(2)**

Given that $y = 5x^4 - 3 + \dfrac{2x^2 - x^{\frac{3}{2}}}{\sqrt{x}}$,

(*b*) find $\dfrac{dy}{dx}$, simplifying the coefficient of each term.

**(4)**

**Jan 2009**

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**6.** The curve with equation $y = \mathrm{f}(x)$ passes through the point $(-1, 0)$.

Given that

$$\mathrm{f}'(x) = 12x^2 - 8x + 1,$$

find $\mathrm{f}(x)$.

**(5)**

**Jan 2011**

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**7.**

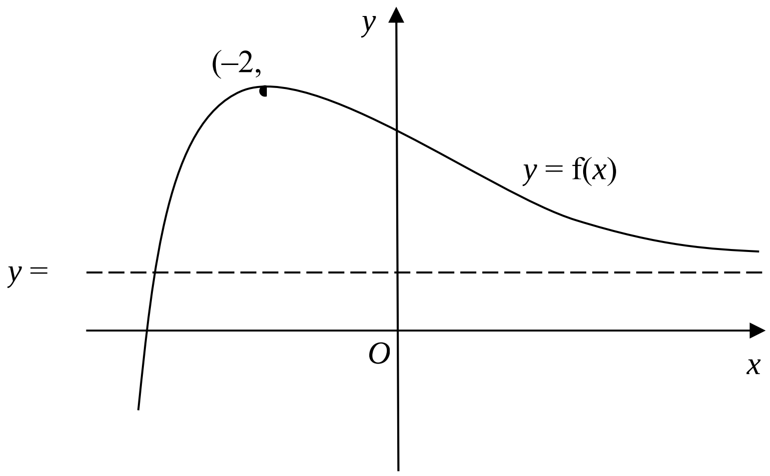


**Figure 1**

Figure 1 shows a sketch of part of the curve with equation $y = \mathrm{f}(x)$.

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

On separate diagrams, sketch the curve with equation

(*a*) $y = \mathrm{f}(x) + 2$,

**(2)**

(*b*) $y = 4\mathrm{f}(x)$,

**(2)**

(c) $y = \mathrm{f}(x + 1)$.

**(3)**

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

**Jan 2010**

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**8.** (*a*) Factorise completely $x^3 - 4x$.

**(3)**

(*b*) Sketch the curve $C$ with equation

$$y = x^3 - 4x,$$

showing the coordinates of the points at which the curve meets the axis.

**(3)**

The point $A$ with $x$-coordinate $-1$ and the point $B$ with $x$-coordinate 3 lie on the curve $C$.

(*c*) Find an equation of the line which passes through $A$ and $B$, giving your answer in the form $y = mx + c$, where $m$ and $c$ are constants.

**(5)**

(*d*) Show that the length of $AB$ is $k\sqrt{10}$, where $k$ is a constant to be found.

**(2)**

**Jan 2010**

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**9.**

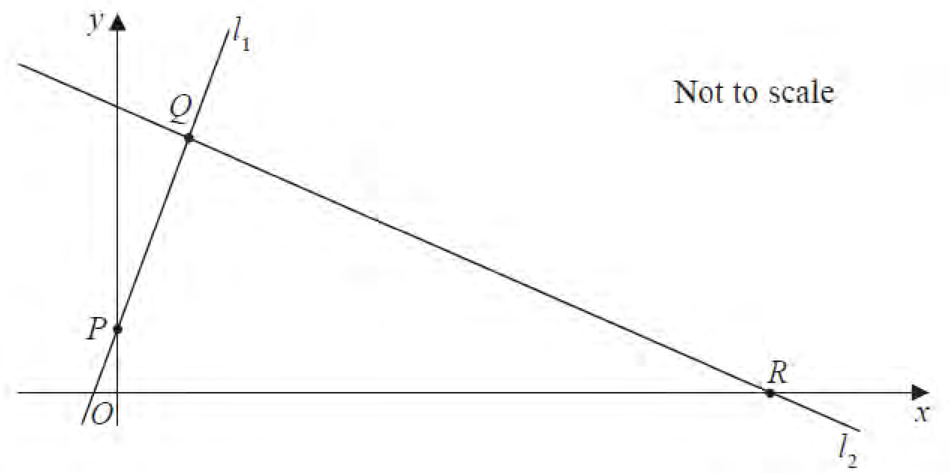


**Figure 2**

The points $P$ (0, 2) and $Q$ (3, 7) lie on the line $l_1$, as shown in Figure 2.

The line $l_2$ is perpendicular to $l_1$, passes through $Q$ and crosses the $x$-axis at the point $R$, as shown in Figure 2.

Find

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

**(5)**

(*b*) the exact coordinates of $R$,

**(2)**

(*c*) the exact area of the quadrilateral $ORQP$, where $O$ is the origin.

**(5)**

**May 2016**

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**10.** The gradient of a curve $C$ is given by $\frac{dy}{dx} = \frac{(x^2+3)^2}{x^2}$, $x \neq 0$.

(*a*) Show that $\frac{dy}{dx} = x^2 + 6 + 9x^{-2}$.

**(2)**

The point (3, 20) lies on $C$.

(*b*) Find an equation for the curve $C$ in the form $y = f(x)$.

**(6)**

**May 2008**

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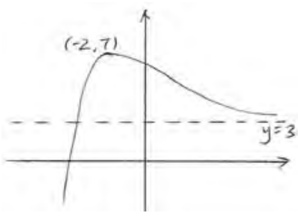
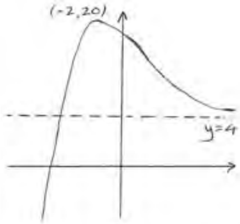
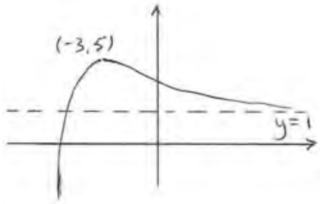
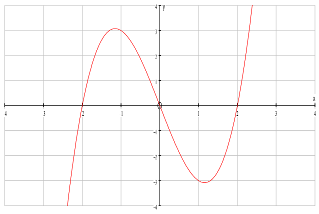
**TOTAL FOR PAPER: 75 MARKS**

**END**

| Question Number | Scheme | Marks |
|---|---|---|
| 1 | $\left\{\int\left(6x^2+\frac{2}{x^2}+5\right)\mathrm{d}x\right\} = \frac{6x^3}{3}+\frac{2x^{-1}}{-1}+5x\ (+c)$ | M1 A1 |
| | $= 2x^3 - 2x^{-1}\ ;+5x+c$ | A1 A1 |
| | | [4] |
| 2 | $\frac{(5-\sqrt{3})}{(2+\sqrt{3})}\times\frac{(2-\sqrt{3})}{(2-\sqrt{3})}$ | M1 |
| | $= \frac{10-2\sqrt{3}-5\sqrt{3}+(\sqrt{3})^2}{\ldots}$ $\left(=\frac{10-7\sqrt{3}+3}{\ldots}\right)$ | M1 |
| | $(=13-7\sqrt{3})$ $\left(\text{Allow } \frac{13-7\sqrt{3}}{1}\right)$ 13 $(a=13)$ | A1 |
| | $-7\sqrt{3}$ $(b=-7)$ | A1 |
| | | [4] |
| 3 (a) | $(x_2=)$ a + 5 | B1 |
| | | (1) |
| (b) | $(x_3)=a"(a+5)"+5$ | M1 |
| | $= a^2+5a+5$ (*) | A1 cso |
| | | (2) |
| (c) | $41 = a^2+5a+5 \Rightarrow a^2+5a-36(=0)$ or $36=a^2+5a$ | M1 |
| | (a + 9)( a – 4) = 0 | M1 |
| | a = 4 or –9 | A1 |
| | | (3) |
| | | [6] |

| Question Number | Scheme | Marks |
|---|---|---|
| | Boy's Sequence: $10, 15, 20, 25, \ldots$ | |
| 4 (a) | $\{a = 10,\ d = 5 \Rightarrow T_{15} =\}\ a + 14d = 10 + 14(5); = 80$ or <br> $0.1 + 14(0.05); = £0.80$ | M1 A1 |
| | | **(2)** |
| (b) | $\{S_{60} =\}\ \frac{60}{2}[2(10) + 59(5)]$ | M1 A1 |
| | $= 30(315) = 9450$ or $£94.50$ | A1 |
| | | **(3)** |
| | Boy's Sister's Sequence: $10, 20, 30, 40, \ldots$ | |
| (c) | $\{a = 10,\ d = 10 \Rightarrow S_m =\}\ \frac{m}{2}(2(10) + (m-1)(10))$ $\left(\text{or } \frac{m}{2} \times 10(m+1) \text{ or } 5m(m+1)\right)$ | M1 A1 |
| | 63 or $6300 = \frac{m}{2}(2(10) + (m-1)(10))$ | dM1 |
| | $6300 = \frac{m}{2}(10)(m+1)$ or $12600 = 10m(m+1)$ <br> $1260 = m(m+1)$ <br> $35 \times 36 = m(m+1)$ **(*)** | A1 cso |
| | | **(4)** |
| (d) | $\{m =\}\ 35$ | B1 |
| | | **(1)** |
| | | **[10]** |
| 5 (a) | $2x^{3/2}$ or $p = \frac{3}{2}$ (<u>Not</u> $2x\sqrt{x}$ ) | B1 |
| | $-x$ or $-x^1$ or $q = 1$ | B1 |
| | | **(2)** |
| (b) | $\left(\frac{dy}{dx} =\right)\ 20x^3 + 2 \times \frac{3}{2} x^{1/2} - 1$ | M1 |
| | $= 20x^3 + 3x^{\frac{1}{2}} - 1$ | A1A1 ftA1ft |
| | | **(4)** |
| | | **[6]** |
| 6 | $(f(x) =) \frac{12x^3}{3} - \frac{8x^2}{2} + x (+c)$ | M1A1A1 |
| | $(f(-1) = 0 \Rightarrow)\ 0 = 4 \times (-1) - 4 \times 1 - 1 + c$ | M1 |
| | $c = 9$ | A1 |
| | $\left[f(x) = 4x^3 - 4x^2 + x + 9\right]$ | **[5]** |

| Question Number | Scheme | Marks |
|---|---|---|
| 7 | (a)   (b)   (c)   | |
| **(a)** | $(-2, 7)$, $y = 3$ (Marks are dependent upon a sketch being attempted)<br>See conditions below. | B1 B1<br>**(2)** |
| **(b)** | $(-2, 20)$, $y = 4$ (Marks are dependent upon a sketch being attempted)<br>See conditions below. | B1 B1<br>**(2)** |
| **(c)** | Sketch: Horizontal translation (either way)(There must be evidence that $y = 5$ at the max and that the asymptote is still $y = 1$)<br>$(-3, 5)$, $y = 1$ | B1<br>B1 B1<br>**(3)**<br>**[7]** |

| Question Number | Scheme | Marks |
|---|---|---|
| **8 (a)** | $x(x^2-4)$ Factor $x$ seen in a <u>correct</u> factorised form of the expression. | B1 |
| | $= x(x-2)(x+2)$ M: Attempt to factorise quadratic (general principles). | M1 A1 |
| | Accept $(x-0)$ or $(x+0)$ instead of $x$ at any stage. | **(3)** |
| | Factorisation must be seen in part (a) to score marks | |
| **(b)** |  Shape (2 turning points required) | B1 |
| | Through (or touching) origin | B1 |
| | Crossing $x$-axis or "stopping at $x$-axis" (<u>not</u> a turning point) at (–2, 0) and (2, 0). Allow –2 and 2 on $x$-axis. | B1 |
| | Also allow (0, –2) and (0, 2) if marked on $x$-axis. | **(3)** |
| | Ignore extra intersections with $x$-axis. | |
| **(c)** | <u>Either</u> $y = 3$ (at $x = -1$) <u>or</u> $y = 15$ (at $x = 3$) Allow if seen elsewhere. | B1 |
| | Gradient $= \dfrac{"15-3"}{3-(-1)} \ (=3)$ | M1 |
| | Attempt correct grad. formula with their $y$ values. For gradient M mark, if correct formula not seen, allow one slip, e.g. $\dfrac{"15-3"}{3-1}$ | |
| | $y-"15"=m(x-3)$ or $y-"3"=m(x-(-1))$, with any value for $m$. | M1 |
| | $y-15=3(x-3)$ or the <u>correct</u> equation in <u>any</u> form, e.g. $y-3=\dfrac{15-3}{3-(-1)}(x-(-1))$, $\dfrac{y-3}{x+1}=\dfrac{15-3}{3+1}$ | A1 |
| | $y = 3x+6$ | A1 |
| | | **(5)** |
| **(d)** | $AB=\sqrt{("15-3")^2+(3-(-1))^2}$ (With their <u>non-zero</u> $y$ values)... Square root is required. | M1 |
| | $=\sqrt{160}\ \left(=\sqrt{16}\sqrt{10}\right) = 4\sqrt{10}$ (Ignore ± if seen) ($\sqrt{16}\sqrt{10}$ need not be seen). | A1 |
| | | **(2)** |
| | | **[13]** |

| Question Number | Scheme | Marks |
|---|---|---|
| 9 | **Gradient of $l_1$ is** $\frac{7-2}{3-0}\left(=\frac{5}{3}\right)$ | B1 |
| | $m(l_2) = -1 \div their\ \frac{5}{3}$ | M1 |
| | $y - 7 = "-\frac{3}{5}"(x-3)$ | |
| | or | M1A1ft |
| | $y = "-\frac{3}{5}"x + c,\ \ 7 = "-\frac{3}{5}"(3) + c \Rightarrow c = \frac{44}{5}$ | |
| | $3x + 5y - 44 = 0$ | A1 |
| | | **(5)** |
| (b) | When $y = 0$ $x = \frac{44}{3}$ | M1 A1 |
| | | **(2)** |
| | Correct attempt at finding the area of any one of the triangles or one of the trapezia. | M1 |
| | A correct numerical **expression** for the area of one **triangle** or one **trapezium** for **their coordinates**. | A1ft |
| | Combines the correct areas together correctly | dM1 |
| | Correct numerical expression for the area of *ORQP*. | A1 |
| | Correct exact area e.g. $54\frac{1}{3}$, $\frac{163}{3}$, $\frac{326}{6}$, $54.\dot{3}$ or any exact equivalent | A1 |
| | | **(5)** |
| | | **[12]** |

| Question Number | Scheme | Marks |
|---|---|---|
| 10 | $\left(x^2+3\right)^2 = x^4+3x^2+3x^2+3^2$ | M1 |
| | $\dfrac{\left(x^2+3\right)^2}{x^2} = \dfrac{x^4+6x^2+9}{x^2} = x^2+6+9x^{-2}$ **(*)** | A1 cso |
| | | **(2)** |
| (b) | $y = \dfrac{x^3}{3}+6x+\dfrac{9}{-1}x^{-1}\left(+c\right)$ | M1 A1<br>A1 |
| | $20 = \dfrac{27}{3}+6\times3-\dfrac{9}{3}+c$ | M1 |
| | $c = -4$ | A1 |
| | $[y=]\dfrac{x^3}{3}+6x-9x^{-1}-4$ | A1 ft |
| | | **(6)** |
| | | **[8]** |

## Examiner reports

**Question 1**
About three-quarters of the candidature achieved all 4 marks in this question.

While most candidates were able to integrate both $6x^2$ and 5 correctly, a significant minority struggled to integrate $\frac{2}{x^2}$ correctly, giving incorrect answers such as $\frac{2x^{-3}}{3}$ or $-\frac{1}{2x}$ or $4x^{-1}$ or $4x^{-3}$.

Incorrect simplification of either $\frac{6x^3}{3}$ to $3x^3$ or $-2x^{-1}$ to $-\frac{1}{2x}$; or not simplifying $+ -2x^{-1}$ to $-2x^{-1}$ and the omission of the constant of integration were also other common errors.

It was pleasing to see very few candidates who differentiated all three terms.

**Question 2**
There were many completely correct solutions to this question. The majority of candidates knew the correct method of multiplying the numerator and denominator by $(2-\sqrt{3})$ and many were correct in the arithmetic manipulation. Some multiplied incorrectly by $(2+\sqrt{3})$ or by $(5+\sqrt{3})$. A number of candidates were unable to square $\sqrt{3}$ correctly and it was disappointing to see marks lost though careless arithmetic. Only a small minority of candidates had no idea of how to start.

**Question 3**
Most candidates answered this question well. Few failed to write down $a + 5$ or $a(1) + 5$ in part (a) and the minimal evidence of $a(a + 5) + 5$ almost always preceded the answer in part (b). A small minority of candidates still do not understand the notation in this question and their answers often contained terms in $x$.

Some candidates had difficulties with part (c). The correct equation was usually identified but sometimes it was not reduced to a three-term quadratic or the method of solution was incorrect. A few attempted to square root both sides and it was not uncommon to see $a + 5a = \sqrt{36}$. Some candidates obtained $a = 4$ by trial but credit will only be given for a complete solution leading to both answers.

**Question 4**
This question was both well answered and discriminating with about three-quarters of the candidature gaining at least 7 of the 10 marks available and one-quarter achieving full marks.

Part (a) was well answered with the majority using $a + 14d$ and a small minority using $5n + 5$ in order to find the 15th term. Few candidates listed each term and a number identified the 15th term correctly. A small number of candidates found the total amount saved over the 15 weeks.

In part (b), many candidates frequently used $\frac{n}{2}(2a + (n-1)d)$ to find the total amount paid over 60 weeks, although a few applied $l = a + (n - 1)d$ and then substituted the result into $\frac{n}{2}(a + l)$. It was not uncommon, however, to see arithmetic errors such as mulitplying 315 by 30 or even adding 20 to 295. Other candidates who failed to get full credit often mixed $n = 15$ and $n = 60$, used $d = 5$ or found $T_{60}$ instead of $S_{60}$.

In part (c), most candidates successfully created an expression in pence for $S_m$ and set it equal to either 63 or 6300. Of those that set the expression to 63, a large majority did not successfully convert from pounds to pence and as a result did not reach the answer given on the paper. Some fudged their attempts by implying $m(m + 1) = 1260$ from an incorrect $10m(m + 1) = 126$.

In part (d), a significant number of candidates were unable to deduce $m = 35$ by looking at the given result in part (c). Instead, a number of these candidates wasted unnecessary time in attempting to factorise and solve a quadratic equation to give $m = -36$, 35 with some not realising that they needed to reject the negative result.

**Question 5**
Good candidates generally had no difficulty with the division in part (a) of this question, but others were often unable to cope with the required algebra and produced some very confused solutions. A common mistake was to "multiply instead of divide", giving $2x^2 \div \sqrt{x} = 2x^{\frac{5}{2}}$, and sometimes $\sqrt{x}$ was interpreted as $x^{-1}$. Examiners saw a wide variety of wrong answers for $p$ and $q$.

Most candidates were able to pick up at least two marks in part (b), where follow-through credit was available in many cases. While the vast majority used the answers from part (a), a few differentiated the numerator and denominator of the fraction term separately, then divided.

**Question 6**
This question was done well by most candidates and the actual process of integration was well practised. There were a large number of completely correct responses. Some candidates however did not realise that the constant of integration had to be found and stopped after integrating. They lost the final two marks. For those who continued the majority of errors arose because they incorrectly evaluated their expression with $x = -1$. This was due to the minus sign, which had to be cubed and squared. Some who did substitute correctly failed to realise that their expression in c needed setting equal to zero and so they made a false conclusion leading to $c = -9$.

**Question 7**

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 8**

The parts of this question could be tackled independently of each other and most candidates were able to pick up marks in one or more of the parts. In part (a), it was disappointing that so many failed to give a complete factorisation, commonly leaving the answer as $x(x^2 - 4)$. Sketches of the cubic graph in part (b) were often very good, even when the link between parts (a) and (b) was not appreciated.

A common misconception in part (c) was that the gradient of *AB* could be found by differentiating the equation of the curve and evaluating at either $x = 3$ or $x = -1$. Apart from this, numerical slips frequently spoiled solutions.

A significant number of candidates failed to attempt part (d), but those that did were often successful in obtaining the correct length of *AB*.

**Question 9**

Part (a) and (b) were accessible to almost all the candidates, with nearly all the candidates achieving at least the first two marks in part (a). In order to find the equation of a line, centres should be encouraging their candidates to use the formula $y - y_1 = m(x - x_1)$ and quote the formula first. Correct substitution would have scored candidates two marks, whereas there is more work to do when using $y = mx + c$, and it is more error prone. Many candidates made careless mistakes when rearranging their equation, in particular, it was common to see 9 added to –35 rather than subtracting.

In part (b) a significant number of candidates scored no marks as they incorrectly substituted $x = 0$ rather than $y = 0$.

Part (c) discriminated well between candidates. Completely correct solutions were relatively rare but some correct solutions were concise and well explained. It was fairly common for an attempt to be very difficult to follow, with many candidates not labelling any of the areas they were finding or explaining any of their steps. In most cases the final answer was wrong because the separate areas were inaccurately calculated, or else an invalid approach to splitting the quadrilateral area was used. In contrast, those solutions where the provided diagram was clear split into triangles and labelled usually had more success in reaching the correct final area. The ease or difficulty of calculating the areas depended on how the quadrilateral *OPQR* was split. A vertical line dropped through *Q* to the *x*-axis being the most common and most successful. Arithmetical work involving fractions was weak for a significant number of candidates and many candidates over-complicated the problem by using Pythagoras' theorem to find unnecessary lengths.

**Question 10**

Part (a) was usually answered correctly although there were a few errors seen: $x^4 + 9$ for the expansion and partial or incorrect division being the common ones.

Part (b) was less well done. Some failed to realise that integration was required and others found the equation of a tangent. Those who did integrate sometimes struggled with the negative index and $9x^{-3}$ appeared. Those who successfully integrated sometimes forgot the $+c$ (and lost the final 3 marks) and others couldn't simplify $9x^{-1}$ as it later became $\frac{1}{9x}$. Simple arithmetic let down a few too with $3^3 = 9$ or $9 \times 3^{-1} = 27$ spoiling otherwise promising solutions.

# Statistics for C1 Practice Paper Silver Level S1

| | | | | Mean score for students achieving grade: | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Qu** | **Max score** | **Modal score** | **Mean %** | **ALL** | **A*** | **A** | **B** | **C** | **D** | **E** | **U** |
| **1** | 4 | | 91 | 3.62 | 3.98 | 3.94 | 3.87 | 3.80 | 3.74 | 3.60 | 2.90 |
| **2** | 4 | | 81 | 3.22 | | 3.92 | 3.71 | 3.54 | 3.22 | 2.86 | 1.98 |
| **3** | 6 | | 88 | 5.26 | 5.98 | 5.96 | 5.88 | 5.79 | 5.60 | 5.42 | 4.00 |
| **4** | 10 | | 75 | 7.53 | 9.60 | 9.34 | 8.67 | 8.06 | 7.47 | 6.74 | 4.66 |
| **5** | 6 | | 77 | 4.63 | | 5.82 | 5.41 | 5.13 | 4.61 | 4.09 | 3.05 |
| **6** | 5 | | 80 | 4.00 | 4.97 | 4.91 | 4.81 | 4.61 | 4.22 | 3.74 | 2.36 |
| **7** | 7 | | 78 | 5.49 | | 6.56 | 6.13 | 5.90 | 5.16 | 4.84 | 3.27 |
| **8** | 13 | | 72 | 9.34 | | 12.52 | 11.69 | 10.75 | 9.00 | 7.78 | 4.93 |
| **9** | 12 | 12 | 68 | 8.20 | 10.90 | 10.15 | 9.07 | 8.38 | 7.70 | 6.90 | 4.55 |
| **10** | 8 | | 64 | 5.08 | | 7.37 | 6.30 | 5.38 | 4.28 | 3.41 | 1.69 |
| | **75** | | **75.16** | **56.37** | | **70.49** | **65.54** | **61.34** | **55.00** | **49.38** | **33.39** |