Paper Reference(s)

6664/01

Edexcel GCE

Core Mathematics C2

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 C2), the paper reference (6664), 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 9 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	65	58	51	44	38

1. (a) Find the first four terms, in ascending powers of x, in the bionomial expansion of $(1 + kx)^6$, where k is a non-zero constant.

(3)

Given that, in this expansion, the coefficients of x and x^2 are equal, find

(b) the value of k,

(2)

(c) the coefficient of x^3.

(1)

May 2007

2.

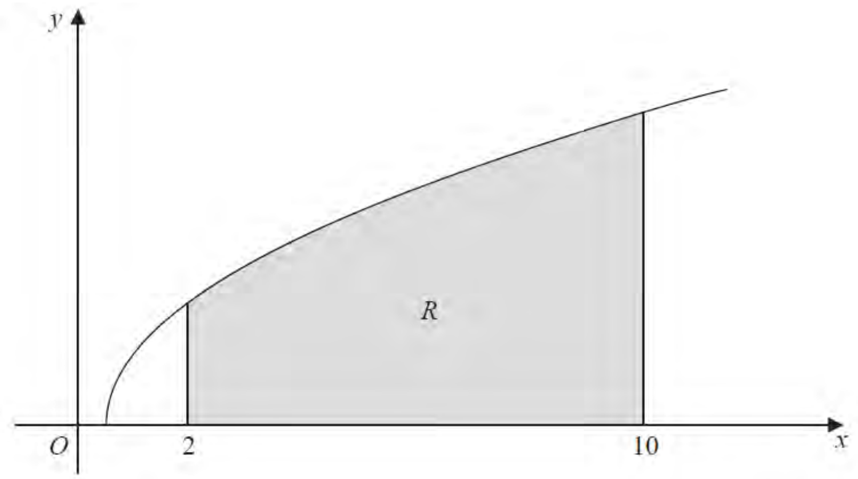

Figure 1

Figure 1 shows a sketch of part of the curve with equation $y = \sqrt{(2x - 1)}$, $x \geq 0.5$.

The finite region R, shown shaded in Figure 1, is bounded by the curve, the x-axis and the lines with equations $x = 2$ and $x = 10$.

The table below shows corresponding values of x and y for $y = \sqrt{(2x - 1)}$.

x	2	4	6	8	10
y	$\sqrt{3}$		$\sqrt{11}$		$\sqrt{19}$

(a) Complete the table with the values of y corresponding to $x = 4$ and $x = 8$.

(1)

(b) Use the trapezium rule, with all the values of y in the completed table, to find an approximate value for the area of R, giving your answer to 2 decimal places.

(3)

(c) State whether your approximate value in part (b) is an overestimate or an underestimate for the area of R.

(1)

May 2014 (R)

3. The circle C has equation

$$x^2 + y^2 + 4x - 2y - 11 = 0.$$

Find

(*a*) the coordinates of the centre of C,

(2)

(*b*) the radius of C,

(2)

(*c*) the coordinates of the points where C crosses the y-axis, giving your answers as simplified surds.

(4)

May 2011

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4. Given that $0 < x < 4$ and

$$\log_5 (4 - x) - 2 \log_5 x = 1,$$

find the value of x.

(6)

January 2009

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5. $f(x) = ax^3 - 11x^2 + bx + 4$, where a and b are constants.

When $f(x)$ is divided by $(x - 3)$ the remainder is 55.

When $f(x)$ is divided by $(x + 1)$ the remainder is -9.

(*a*) Find the value of a and the value of b.

(5)

Given that $(3x + 2)$ is a factor of $f(x)$,

(*b*) factorise $f(x)$ completely.

(4)

May 2013 (R)

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6. The first three terms of a geometric series are $4p$, $(3p + 15)$ and $(5p + 20)$ respectively, where p is a **positive** constant.

(a) Show that $11p^2 - 10p - 225 = 0$.

(4)

(b) Hence show that $p = 5$.

(2)

(c) Find the common ratio of this series.

(2)

(d) Find the sum of the first ten terms of the series, giving your answer to the nearest integer.

(3)

May 2013 (R)

7.

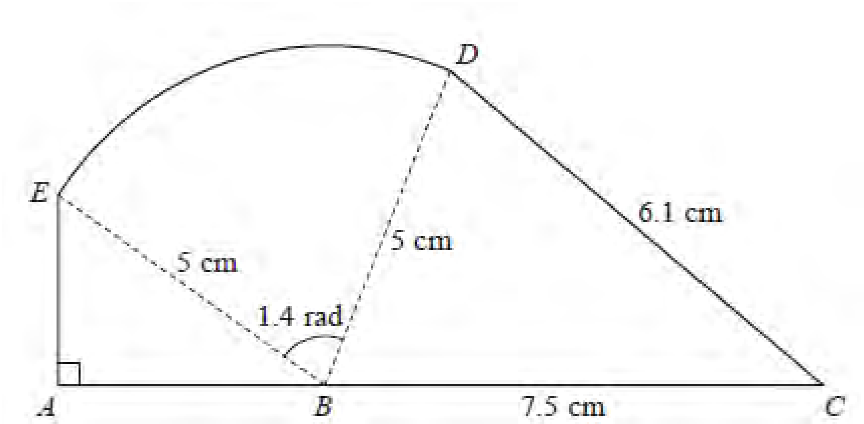

Figure 2

The shape $ABCDEA$, as shown in Figure 2, consists of a right-angled triangle EAB and a triangle DBC joined to a sector BDE of a circle with radius 5 cm and centre B.

The points A, B and C lie on a straight line with BC = 7.5 cm.

Angle $EAB = \dfrac{\pi}{2}$ radians, angle EBD = 1.4 radians and CD = 6.1 cm.

(a) Find, in cm^2, the area of the sector BDE.

(2)

(b) Find the size of the angle DBC, giving your answer in radians to 3 decimal places.

(2)

(c) Find, in cm^2, the area of the shape $ABCDEA$, giving your answer to 3 significant figures.

(5)

May 2014

8.

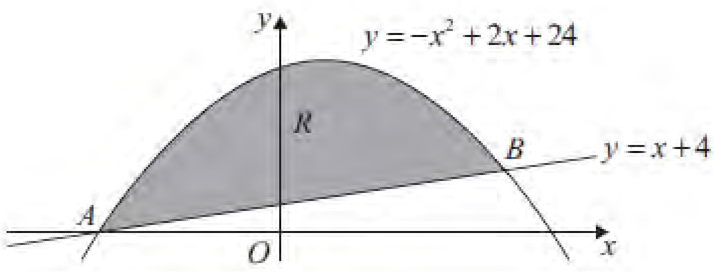

Figure 3

The straight line with equation $y = x + 4$ cuts the curve with equation $y = -x^2 + 2x + 24$ at the points A and B, as shown in Figure 3.

(a) Use algebra to find the coordinates of the points A and B.

(4)

The finite region R is bounded by the straight line and the curve and is shown shaded in Figure 3.

(b) Use calculus to find the exact area of R.

(7)

May 2011

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9. The volume V cm^3 of a box, of height x cm, is given by

$$V = 4x(5 - x)^2, \quad 0 < x < 5.$$

(a) Find $\frac{dV}{dx}$.

(4)

(b) Hence find the maximum volume of the box.

(4)

(c) Use calculus to justify that the volume that you found in part (b) is a maximum.

(2)

January 2011

TOTAL FOR PAPER: 75 MARKS

END

Question number	Scheme	Marks
1 (a)	$1+6kx$ [Allow unsimplified versions, e.g. $1^6+6(1^5)kx$, ${}^6C_0+{}^6C_1kx$]	B1
	$+\frac{6\times5}{2}(kx)^2+\frac{6\times5\times4}{3\times2}(kx)^3$	M1 A1
	N.B. THIS NEED NOT BE SIMPLIFIED FOR THE A1	
	(isw is applied)	
		(3)
(b)	$6k=15k^2 \qquad k=\frac{2}{5}$ (or equiv. fraction, or 0.4)	M1A1cso
	(Ignore $k = 0$, if seen)	
		(2)
(c)	$c=\frac{6\times5\times4}{3\times2}\left(\frac{2}{5}\right)^3=\frac{32}{25}$ (or equiv. fraction, or 1.28)	A1cso
	(Ignore x^3, so $\frac{32}{25}x^3$ is fine)	
		(1)
		[6]
2 (a)	$\sqrt{7}$ and $\sqrt{15}$	B1
		(1)
(b)	$\text{Area}(R)\approx\frac{1}{2}\times2;\times\underline{\left\{\sqrt{3}+2\left(\sqrt{7}+\sqrt{11}+\sqrt{15}\right)+\sqrt{19}\right\}}$	B1; M1
	Note decimal values are	
	$\frac{1}{2}\times2;\times\underline{\left\{\sqrt{3}+\sqrt{19}+2\left(\sqrt{7}+\sqrt{11}+\sqrt{15}\right)\right\}}=\frac{1}{2}\times2;\times\underline{\left\{6.0909..+19.6707...\right\}}$	
	$=1\times25.76166865...\ =\ 25.76166...\ =\ \underline{25.76}$ (2dp)	A1 cao
		(3)
(c)	underestimate	B1
		(1)
		[5]

Question number	Scheme		Marks
3 (a)	$x^2 + y^2 + 4x - 2y - 11 = 0$		
	$\left\{\underline{(x+2)^2 - 4} + \underline{\underline{(y-1)^2}} - 1 - 11 = 0\right\}$	$(\pm 2, \pm 1)$, see notes.	M1
	Centre is $(-2, 1)$.	$(-2, 1)$.	A1 cao
			(2)
(b)	$(x+2)^2 + (y-1)^2 = 11 + 1 + 4$	$r = \sqrt{11 \pm "1" \pm "4"}$	M1
	So $r = \sqrt{11+1+4} \Rightarrow r = 4$	4 or $\sqrt{16}$ (Award A0 for ± 4).	A1
			(2)
(c)	When $x = 0$, $y^2 - 2y - 11 = 0$	Putting $x = 0$ in C or their C.	M1
		$y^2 - 2y - 11 = 0$ or $(y-1)^2 = 12$, etc	A1 aef
	$y = \dfrac{2 \pm \sqrt{(-2)^2 - 4(1)(-11)}}{2(1)}$ $\left\{= \dfrac{2 \pm \sqrt{48}}{2}\right\}$	Attempt to use formula or a method of completing the square in order to find $y = ...$	M1
	So, $y = 1 \pm 2\sqrt{3}$	$1 \pm 2\sqrt{3}$	A1 cao
			(4)
			[8]
4	$2\log_5 x = \log_5\left(x^2\right)$,	$\log_5(4-x) - \log_5(x^2) = \log_5 \dfrac{4-x}{x^2}$	B1, M1
	$\log\left(\dfrac{4-x}{x^2}\right) = \log 5$	$5x^2 + x - 4 = 0$ **or** $5x^2 + x = 4$ **o.e.**	M1 A1
	$(5x-4)(x+1) = 0$ $\quad x = \dfrac{4}{5}$	$(x = -1)$	dM1 A1 **[6]**

Question number	Scheme		Marks
5 (a)	Way 1	Way 2	
	Attempting f(±1) or f(±3)	Divides by (x-3) and reaches remainder or divides by (x+1) and reaches remainder	M1
	Sets f(3)=55 i.e. $27a-99+3b+4=55$	Sets remainder =55 $27a-99+3b+4=55$	A1
	Sets f(-1)=-9 i.e. $-a-11-b+4=-9$	Sets remainder = -9 $-a-11-b+4=-9$	A1
	$a=..../b=....$	$a=..../b=....$	M1
	a = 6 and b = -4		A1cao
			(5)
(b)	$f(x)=(3x+2)(2x^2-5x+2)$ or $(x+\frac{2}{3})(6x^2-15x+6)$		M1 A1
	$=(3x+2)(x-2)(2x-1)$ or $=(3x+2)(2-x)(1-2x)$		M1 A1
			(4)
			[9]
6 (a)	$a=4p$, $ar=(3p+15)$ and $ar^2=5p+20$		B1
	(So $r=$) $\dfrac{5p+20}{3p+15}=\dfrac{3p+15}{4p}$ or $4p(5p+20)=(3p+15)^2$ or equivalent		M1
	See $(3p+15)^2=9p^2+90p+225$		M1
	$20p^2+80p=9p^2+90p+225\rightarrow\ 11p^2-10p-225=0$ *		A1 *
			(4)
(b)	$(p-5)(11p+45)$ so $p=$		M1
	p = 5 only (after rejecting - 45/11)		A1
	<u>N.B. Special case p = 5 can be verified in (b) (1 mark only)</u> $11\times5^2-10\times5-225 \quad =275-50-225=0$ M1A0		**(2)**
(c)	$\dfrac{3\times5+15}{4\times5}$ or $\dfrac{5\times5+20}{3\times5+15}$		M1
	$r=\dfrac{3}{2}$		A1
			(2)
(d)	$S_{10}=\dfrac{20\left(1-\left("\frac{3}{2}"\right)^{10}\right)}{\left(1-"\frac{3}{2}"\right)}$		M1A1ft
	(= 2266.601568…) = 2267		A1
			(3)
			[11]

Question number	Scheme	Marks
7 (a)	Area BDE $=\frac{1}{2}(5)^2(1.4)$ $=17.5\ (\text{cm}^2)$	M1A1
		(2)
(b)	**Parts (b) and (c) can be marked together**	
	$6.1^2 = 5^2+7.5^2-\left(2\times5\times7.5\cos DBC\right)$ or $\cos DBC=\frac{5^2+7.5^2-6.1^2}{2\times5\times7.5}$ (or equivalent)	M1
	Angle $DBC = 0.943201...$ awrt 0.943	A1
		(2)
(c)	**Note that candidates may work in degrees in (c) (**Angle $DBC = 54.04....\text{degrees}$)	
	Area $CBD=\frac{1}{2}5(7.5)\sin(0.943)$	
	Angle $EBA=\pi-1.4-\text{"}0.943\text{"}$ **(Maybe seen on the diagram)** / Area $CBD=\frac{1}{2}5(7.5)\sin(\text{their }0.943)$ or awrt 15.2. (Note area of $CBD=15.177...$) A correct method for the area of triangle CBD which can be implied by awrt 15.2	M1
	$\pi-1.4-\text{"their }0.943\text{"}$	M1
	$AB=5\cos(\pi-1.4-\text{"}0.943\text{"})$ or $AE=5\sin(\pi-1.4-\text{"}0.943\text{"})$	
	$AB=5\cos(\pi-1.4-\text{their }0.943)$ $AB=5\cos(0.79859...)=3.488577938...$ Or $AE=5\sin(\pi-1.4-\text{their }0.943)$ $AE=5\sin(0.79859...)=3.581874365688...$	M1
	Area $EAB=\frac{1}{2}5\cos(\pi-1.4-\text{"}0.943\text{"})\times5\sin(\pi-1.4-\text{"}0.943\text{"})$	dM1
	Area $ABCDE=15.17...+17.5+6.24...=38.92...$	
	awrt 38.9	A1cso
		(5)
		[9]

Question number	Scheme		Marks
8 (a)	Curve: $y = -x^2 + 2x + 24$, Line: $y = x + 4$		
	$\{\text{Curve} = \text{Line}\} \Rightarrow -x^2 + 2x + 24 = x + 4$	Eliminating y correctly.	B1
	$x^2 - x - 20\ \{= 0\} \Rightarrow (x-5)(x+4)\ \{= 0\} \Rightarrow x = .$	Attempt to solve a ***resulting*** quadratic to give x = their values.	M1
	So, $x = 5, -4$	Both $x = 5$ and $x = -4$.	A1
	So corresponding y-values are $y = 9$ and $y = 0.$.		B1ft
			(4)
(b)	$\left\{\int(-x^2 + 2x + 24)\,\mathrm{d}x\right\} = \underline{-\frac{x^3}{3} + \frac{2x^2}{2}} + 24x\ \{+c\}$	M1: $x^n \to x^{n+1}$ for any one term. 1st A1 at least two out of three terms. 2nd A1 for <u>correct answer</u>.	M1A1 A1
	$\left[-\frac{x^3}{3} + \frac{2x^2}{2} + 24x\right]_{-4}^{5} = (......) - (......)$	Substitutes 5 and -4 (or their limits from part(a)) into an "integrated function" and subtracts, either way round.	dM1
	$\left\{\left(-\frac{125}{3} + 25 + 120\right) - \left(\frac{64}{3} + 16 - 96\right) = \left(103\frac{1}{3}\right) - \left(-58\frac{2}{3}\right) = 162\right\}$		
	Area of $\Delta = \frac{1}{2}(9)(9) = 40.5$	Uses correct method for finding area of triangle.	M1
	So area of R is $162 - 40.5 = 121.5$	Area under curve – Area of triangle.	M1
		121.5	A1 oe cao
			(7)
			[11]

Question number	Scheme		Marks
9 (a)	$V = 4x(5-x)^2 = 4x(25-10x+x^2)$		
	$\pm\alpha x \pm \beta x^2 \pm \gamma x^3$, where $\alpha, \beta, \gamma \neq 0$		M1
	So, $V = 100x - 40x^2 + 4x^3$	$V = 100x - 40x^2 + 4x^3$	A1
	$\frac{dV}{dx} = 100 - 80x + 12x^2$	At least two of their expanded terms differentiated correctly.	M1
		$100 - 80x + 12x^2$	A1 cao
			(4)
(b)	$100 - 80x + 12x^2 = 0$	Sets their $\frac{dV}{dx}$ from part (a) $= 0$	M1
	$\{\Rightarrow 4(3x^2 - 20x + 25) = 0 \Rightarrow 4(3x-5)(x-5) = 0\}$		
	$\{\text{As } 0 < x < 5\}\ x = \frac{5}{3}$	$x = \frac{5}{3}$ or $x =$ awrt 1.67	A1
	$x = \frac{5}{3},\ V = 4(\frac{5}{3})(5 - \frac{5}{3})^2$	Substitute candidate's value of x **where** $0 < x < 5$ into a formula for V.	dM1
	So, $V = \frac{2000}{27} = 74\frac{2}{27} = 74.074...$	Either $\frac{2000}{27}$ or $74\frac{2}{27}$ or awrt 74.1	A1
			(4)
(c)	$\frac{d^2V}{dx^2} = -80 + 24x$	Differentiates their $\frac{dV}{dx}$ **correctly** to give $\frac{d^2V}{dx^2}$	M1
	When $x = \frac{5}{3}$, $\frac{d^2V}{dx^2} = -80 + 24\left(\frac{5}{3}\right)$		
	$\frac{d^2V}{dx^2} = -40 < 0 \Rightarrow V$ is a maximum	$\underline{\frac{d^2V}{dx^2} = -40}$ and $\underline{< 0 \text{ or negative}}$ and $\underline{\text{maximum}}$.	A1 cso
			(2)
			[10]

Examiner reports

Question 1

This question was not particularly well answered, many candidates having difficulty coping with the constant k in their binomial expansion. Pascal's Triangle was sometimes used (rather than the binomial expansion formula) in part (a), and while terms did not need to be simplified at this stage, mistakes in simplification frequently spoilt solutions to parts (b) and (c). A very common mistake was to have $kx2$ and $kx3$ rather than $(kx)2$ and $(kx)3$. Candidates who made this mistake often produced $6k = 15k$ in part (b) and were then confused (but often proceeded to obtain non-zero solutions of this equation). The difference between 'coefficients' and 'terms' was not well understood, so $6kx = 15k\ 2\ x2$ was often seen. Sometimes 'recovery' led to the correct answers in parts (b) and (c), but sometimes tried to solve an equation in two unknowns and made no progress.

Question 2

This question was well done by most students. Most errors seen were either bracketing problems or issues finding the value of h. Many who did use an incorrect h often divided by 5 not 4 in finding the width of the strips. As the trapezia were of width two, the multiplying factor outside the bracket was 1. This meant that it was not realistically possible to identify genuine bracketing errors so that expressions such as

$\left(\frac{1}{2}\times 2\right)\times\left(\sqrt{3}+\sqrt{19}\right)+2\left(\sqrt{7}+\sqrt{11}+\sqrt{15}\right)$ or $\left(\frac{1}{2}\times 2\right)\times\sqrt{3}+\sqrt{19}+2\left(\sqrt{7}+\sqrt{11}+\sqrt{15}\right)$

were condoned and it was assumed that students were interpreting the trapezium rule correctly.

Question 3

Most candidates attempted this question with varying degrees of success. Those candidates who completed the square correctly tended to gain full marks in parts (a) and (b). Some candidates who arrived at the correct equation for the circle then gave the coordinates of the centre with the signs the wrong way round i.e. $(2,-1)$.

Some candidates realised that they needed to have $(x + 2)^2$ and $(y - 1)^2$ but failed to subtract a constant term when completing the square. These candidates usually gave $\sqrt{11}$ as the radius. Others added the constants when completing the square and obtained $r = \sqrt{6}$, or did not square the constants and obtained either $r = \sqrt{14}$ or $r = \sqrt{8}$. Some candidates incorrectly squared the 1 from the y bracket to give $1^2 = 2$.

Some candidates failed to complete the square correctly and factorised x and y to get $x(x + 4) + y(y - 2) = 11$ leading to answers of $(-4, 2)$ for centre and $\sqrt{11}$ for radius.

A small minority of candidates who compared $x^2 + y^2 + 4x - 2y - 11 = 0$ with $x^2 + y^2 + 2gx + 2fy + c = 0$ were usually successful in answering parts (a) and (b).

In some instances, part (c) was completed more successfully than parts (a) and (b). A notable number of candidates achieved full marks in (c) by using the equation given on the question paper having gained no marks in parts (a) and (b). Many candidates understood that intersections with the y-axis can be found by substituting $x = 0$, although a significant minority substituted $y = 0$ into their circle equation. When substituting $x = 0$ it was preferable for candidates to use the original form of the equation - thus avoiding any errors they had introduced in manipulation for parts (a) and (b). Those that used the squared form of the equation of the circle on occasion substituted $(x + 2)^2$ as 0 rather than just x.

Many candidates solved the resulting equation either by use of the formula or by completing the square, although a number of those who completed the square omitted one of the two exact solutions. A minority of candidates did not give their answer in a simplified surd form.

A very small minority of candidates attempted part (c) by drawing a diagram showing the circle in relation to the axes, followed by a solution involving Pythagoras.

Question 4
The better candidates produced neat and concise solutions but many candidates seem to have little or no knowledge of the laws of logs. Those who didn't deal with the 2logx term first usually gained no credit.

A significant minority dealt successfully with log theory to arrive at $\log\frac{4-x}{x^2} = 1$ but were let down by basic fraction algebra, "cancelling" to obtain log {4/x} = 1, and even going on "correctly" thereafter to 4/x = 5, x = 4/5!

Another group were unable to proceed from log {(4-x)/x2} = 1, usually just removing the "log" and solving the resulting quadratic. Making the final M mark dependent on the previous two very fairly prevented this spurious solution gaining unwarranted credit.

A few obtained the answer with trial and improvement or merely stated the answer with no working presumably by plugging numbers into their calculator. Neither of these latter methods is expected or intended however.

Question 5
Most candidates used the remainder theorem in part (a). They found f(3) and f(–1) correctly with only a few failing to set these equal to the remainders. $3^3 = 9$ was a relatively common error. Few mistakes were made solving the simultaneous equations.

A few attempted algebraic division as an alternative method, obtaining awkward equations and sometimes making errors, though even this method was usually done correctly.

Provided the values found in (a) were reasonable, factorisation into (quadratic x linear) was generally done well. Many could do this by inspection, some used algebraic division (again, correctly if their coefficients were correct) and synthetic division was quite common, though this latter often led to an incorrect final factorisation as there was confusion over the difference between factorising out $(x + \frac{2}{3})$ and $(3x + 2)$.

Some candidates stopped at (quadratic × linear) without attempting to find the linear factors and some thought they had to show that $(3x + 2)$ was a factor and then often forgot to go on to factorise the cubic at all.

Question 6

Part (a) caused the greatest variety of responses. The most common correct approach was to write the terms as ratios of each other (as in the second line of the mark scheme).This mostly led to the correct answer, with any marks lost being due to slips rather than to errors in the method. Another approach was a multi layered substitution, by squaring the middle term and dividing by the first term and then putting that equal to the third term leading to $4p\left(\frac{3p+15}{4p}\right)^2 = 5p + 20$ which then required more careful algebraic work. The geometric mean method was rarely seen.

Some students also chose to take out the 3 as a common factor on the middle term and the 5 as a common factor of the 3rd term and then manipulated as above. A sizeable minority attempted it incorrectly and then concluded with the final statement and 'hence proved', perhaps hoping that their errors would not be noticed.

In part (b) most were able to solve the quadratic by factorisation and quite a lot by formula, but many lost the second mark for not rejecting the second solution clearly. This was a printed answer.

A small number did it by verification and gained one of the two marks, as they had not shown that 5 was the only value which p could take.

There were no difficulties finding the common ratio in part (c) and it was rare to see the value given as $\frac{2}{3}$ instead of $\frac{3}{2}$ (usually a common error)

The formula for the sum of a geometric series was well applied in part (d) and usually gave the correct answer. A few used $n = 9$ or $n = 20$ or put $a = 5$ leading to errors and some did not give their answer to the nearest integer.

Question 7

Part (a) was well attempted with the majority of students getting the correct answer. Where errors were seen it was commonly the use of $\frac{1}{2}r^2\theta$, $\pi r^2\theta$, or $r\theta$ for the sector area, though occasional miscalculations from a correct formula did occur.

In part (b) most responses correctly used the cosine rule but identification of the correct angle was more problematic. Students sometimes used $\angle BDC$ and others $\angle BCD$. In such cases many students did realise the angle they were finding, and went on to find the area of BCD correctly in part (c), sometimes also recovering 0.943 when they proceeded to find the area of EAB. Truncating too early was not uncommon in such cases.

Where errors in the cosine rule were made it was usually due to mixing up the side lengths. A few students correctly reached the value of cos (DBC) but then failed to use inverse cosine to find the angle. A few instances of sine instead of cosine were seen.

Many students worked in degrees and converted to radians, mostly successfully. A handful of responses rounded to 0.94. Responses where the obtuse angle (2.198…) was found were uncommon. A notable other fairly common incorrect attempt was in assuming $\angle ABE$ was $\frac{\pi}{4}$ and using $\angle DBC = \pi - \frac{\pi}{4} - 1.4$.

In part (c) the area of *BCD* was very well done. A few students incorrectly used 6.1 instead of 7.5. As noted in part (b), there were not infrequent attempts where one of the other angles had been found in part (b) but was used correctly in part (c) for this mark.

The angle $\angle EBA$ was mostly found correctly but some responses used $\frac{\pi}{2}$ or $\frac{\pi}{4}$ or even 2π instead of π. A common error was the assumption that triangle *ABE* was a '3, 4, 5' triangle based on its hypotenuse being 5 cm. Again, some students used degrees and converted to radians but not always correctly. A variety of methods were used to attempt to find the side lengths needed for the area of *EAB* with roughly equal proportions of each. Some found the third angle in the triangle and used the sine rule twice. Some attempted a 'hybrid' solution with a mixture of degrees and radians, with expressions such as $\frac{5}{\sin 90} = \frac{AE}{\sin(0.798...)}$ being used, leading to a common error of EA = 4.004. When this was followed by attempts at Pythagoras then no marks could be gained, though a few students did pick up the method for including $5\sin(\pi - 0.798)$ as part of their expression for the area of *EBA*.

Once the side lengths had been found, most, went on to find the area of *EBA* using a correct method. Errors causing the loss of this mark included use of an incorrect Pythagorean identity to find the third length, mixing degrees and radians (as noted above) and use of area = $b \times h$ for the triangle.

Rounding too early to obtain 39.0 as their final answer caused several students to lose the final accuracy mark. The method marks, however, meant students who made a numerical mistake were not overly penalised.

Question 8

This question was generally well answered by the majority of candidates. In part (a), the vast majority of candidates eliminated y from $y = -x^2 + 2x + 24$ and $y = x + 4$, and solved the resulting equation to find correct x-coordinates of A and B. It was common, however, to see $x = -5$ and $x = 4$ which resulted from incorrect factorisation. Almost all of these candidates found the corresponding y-coordinates by using the equation $y = x + 4$. A less successful method used by a few candidates was to eliminate x. A significant number of candidates only deduced $A(-4, 0)$ by solving $0 = x + 4$. A popular misconception in this part was for candidates to believe that the coordinates were $A(-4, 0)$ and $B(6, 10)$ which were found by solving $0 = -x^2 + 2x + 24$. A small minority of candidates were penalised 2 marks by ignoring the instruction to "use algebra". They usually used a graphical calculator or some form of trial and improvement to find the coordinates of A and B.

The most popular approach in part (b) was to find the area under the curve between $x = -4$ and $x = 5$ and subtract the area of the triangle. Integration and use of limits was usually carried out correctly and many correct solutions were seen. Many candidates stopped after gaining the first four marks in this part, not realising the need to subtract the area of the triangle. Some candidates lost the method mark for limits as they failed to use their x-values from part (a) and proceeded to use the x-intercepts which were calculated by the candidate in part (b).

Candidates either found the area of the triangle by using the formula $\frac{1}{2}$(base)(height) or by integrating $x + 4$ using the limits of $x = -4$ and $x = 5$. Alternatively, in part (b), a significant number of candidates applied the strategy of $\int (-x^2 + 2x + 24) - (x + 4)\, dx$, between their limits found from part (a). Common errors in this approach included subtracting the wrong way round or using incorrect limits or using a bracketing error on the linear expression when applying "curve" – "line".

Question 9

In part (a), most candidates expanded V to obtain a cubic equation of the correct form and then differentiated this to give the correct result. Occasional slips, usually with signs, appeared as did the loss of a term when squaring $(5 - x)^2$. A few candidates attempted to use the product rule but most of them made slips.

In part (b), nearly all candidates were able to put their answer from part (a) equal to 0 and many candidates obtained $x = \frac{5}{3}$ with most of them realising that $x = 5$ was outside the range. Unfortunately a significant number of candidates did not substitute their x-value into an expression for V in order to find the maximum volume. A significant minority of candidates tried to find the value of x which satisfied $\frac{d^2V}{dx^2} = 0$.

In part (c), most candidates knew an appropriate method with almost all opting to find $\frac{d^2V}{dx^2}$. The final mark was often lost, however, due to candidates differentiating an incorrect $\frac{dV}{dx}$ or equating their second differential to zero or failing to evaluate the second differential, and then stating that this was negative which meant that the volume found in part (b) was maximum.

Statistics for C2 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	6		71	4.23		5.75	5.23	4.53	3.69	2.83	1.54
2	5		85.2	4.26	4.96	4.68	4.39	4.08	3.93	3.68	2.62
3	8		59	4.70	7.77	7.25	5.99	4.71	3.46	2.29	0.77
4	6		61	3.66		5.48	4.25	2.77	1.97	1.20	0.63
5	9		91	8.19	9.00	8.89	8.69	7.77	7.61	6.83	4.56
6	11		86	9.44	10.89	10.64	9.91	8.71	8.08	7.40	3.39
7	9		68	6.09	8.57	8.09	7.33	6.55	5.55	4.42	2.18
8	11		72	7.97	10.77	10.39	9.63	8.68	7.39	5.70	2.40
9	10		68	6.81	9.81	9.02	7.27	5.94	4.66	3.68	2.32
	75		**73.80**	**55.35**	**61.77**	**70.19**	**62.69**	**53.74**	**46.34**	**38.03**	**20.41**