Paper Reference(s)

6664

Edexcel GCE

Core Mathematics C2

Advanced Subsidiary

Wednesday 19 January 2005 − Morning

Time: 1 hour 30 minutes

Materials required for examination
Mathematical Formulae (Green)

Items included with question papers
Nil

Candidates may use any calculator EXCEPT those with the facility for symbolic algebra, differentiation and/or integration. Thus candidates may NOT use calculators such as the Texas Instruments TI 89, TI 92, Casio CFX 9970G, Hewlett Packard HP 48G.

Instructions to Candidates

In the boxes on the answer book, 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, other name and signature.
When a calculator is used, the answer should be given to an appropriate degree of accuracy.

Information for Candidates

A booklet 'Mathematical Formulae and Statistical Tables' is provided.
Full marks may be obtained for answers to ALL questions.
This paper has nine questions.
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.

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1. Find the first three terms, in ascending powers of x, of the binomial expansion of $(3 + 2x)^5$, giving each term in its simplest form.

   (4)

2. The points A and B have coordinates $(5, -1)$ and $(13, 11)$ respectively.

   (a) Find the coordinates of the mid-point of AB.

   (2)

   Given that AB is a diameter of the circle C,

   (b) find an equation for C.

   (4)

3. Find, giving your answer to 3 significant figures where appropriate, the value of x for which

   (a) $3^x = 5$,

   (3)

   (b) $\log_2 (2x + 1) - \log_2 x = 2$.

   (4)

4. (a) Show that the equation

   $$5 \cos^2 x = 3(1 + \sin x)$$

   can be written as

   $$5 \sin^2 x + 3 \sin x - 2 = 0.$$

   (2)

   (b) Hence solve, for $0 \le x < 360°$, the equation

   $$5 \cos^2 x = 3(1 + \sin x),$$

   giving your answers to 1 decimal place where appropriate.

   (5)

5. $$f(x) = x^3 - 2x^2 + ax + b, \text{ where } a \text{ and } b \text{ are constants.}$$

When f(x) is divided by ($x - 2$), the remainder is 1.

When f(x) is divided by ($x + 1$), the remainder is 28.

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

(6)

(*b*) Show that ($x - 3$) is a factor of f(x).

(2)

---

6. The second and fourth terms of a geometric series are 7.2 and 5.832 respectively.

The common ratio of the series is positive.

For this series, find

(*a*) the common ratio,

(2)

(*b*) the first term,

(2)

(*c*) the sum of the first 50 terms, giving your answer to 3 decimal places,

(2)

(*d*) the difference between the sum to infinity and the sum of the first 50 terms, giving your answer to 3 decimal places.
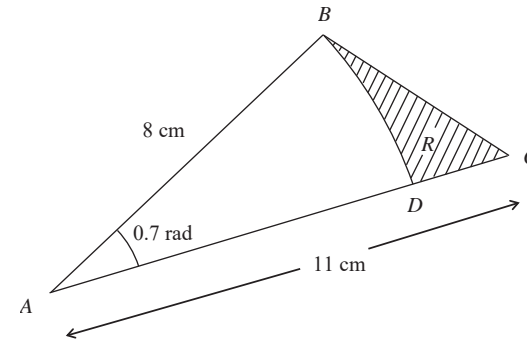
(2)

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7. **Figure 1**

Figure 1 shows the triangle *ABC*, with *AB* = 8 cm, *AC* = 11 cm and $\angle BAC = 0.7$ radians. The arc *BD*, where *D* lies on *AC*, is an arc of a circle with centre *A* and radius 8 cm. The region *R*, shown shaded in Figure 1, is bounded by the straight lines *BC* and *CD* and the arc *BD*.
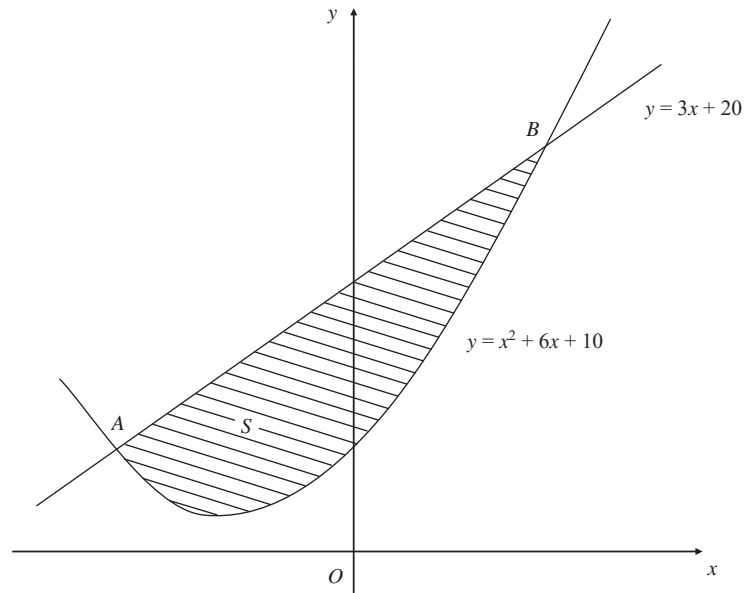
Find

(*a*) the length of the arc *BD*,

(2)

(*b*) the perimeter of *R*, giving your answer to 3 significant figures,

(4)

(*c*) the area of *R*, giving your answer to 3 significant figures.

(5)

8.

Figure 2

The line with equation $y = 3x + 20$ cuts the curve with equation $y = x^2 + 6x + 10$ at the points A and B, as shown in Figure 2.

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

(5)

The shaded region S is bounded by the line and the curve, as shown in Figure 2.

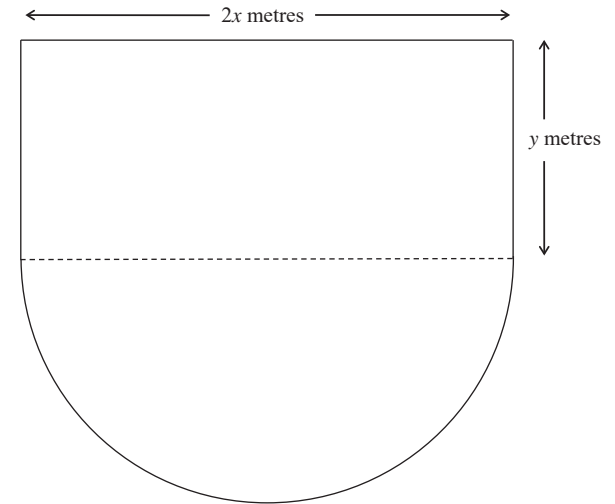(b) Use calculus to find the exact area of S.

(7)

9.

Figure 3

Figure 3 shows the plan of a stage in the shape of a rectangle joined to a semicircle. The length of the rectangular part is $2x$ metres and the width is y metres. The diameter of the semicircular part is $2x$ metres. The perimeter of the stage is 80 m.

(a) Show that the area, A m^2, of the stage is given by

$$A = 80x - \left(2 + \frac{\pi}{2}\right)x^2.$$

(4)

(b) Use calculus to find the value of x at which A has a stationary value.

(4)

(c) Prove that the value of x you found in part (b) gives the maximum value of A.

(2)

(d) Calculate, to the nearest m^2, the maximum area of the stage.

(2)

TOTAL FOR PAPER: 75 MARKS

END

Edexcel GCE

Core Mathematics C2
Advanced Subsidiary

Monday 20 June 2005 − Morning
Time: 1 hour 30 minutes

<u>Materials required for examination</u>	<u>Items included with question papers</u>
Mathematical Formulae (Green)	Nil

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There are 10 questions in this question paper. The total mark for this paper is 75.

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1. Find the coordinates of the stationary point on the curve with equation $y = 2x^2 – 12x$.

   (4)

2. Solve

   (a) $5^x = 8$, giving your answer to 3 significant figures,

   (3)

   (b) $\log_2 (x + 1) – \log_2 x = \log_2 7$.

   (3)

3. (a) Use the factor theorem to show that $(x + 4)$ is a factor of $2x^3 + x^2 – 25x + 12$.

   (2)

   (b) Factorise $2x^3 + x^2 – 25x + 12$ completely.

   (4)

4. (a) Write down the first three terms, in ascending powers of x, of the binomial expansion of $(1 + px)^{12}$, where p is a non-zero constant.

   (2)

   Given that, in the expansion of $(1 + px)^{12}$, the coefficient of x is $(–q)$ and the coefficient of x^2 is $11q$,

   (b) find the value of p and the value of q.

   (4)

5. Solve, for $0 \le x \le 180°$, the equation

   (a) $\sin (x + 10°) = \dfrac{\sqrt{3}}{2}$,

   (4)

   (b) $\cos 2x = –0.9$, giving your answers to 1 decimal place.

   (4)

6. A river, running between parallel banks, is 20 m wide. The depth, y metres, of the river measured at a point x metres from one bank is given by the formula

$$y = \frac{1}{10}x\sqrt{(20 - x)}, \qquad 0 \le x \le 20.$$

(a) Complete the table below, giving values of y to 3 decimal places.

x	0	4	8	12	16	20
y	0		2.771			0

(2)

(b) Use the trapezium rule with all the values in the table to estimate the cross-sectional area of the river.

(4)

Given that the cross-sectional area is constant and that the river is flowing uniformly at 2 m s^{-1},

(c) estimate, in m^3, the volume of water flowing per minute, giving your answer to 3 significant figures.

(2)

7. In the triangle ABC, $AB = 8$ cm, $AC = 7$ cm, $\angle ABC = 0.5$ radians and $\angle ACB = x$ radians.

(a) Use the sine rule to find the value of $\sin x$, giving your answer to 3 decimal places.

(3)

Given that there are two possible values of x,

(b) find these values of x, giving your answers to 2 decimal places.

(3)

8. The circle C, with centre at the point A, has equation $x^2 + y^2 - 10x + 9 = 0$.

Find

(a) the coordinates of A,

(2)

(b) the radius of C,

(2)

(c) the coordinates of the points at which C crosses the x-axis.

(2)

Given that the line l with gradient $\frac{7}{2}$ is a tangent to C, and that l touches C at the point T,

(d) find an equation of the line which passes through A and T.

(3)

9. (a) A geometric series has first term a and common ratio r. Prove that the sum of the first n terms of the series is

$$\frac{a(1 - r^n)}{1 - r}.$$

(4)

Mr King will be paid a salary of £35 000 in the year 2005. Mr King's contract promises a 4% increase in salary every year, the first increase being given in 2006, so that his annual salaries form a geometric sequence.

(b) Find, to the nearest £100, Mr King's salary in the year 2008.

(2)

Mr King will receive a salary each year from 2005 until he retires at the end of 2024.

(c) Find, to the nearest £1000, the total amount of salary he will receive in the period from 2005 until the end of 2024.
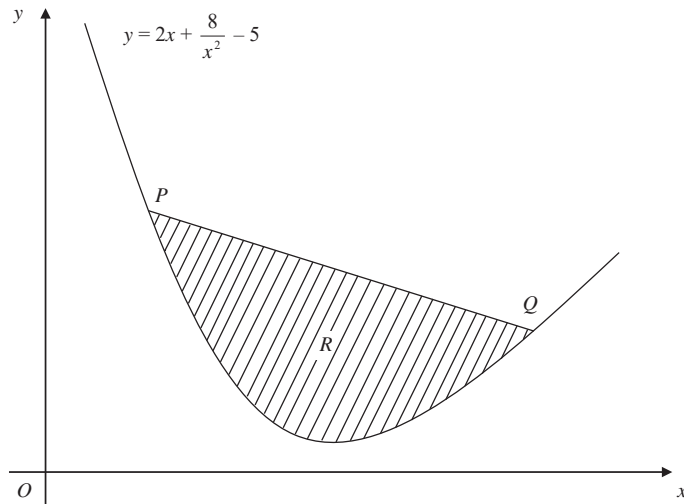
(4)

10.

Figure 1

Figure 1 shows part of a curve C with equation $y = 2x + \dfrac{8}{x^2} - 5$, $x > 0$.

The points P and Q lie on C and have x-coordinates 1 and 4 respectively. The region R, shaded in Figure 1, is bounded by C and the straight line joining P and Q.

(a) Find the exact area of R.

(8)

(b) Use calculus to show that y is increasing for $x > 2$.

(4)

TOTAL FOR PAPER: 75 MARKS

END

Edexcel GCE

Core Mathematics C2

Advanced Subsidiary

Tuesday 10 January 2006 – Afternoon

Time: 1 hour 30 minutes

Materials required for examination	Items included with question papers
Mathematical Formulae (Green)	Nil

Candidates may use any calculator EXCEPT those with the facility for symbolic algebra, differentiation and/or integration. Thus candidates may NOT use calculators such as the Texas Instruments TI 89, TI 92, Casio CFX 9970G, Hewlett Packard HP 48G.

Instructions to Candidates

In the boxes on the answer book, 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, other name and signature.
When a calculator is used, the answer should be given to an appropriate degree of accuracy.

Information for Candidates

A booklet 'Mathematical Formulae and Statistical Tables' is provided.
Full marks may be obtained for answers to ALL questions.
The marks for individual questions and the parts of questions are shown in round brackets: e.g. **(2)**.
There are 9 questions on this 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.

1.

$$f(x) = 2x^3 + x^2 - 5x + c, \text{ where } c \text{ is a constant.}$$

Given that $f(1) = 0$,

(*a*) find the value of c,

(2)

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

(4)

(*c*) find the remainder when $f(x)$ is divided by $(2x - 3)$.

(2)

2. (*a*) Find the first 3 terms, in ascending powers of x, of the binomial expansion of

$$(1 + px)^9,$$

where p is a constant.

(2)

The first 3 terms are 1, $36x$ and qx^2, where q is a constant.

(*b*) Find the value of p and the value of q.

(4)

3. **Figure 1**
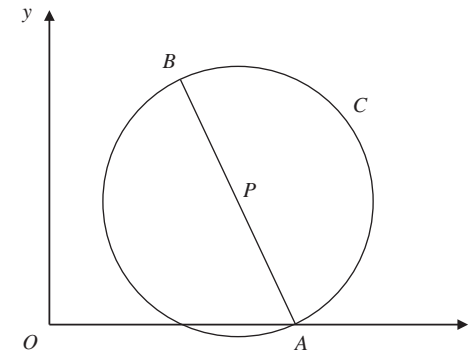
In Figure 1, $A(4, 0)$ and $B(3, 5)$ are the end points of a diameter of the circle C.

Find

(*a*) the exact length of AB,

(2)

(*b*) the coordinates of the midpoint P of AB,

(2)

(*c*) an equation for the circle C.

(3)

4. The first term of a geometric series is 120. The sum to infinity of the series is 480.

(*a*) Show that the common ratio, r, is $\dfrac{3}{4}$.

(3)

(*b*) Find, to 2 decimal places, the difference between the 5th and 6th terms.

(2)

(*c*) Calculate the sum of the first 7 terms.

(2)

The sum of the first n terms of the series is greater than 300.

(*d*) Calculate the smallest possible value of n.

(4)

5.

Figure 2
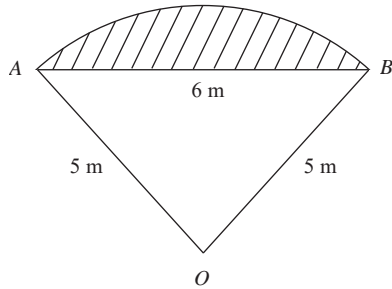
In Figure 2 *OAB* is a sector of a circle, radius 5 m. The chord *AB* is 6 m long.

(*a*) Show that $\cos A\hat{O}B = \dfrac{7}{25}$.

(2)

(*b*) Hence find the angle $A\hat{O}B$ in radians, giving your answer to 3 decimal places.

(1)

(*c*) Calculate the area of the sector *OAB*.

(2)

(*d*) Hence calculate the shaded area.

(3)

---

6. The speed, v m s^{-1}, of a train at time t seconds is given by

$$v = \sqrt{(1.2^t - 1)}, \quad 0 \leq t \leq 30.$$

The following table shows the speed of the train at 5 second intervals.

t	0	5	10	15	20	25	30
v	0	1.22	2.28		6.11		

(*a*) Complete the table, giving the values of v to 2 decimal places.

(3)

The distance, s metres, travelled by the train in 30 seconds is given by

$$s = \int_0^{30} \sqrt{(1.2^t - 1)} \ dt.$$

(*b*) Use the trapezium rule, with all the values from your table, to estimate the value of s.

(3)

---

7. The curve *C* has equation

$$y = 2x^3 - 5x^2 - 4x + 2.$$

(*a*) Find $\dfrac{dy}{dx}$.

(2)

(*b*) Using the result from part (*a*), find the coordinates of the turning points of *C*.

(4)

(*c*) Find $\dfrac{d^2 y}{dx^2}$.

(2)

(*d*) Hence, or otherwise, determine the nature of the turning points of *C*.

(2)

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8. (*a*) Find all the values of θ, to 1 decimal place, in the interval $0° \leq \theta < 360°$ for which

$$5 \sin (\theta + 30°) = 3.$$

(4)

(*b*) Find all the values of θ, to 1 decimal place, in the interval $0° \leq \theta < 360°$ for which

$$\tan^2 \theta = 4.$$
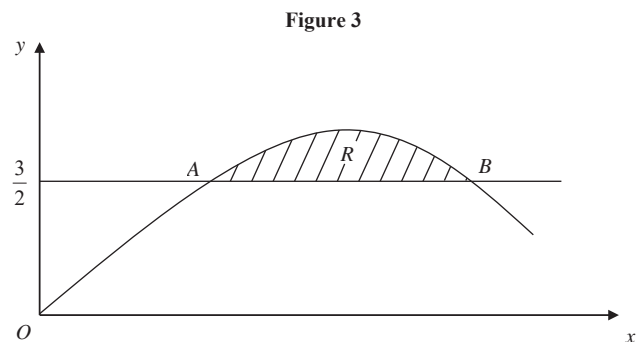
(5)

9.

Figure 3

Figure 3 shows the shaded region R which is bounded by the curve $y = -2x^2 + 4x$ and the line $y = \dfrac{3}{2}$. The points A and B are the points of intersection of the line and the curve.

Find

(*a*) the x-coordinates of the points A and B,

(4)

(*b*) the exact area of R.

(6)

TOTAL FOR PAPER: 75 MARKS

END

Edexcel GCE
Core Mathematics C2
Advanced Subsidiary

Monday 22 May 2006 – Morning
Time: 1 hour 30 minutes

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Instructions to Candidates

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1. Find the first 3 terms, in ascending powers of x, of the binomial expansion of $(2 + x)^6$, giving each term in its simplest form.

(4)

2. Use calculus to find the exact value of $\int_{1}^{2}\left(3x^2 + 5 + \dfrac{4}{x^2}\right) dx$.

(5)

3. (i) Write down the value of $\log_6 36$.

(1)

(ii) Express $2 \log_a 3 + \log_a 11$ as a single logarithm to base a.

(3)

4. $$f(x) = 2x^3 + 3x^2 - 29x - 60.$$

(a) Find the remainder when $f(x)$ is divided by $(x + 2)$.

(2)

(b) Use the factor theorem to show that $(x + 3)$ is a factor of $f(x)$.

(2)

(c) Factorise $f(x)$ completely.

(4)

5. (a) Sketch the graph of $y = 3^x$, $x \in \mathbb{R}$, showing the coordinates of the point at which the graph meets the y-axis.

(2)

(b) Copy and complete the table, giving the values of 3^x to 3 decimal places.

x	0	0.2	0.4	0.6	0.8	1
3^x		1.246	1.552			3

(2)

(c) Use the trapezium rule, with all the values from your tables, to find an approximation for the value of $\int_{0}^{1} 3^x \ dx$.

(4)

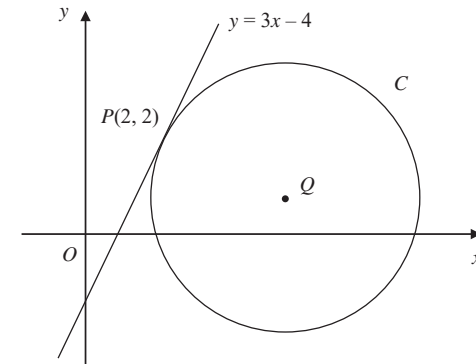6. (a) Given that $\sin \theta = 5 \cos \theta$, find the value of $\tan \theta$.

(1)

(b) Hence, or otherwise, find the values of θ in the interval $0 \leq \theta < 360°$ for which

$$\sin \theta = 5 \cos \theta,$$

giving your answers to 1 decimal place.

(3)

7.

Figure 1

The line $y = 3x - 4$ is a tangent to the circle C, touching C at the point P(2, 2), as shown in Figure 1.

The point Q is the centre of C.

(a) Find an equation of the straight line through P and Q.

(3)

Given that Q lies on the line $y = 1$,

(b) show that the x-coordinate of Q is 5,

(1)

(c) find an equation for C.
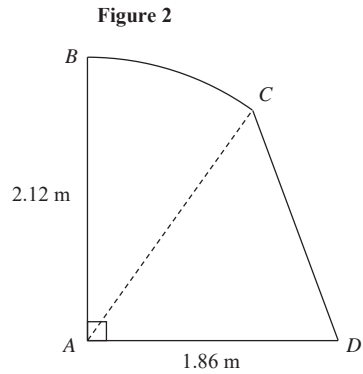
(4)

8.

Figure 2

Figure 2 shows the cross-section *ABCD* of a small shed.

The straight line *AB* is vertical and has length 2.12 m.

The straight line *AD* is horizontal and has length 1.86 m.

The curve *BC* is an arc of a circle with centre *A*, and *CD* is a straight line.

Given that the size of ∠*BAC* is 0.65 radians, find

(*a*) the length of the arc *BC*, in m, to 2 decimal places,

(2)

(*b*) the area of the sector *BAC*, in m², to 2 decimal places,

(2)

(*c*) the size of ∠*CAD*, in radians, to 2 decimal places,

(2)

(*d*) the area of the cross-section *ABCD* of the shed, in m², to 2 decimal places.

(3)

9. A geometric series has first term *a* and common ratio *r*. The second term of the series is 4 and the sum to infinity of the series is 25.

(*a*) Show that $25r^2 - 25r + 4 = 0$.

(4)

(*b*) Find the two possible values of *r*.

(2)

(*c*) Find the corresponding two possible values of *a*.

(2)

(*d*) Show that the sum, S_n, of the first *n* terms of the series is given by

$$S_n = 25(1 - r^n).$$

(1)

Given that *r* takes the larger of its two possible values,

(*e*) find the smallest value of *n* for which S_n exceeds 24.
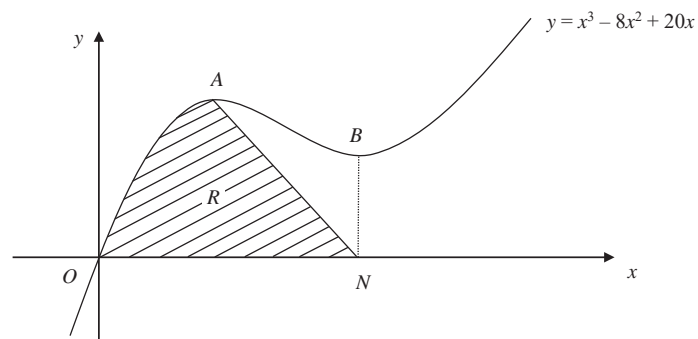
(2)

10.

Figure 3

Figure 3 shows a sketch of part of the curve with equation $y = x^3 - 8x^2 + 20x$. The curve has stationary points A and B.

(*a*) Use calculus to find the *x*-coordinates of *A* and *B*.

(4)

(*b*) Find the value of $\dfrac{d^2 y}{dx^2}$ at *A*, and hence verify that *A* is a maximum.

(2)

The line through *B* parallel to the *y*-axis meets the *x*-axis at the point *N*. The region *R*, shown shaded in Figure 3, is bounded by the curve, the *x*-axis and the line from *A* to *N*.

(*c*) Find $\displaystyle\int (x^3 - 8x^2 + 20x)\ dx$.

(3)

(*d*) Hence calculate the exact area of *R*.

(5)

TOTAL FOR PAPER: 75 MARKS

END

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Core Mathematics C2
Advanced Subsidiary

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1.
$$f(x) = x^3 + 3x^2 + 5.$$

Find

(a) f''(x),

(3)

(b) $\displaystyle\int_1^2 f(x) \ dx$.

(4)

2. (a) Find the first 4 terms, in ascending powers of x, of the binomial expansion of $(1 - 2x)^5$. Give each term in its simplest form.

(4)

(b) If x is small, so that x^2 and higher powers can be ignored, show that

$$(1 + x)(1 - 2x)^5 \approx 1 - 9x.$$

(2)

3. The line joining points $(-1, 4)$ and $(3, 6)$ is a diameter of the circle C.

Find an equation for C.

(6)

4. Solve the equation $5^x = 17$, giving your answer to 3 significant figures.

(3)

5.
$$f(x) = x^3 + 4x^2 + x - 6.$$

(a) Use the factor theorem to show that $(x + 2)$ is a factor of f(x).

(2)

(b) Factorise f(x) completely.

(4)

(c) Write down all the solutions to the equation

$$x^3 + 4x^2 + x - 6 = 0.$$

(1)

6. Find all the solutions, in the interval $0 \le x < 2\pi$, of the equation

$$2 \cos^2 x + 1 = 5 \sin x,$$

giving each solution in terms of π.
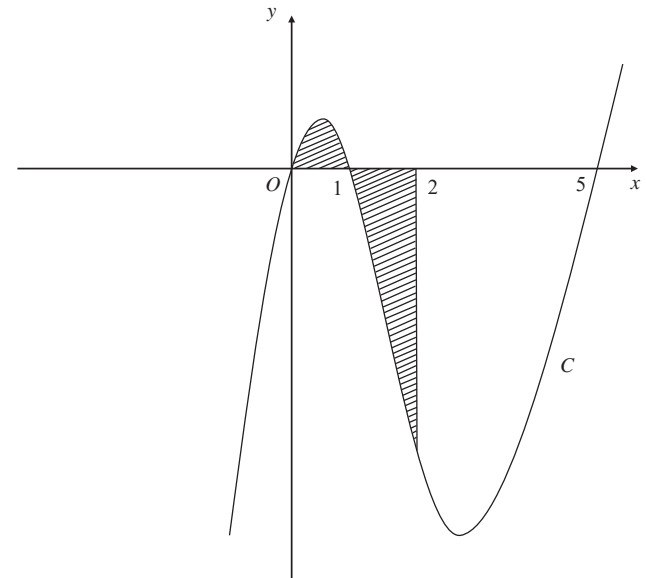
(6)

7.

Figure 1

Figure 1 shows a sketch of part of the curve C with equation

$$y = x(x - 1)(x - 5).$$

Use calculus to find the total area of the finite region, shown shaded in Figure 1, that is between $x = 0$ and $x = 2$ and is bounded by C, the x-axis and the line $x = 2$.

(9)

8. A diesel lorry is driven from Birmingham to Bury at a steady speed of v kilometres per hour. The total cost of the journey, £C, is given by

$$C = \frac{1400}{v} + \frac{2v}{7}.$$

(*a*) Find the value of v for which C is a minimum.

(5)

(*b*) Find $\dfrac{\mathrm{d}^2 C}{\mathrm{d}v^2}$ and hence verify that C is a minimum for this value of v.

(2)

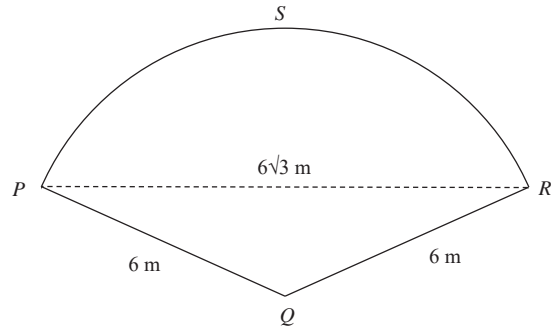(*c*) Calculate the minimum total cost of the journey.

(2)

9.

Figure 2

Figure 2 shows a plan of a patio. The patio *PQRS* is in the shape of a sector of a circle with centre *Q* and radius 6 m.

Given that the length of the straight line *PR* is 6√3 m,

(*a*) find the exact size of angle *PQR* in radians.

(3)

(*b*) Show that the area of the patio *PQRS* is $12\pi\,\mathrm{m}^2$.

(2)

(*c*) Find the exact area of the triangle *PQR*.

(2)

(*d*) Find, in m² to 1 decimal place, the area of the segment *PRS*.

(2)

(*e*) Find, in m to 1 decimal place, the perimeter of the patio *PQRS*.

(2)

10. A geometric series is $a + ar + ar^2 + \ldots$

(*a*) Prove that the sum of the first n terms of this series is given by

$$S_n = \frac{a(1 - r^n)}{1 - r}.$$

(4)

(*b*) Find

$$\sum_{k=1}^{10} 100(2^k).$$

(3)

(*c*) Find the sum to infinity of the geometric series

$$\frac{5}{6} + \frac{5}{18} + \frac{5}{54} + \ldots$$

(3)

(*d*) State the condition for an infinite geometric series with common ratio r to be convergent.

(1)

TOTAL FOR PAPER: 75 MARKS

END

Edexcel GCE

Core Mathematics C2

Advanced Subsidiary Level

Monday 21 May 2007 – Morning
Time: 1 hour 30 minutes

Materials required for examination	**Items included with question papers**
Mathematical Formulae (Green)	Nil

Candidates may use any calculator EXCEPT those with the facility for symbolic algebra, differentiation and/or integration. Thus candidates may NOT use calculators such as the Texas Instruments TI 89, TI 92, Casio CFX 9970G, Hewlett Packard HP 48G.

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 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.

1. Evaluate $\int_1^8 \dfrac{1}{\sqrt{x}}\, dx$, giving your answer in the form $a + b\sqrt{2}$, where a and b are integers.

   (4)

2. $$f(x) = 3x^3 - 5x^2 - 16x + 12.$$

   (a) Find the remainder when $f(x)$ is divided by $(x - 2)$.

   (2)

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

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

   (4)

3. (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)

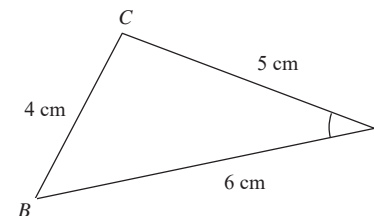   (c) the coefficient of x^3.

   (1)

4.

Figure 1

Figure 1 shows the triangle ABC, with $AB = 6$ cm, $BC = 4$ cm and $CA = 5$ cm.

   (a) Show that $\cos A = \frac{3}{4}$.

   (3)

   (b) Hence, or otherwise, find the exact value of $\sin A$.

   (2)

5. The curve C has equation

$$y = x\sqrt{(x^3 + 1)}, \qquad 0 \leq x \leq 2.$$

(a) Copy and complete the table below, giving the values of y to 3 decimal places at $x = 1$ and $x = 1.5$.

x	0	0.5	1	1.5	2
y	0	0.530			6

(2)

(b) Use the trapezium rule, with all the y values from your table, to find an approximation for the value of $\displaystyle\int_0^2 x\sqrt{(x^3 + 1)} \ dx$, giving your answer to 3 significant figures.
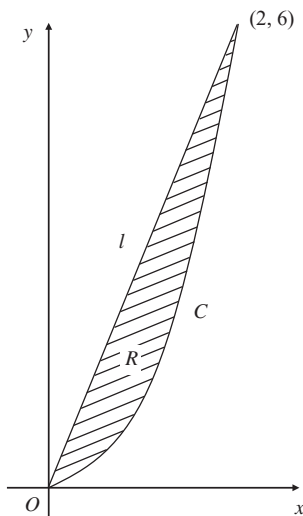
(4)

Figure 2

Figure 2 shows the curve C with equation $y = x\sqrt{(x^3 + 1)}$, $0 \leq x \leq 2$, and the straight line segment l, which joins the origin and the point (2, 6). The finite region R is bounded by C and l.

(c) Use your answer to part (b) to find an approximation for the area of R, giving your answer to 3 significant figures.

(3)

6. (a) Find, to 3 significant figures, the value of x for which $8^x = 0.8$.

(2)

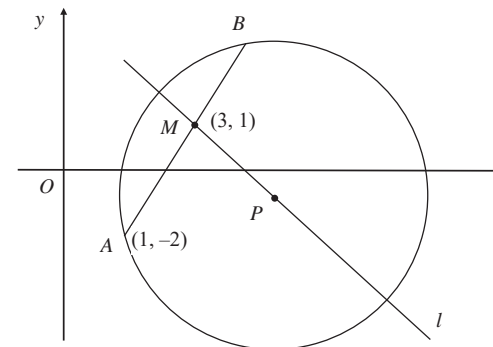(b) Solve the equation

$$2 \log_3 x - \log_3 7x = 1.$$

(4)

7.

Figure 3

The points A and B lie on a circle with centre P, as shown in Figure 3.
The point A has coordinates (1, –2) and the mid-point M of AB has coordinates (3, 1).
The line l passes through the points M and P.

(a) Find an equation for l.

(4)

Given that the x-coordinate of P is 6,

(b) use your answer to part (a) to show that the y-coordinate of P is –1,

(1)

(c) find an equation for the circle.

(4)

8. A trading company made a profit of £50 000 in 2006 (Year 1).

A model for future trading predicts that profits will increase year by year in a geometric sequence with common ratio r, $r > 1$.

The model therefore predicts that in 2007 (Year 2) a profit of £50 000r will be made.

(*a*) Write down an expression for the predicted profit in Year n.

(1)

The model predicts that in Year n, the profit made will exceed £200 000.

(*b*) Show that $n > \dfrac{\log 4}{\log r} + 1$.

(3)

Using the model with $r = 1.09$,

(*c*) find the year in which the profit made will first exceed £200 000,

(2)

(*d*) find the total of the profits that will be made by the company over the 10 years from 2006 to 2015 inclusive, giving your answer to the nearest £10 000.

(3)

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9. (*a*) Sketch, for $0 \leq x \leq 2\pi$, the graph of $y = \sin\left(x + \dfrac{\pi}{6}\right)$.

(2)

(*b*) Write down the exact coordinates of the points where the graph meets the coordinate axes.

(3)

(*c*) Solve, for $0 \leq x \leq 2\pi$, the equation

$$\sin\left(x + \dfrac{\pi}{6}\right) = 0.65,$$
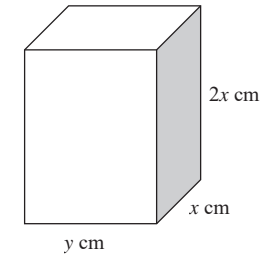
giving your answers in radians to 2 decimal places.

(5)

10.

Figure 4

Figure 4 shows a solid brick in the shape of a cuboid measuring $2x$ cm by x cm by y cm.

The total surface area of the brick is 600 cm^2.

(*a*) Show that the volume, V cm^3, of the brick is given by

$$V = 200x - \frac{4x^3}{3}.$$

(4)

Given that x can vary,

(*b*) use calculus to find the maximum value of V, giving your answer to the nearest cm^3.

(5)

(*c*) Justify that the value of V you have found is a maximum.

(2)

TOTAL FOR PAPER: 75 MARKS

END

Edexcel GCE

Core Mathematics C2
Advanced Subsidiary

Wednesday 9 January 2008 – Afternoon
Time: 1 hour 30 minutes

Materials required for examination	Items included with question papers
Mathematical Formulae (Green)	Nil

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The marks for individual questions and the parts of questions are shown in round brackets: e.g. **(2)**.
There are 9 questions in this question paper. The total mark for this paper is 75.

Advice to Candidates

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1. (a) Find the remainder when

$$x^3 - 2x^2 - 4x + 8$$

is divided by

(i) $x - 3$,

(ii) $x + 2$.

(3)

(b) Hence, or otherwise, find all the solutions to the equation

$$x^3 - 2x^2 - 4x + 8 = 0.$$

(4)

---

2. The fourth term of a geometric series is 10 and the seventh term of the series is 80.

For this series, find

(a) the common ratio,

(2)

(b) the first term,

(2)

(c) the sum of the first 20 terms, giving your answer to the nearest whole number.

(2)

---

3. (a) Find the first 4 terms of the expansion of $\left(1 + \dfrac{x}{2}\right)^{10}$ in ascending powers of x, giving each term in its simplest form.

(4)

(b) Use your expansion to estimate the value of $(1.005)^{10}$, giving your answer to 5 decimal places.

(3)

4. (*a*) Show that the equation

$$3 \sin^2 \theta - 2 \cos^2 \theta = 1$$

can be written as

$$5 \sin^2 \theta = 3.$$

(2)

(*b*) Hence solve, for $0° \leq \theta < 360°$, the equation

$$3 \sin^2 \theta - 2 \cos^2 \theta = 1,$$

giving your answer to 1 decimal place.

(7)

5. Given that *a* and *b* are positive constants, solve the simultaneous equations

$$a = 3b,$$

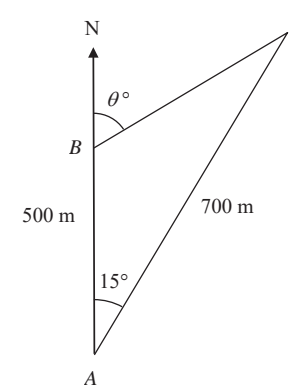$$\log_3 a + \log_3 b = 2.$$

Give your answers as exact numbers.

(6)

6. **Figure 1**

Figure 1 shows 3 yachts *A*, *B* and *C* which are assumed to be in the same horizontal plane. Yacht *B* is 500 m due north of yacht *A* and yacht *C* is 700 m from *A*. The bearing of *C* from *A* is 015°.

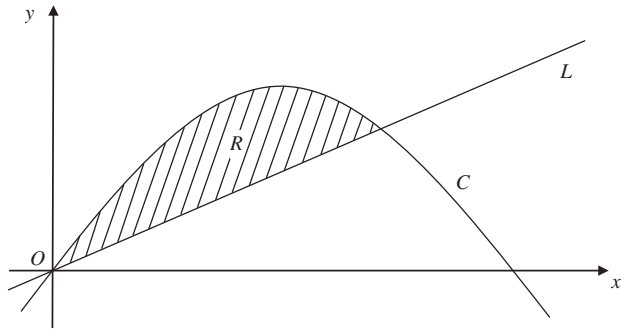(*a*) Calculate the distance between yacht *B* and yacht *C*, in metres to 3 significant figures.

(3)

The bearing of yacht *C* from yacht *B* is $\theta°$, as shown in Figure 1.

(*b*) Calculate the value of θ.

(4)

7.

Figure 2

In Figure 2 the curve *C* has equation $y = 6x - x^2$ and the line *L* has equation $y = 2x$.

(*a*) Show that the curve *C* intersects with the *x*-axis at $x = 0$ and $x = 6$.

(1)

(*b*) Show that the line *L* intersects the curve *C* at the points (0, 0) and (4, 8).

(3)

The region *R*, bounded by the curve *C* and the line *L*, is shown shaded in Figure 2.

(*c*) Use calculus to find the area of *R*.

(6)

8. A circle *C* has centre *M*(6, 4) and radius 3.

(*a*) Write down the equation of the circle in the form

$$(x - a)^2 + (y - b)^2 = r^2.$$
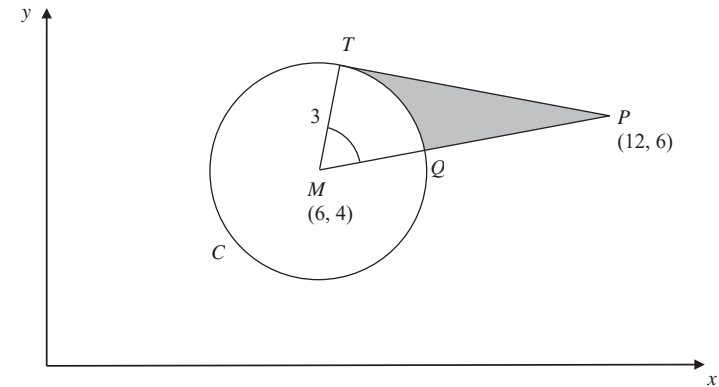
(2)

Figure 3

Figure 3 shows the circle *C*. The point *T* lies on the circle and the tangent at *T* passes through the point *P*(12, 6). The line *MP* cuts the circle at *Q*.

(*b*) Show that the angle *TMQ* is 1.0766 radians to 4 decimal places.

(4)

The shaded region *TPQ* is bounded by the straight lines *TP*, *QP* and the arc *TQ*, as shown in Figure 3.

(*c*) Find the area of the shaded region *TPQ*. Give your answer to 3 decimal places.
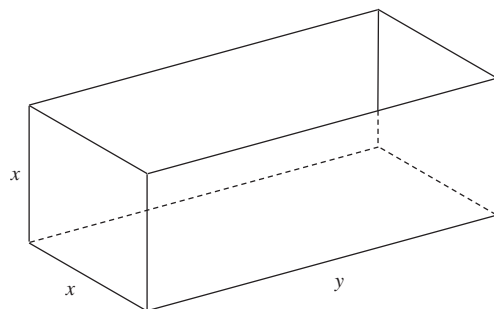
(5)

9.

Figure 4

Figure 4 shows an open-topped water tank, in the shape of a cuboid, which is made of sheet metal. The base of the tank is a rectangle x metres by y metres. The height of the tank is x metres.

The capacity of the tank is 100 m^3.

(*a*) Show that the area A m^2 of the sheet metal used to make the tank is given by

$$A = \frac{300}{x} + 2x^2.$$

(4)

(*b*) Use calculus to find the value of x for which A is stationary.

(4)

(*c*) Prove that this value of x gives a minimum value of A.

(2)

(*d*) Calculate the minimum area of sheet metal needed to make the tank.

(2)

TOTAL FOR PAPER: 75 MARKS

END

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Advice to Candidates

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Answers without working may not gain full credit.

1.
$$f(x) = 2x^3 - 3x^2 - 39x + 20$$

(a) Use the factor theorem to show that $(x + 4)$ is a factor of f (x).

(2)

(b) Factorise f (x) completely.

(4)

2.
$$y = \sqrt{(5^x + 2)}$$

(a) Copy and complete the table below, giving the values of y to 3 decimal places.

x	0	0.5	1	1.5	2
y			2.646	3.630	

(2)

(b) Use the trapezium rule, with all the values of y from your table, to find an approximation for the value of $\displaystyle\int_0^2 \sqrt{(5^x + 2)} \; dx$.

(4)

3. (a) Find the first 4 terms, in ascending powers of x, of the binomial expansion of $(1 + ax)^{10}$, where a is a non-zero constant. Give each term in its simplest form.

(4)

Given that, in this expansion, the coefficient of x^3 is double the coefficient of x^2,

(b) find the value of a.

(2)

4. (a) Find, to 3 significant figures, the value of x for which $5^x = 7$.

(2)

(b) Solve the equation $5^{2x} - 12(5^x) + 35 = 0$.

(4)

5. The circle C has centre (3, 1) and passes through the point $P(8, 3)$.

(a) Find an equation for C.

(4)

(b) Find an equation for the tangent to C at P, giving your answer in the form $ax + by + c = 0$, where a, b and c are integers.

(5)

6. A geometric series has first term 5 and common ratio $\dfrac{4}{5}$.

Calculate

(a) the 20th term of the series, to 3 decimal places,

(2)

(b) the sum to infinity of the series.

(2)

Given that the sum to k terms of the series is greater than 24.95,

(c) show that $k > \dfrac{\log 0.002}{\log 0.8}$,

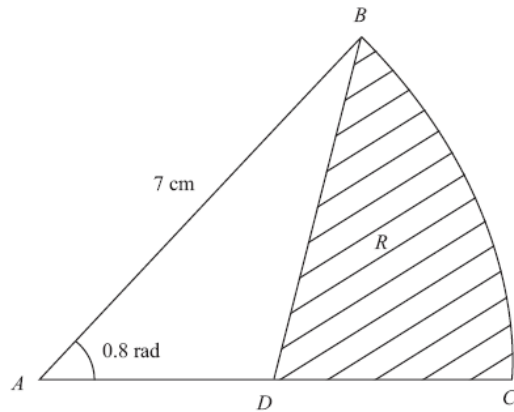**(4)**

(d) find the smallest possible value of k.

(1)

7.

Figure 1

Figure 1 shows *ABC*, a sector of a circle with centre *A* and radius 7 cm.

Given that the size of ∠*BAC* is exactly 0.8 radians, find

(*a*) the length of the arc *BC*,

(2)

(*b*) the area of the sector *ABC*.

(2)

The point *D* is the mid-point of *AC*. The region *R*, shown shaded in Figure 1, is bounded by *CD*, *DB* and the arc *BC*.

Find

(*c*) the perimeter of *R*, giving your answer to 3 significant figures,

(4)

(*d*) the area of *R*, giving your answer to 3 significant figures.
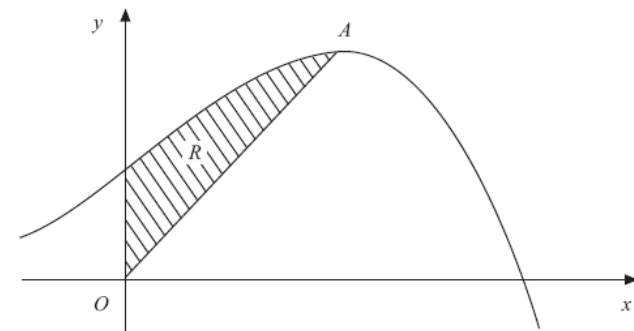
(4)

8.

Figure 2

Figure 2 shows a sketch of part of the curve with equation $y = 10 + 8x + x^2 - x^3$.

The curve has a maximum turning point *A*.

(*a*) Using calculus, show that the *x*-coordinate of *A* is 2.

(3)

The region *R*, shown shaded in Figure 2, is bounded by the curve, the *y*-axis and the line from *O* to *A*, where *O* is the origin.

(*b*) Using calculus, find the exact area of *R*.

(8)

9. Solve, for $0 \le x < 360°$,

(*a*) $\sin(x - 20°) = \dfrac{1}{\sqrt{2}}$,

(4)

(*b*) $\cos 3x = -\dfrac{1}{2}$.

(6)

TOTAL FOR PAPER: 75 MARKS

END

Edexcel GCE

Core Mathematics C2

Advanced Subsidiary

Friday 9 January 2009 − Morning

Time: 1 hour 30 minutes

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---

1. Find the first 3 terms, in ascending powers of x, of the binomial expansion of $(3 - 2x)^5$, giving each term in its simplest form.
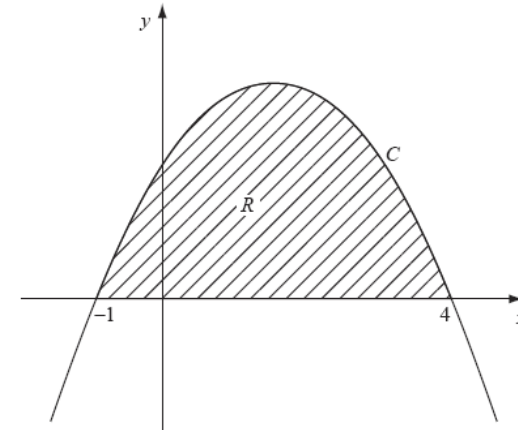
(4)

2.

Figure 1

Figure 1 shows part of the curve C with equation $y = (1 + x)(4 - x)$.

The curve intersects the x-axis at $x = -1$ and $x = 4$. The region R, shown shaded in Figure 1, is bounded by C and the x-axis.

Use calculus to find the exact area of R.

(5)

3.

$$y = \sqrt{(10x - x^2)}.$$

(*a*) Copy and complete the table below, giving the values of *y* to 2 decimal places.

x	1	1.4	1.8	2.2	2.6	3
y	3	3.47			4.39	

(2)

(*b*) Use the trapezium rule, with all the values of *y* from your table, to find an approximation for

the value of $\displaystyle\int_{1}^{3} \sqrt{(10x - x^2)} \ dx$.

(4)

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

$$\log_5 (4 - x) - 2 \log_5 x = 1,$$
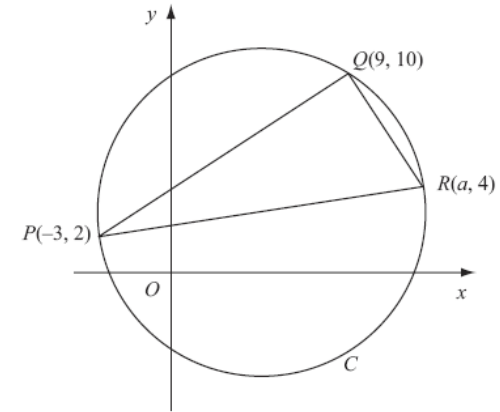
find the value of *x*.

(6)

5.

Figure 2

The points $P(-3, 2)$, $Q(9, 10)$ and $R(a, 4)$ lie on the circle *C*, as shown in Figure 2.

Given that *PR* is a diameter of *C*,

(*a*) show that $a = 13$,

(3)

(*b*) find an equation for *C*.

(5)

6.

$$f(x) = x^4 + 5x^3 + ax + b,$$

where *a* and *b* are constants.

The remainder when f(*x*) is divided by $(x - 2)$ is equal to the remainder when f(*x*) is divided by $(x + 1)$.

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

(5)

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

(*b*) find the value of *b*.

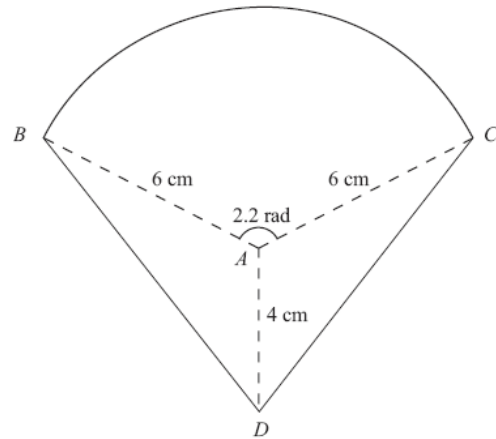**(3)**

7.

Figure 3

The shape *BCD* shown in Figure 3 is a design for a logo.

The straight lines *DB* and *DC* are equal in length. The curve *BC* is an arc of a circle with centre *A* and radius 6 cm. The size of ∠*BAC* is 2.2 radians and *AD* = 4 cm.

Find

(*a*) the area of the sector *BAC*, in cm²,

(2)

(*b*) the size of ∠*DAC*, in radians to 3 significant figures,

(2)

(*c*) the complete area of the logo design, to the nearest cm².

(4)

8. (*a*) Show that the equation

$$4 \sin^2 x + 9 \cos x - 6 = 0$$

can be written as

$$4 \cos^2 x - 9 \cos x + 2 = 0.$$

(2)

(*b*) Hence solve, for $0 \le x < 720°$,

$$4 \sin^2 x + 9 \cos x - 6 = 0,$$

giving your answers to 1 decimal place.

(6)

9. The first three terms of a geometric series are $(k + 4)$, k and $(2k - 15)$ respectively, where k is a positive constant.

(*a*) Show that $k^2 - 7k - 60 = 0$.

(4)

(*b*) Hence show that $k = 12$.

(2)

(*c*) Find the common ratio of this series.

(2)

(*d*) Find the sum to infinity of this series.

(2)

10. A solid right circular cylinder has radius *r* cm and height *h* cm.

The total surface area of the cylinder is 800 cm² .

(*a*) Show that the volume, V cm³ , of the cylinder is given by

$$V = 400r - \pi r^3.$$

(4)

Given that *r* varies,

(*b*) use calculus to find the maximum value of *V*, to the nearest cm³.

(6)

(*c*) Justify that the value of *V* you have found is a maximum.

(2)

TOTAL FOR PAPER: 75 MARKS

END

Paper Reference(s)

6664/01

Edexcel GCE

Core Mathematics C2

Advanced Subsidiary

Friday 5 June 2009 − Afternoon

Time: 1 hour 30 minutes

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1. Use calculus to find the value of

$$\int_1^4 (2x + 3\sqrt{x})\ dx.$$

(5)

2. (*a*) Find the first 3 terms, in ascending powers of *x*, of the binomial expansion of

$$(2 + kx)^7$$

where *k* is a constant. Give each term in its simplest form.

(4)

Given that the coefficient of x^2 is 6 times the coefficient of *x*,

(*b*) find the value of *k*.

(2)

3. $$f(x) = (3x - 2)(x - k) - 8$$

where *k* is a constant.

(*a*) Write down the value of f(*k*).

(1)

When f(*x*) is divided by (*x* − 2) the remainder is 4.

(*b*) Find the value of *k*.

(2)

(*c*) Factorise f (*x*) completely.

(3)

4. (*a*) Complete the table below, giving values of $\sqrt{(2^x + 1)}$ to 3 decimal places.

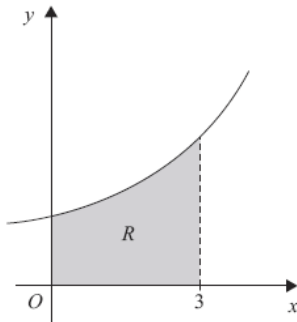| x	0	0.5	1	1.5	2	2.5	3
$\sqrt{(2^x + 1)}$	1.414	1.554	1.732	1.957			3

(2)

Figure 1

Figure 1 shows the region R which is bounded by the curve with equation $y = \sqrt{(2^x + 1)}$, the x-axis and the lines $x = 0$ and $x = 3$

(*b*) Use the trapezium rule, with all the values from your table, to find an approximation for the area of R.

(4)

(*c*) By reference to the curve in Figure 1 state, giving a reason, whether your approximation in part (*b*) is an overestimate or an underestimate for the area of R.

(2)

5. The third term of a geometric sequence is 324 and the sixth term is 96.

(*a*) Show that the common ratio of the sequence is $\dfrac{2}{3}$.

(2)

(*b*) Find the first term of the sequence.

(2)

(*c*) Find the sum of the first 15 terms of the sequence.

(3)

(*d*) Find the sum to infinity of the sequence.

(2)

6. The circle C has equation

$$x^2 + y^2 - 6x + 4y = 12$$

(*a*) Find the centre and the radius of C.

(5)

The point $P(-1, 1)$ and the point $Q(7, -5)$ both lie on C.

(*b*) Show that PQ is a diameter of C.

(2)

The point R lies on the positive y-axis and the angle $PRQ = 90°$.

(*c*) Find the coordinates of R.

(4)

7. (i) Solve, for $-180° \leq \theta < 180°$,

$$(1 + \tan \theta)(5 \sin \theta - 2) = 0.$$

(4)

(ii) Solve, for $0 \leq x < 360°$,

$$4 \sin x = 3 \tan x.$$

(6)

8. (*a*) Find the value of *y* such that

$$\log_2 y = -3.$$

(2)

(*b*) Find the values of *x* such that

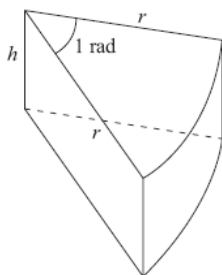$$\frac{\log_2 32 + \log_2 16}{\log_2 x} = \log_2 x.$$

(5)

9.

Figure 2

Figure 2 shows a closed box used by a shop for packing pieces of cake. The box is a right prism of height *h* cm. The cross section is a sector of a circle. The sector has radius *r* cm and angle 1 radian.

The volume of the box is 300 cm³.

(*a*) Show that the surface area of the box, *S* cm², is given by

$$S = r^2 + \frac{1800}{r}.$$

(5)

(*b*) Use calculus to find the value of *r* for which *S* is stationary.

(4)

(*c*) Prove that this value of *r* gives a minimum value of *S*.

(2)

(*d*) Find, to the nearest cm², this minimum value of *S*.

(2)

TOTAL FOR PAPER: 75 MARKS

END

H34263A

5

Paper Reference(s)

6664/01

Edexcel GCE

Core Mathematics C2

Advanced Subsidiary

Monday 11 January 2010 – Morning

Time: 1 hour 30 minutes

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 or integration, or have retrievable mathematical formulae 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.
The marks for the parts of questions are shown in round brackets, e.g. **(2)**.
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 not gain full credit.

1. Find the first 3 terms, in ascending powers of x, of the binomial expansion of

$$(3 - x)^6$$

and simplify each term.

(4)

2. (*a*) Show that the equation

$$5 \sin x = 1 + 2 \cos^2 x$$

can be written in the form

$$2 \sin^2 x + 5 \sin x - 3 = 0.$$

(2)

(*b*) Solve, for $0 \le x < 360°$,

$$2 \sin^2 x + 5 \sin x - 3 = 0.$$

(4)

3.

$$f(x) = 2x^3 + ax^2 + bx - 6,$$

where a and b are constants.

When $f(x)$ is divided by $(2x - 1)$ the remainder is –5.

When $f(x)$ is divided by $(x + 2)$ there is no remainder.

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

(6)

(*b*) Factorise $f(x)$ completely.
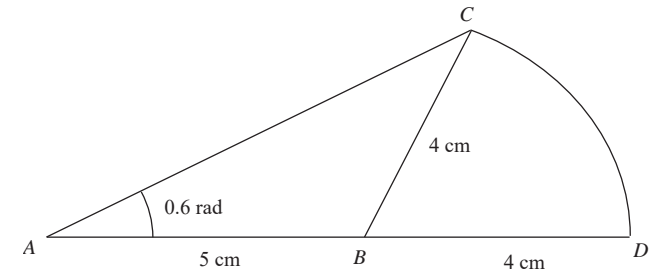
(3)

4.

Figure 1

An emblem, as shown in Figure 1, consists of a triangle *ABC* joined to a sector *CBD* of a circle with radius 4 cm and centre *B*. The points *A*, *B* and *D* lie on a straight line with *AB* = 5 cm and *BD* = 4 cm. Angle *BAC* = 0.6 radians and *AC* is the longest side of the triangle *ABC*.

(*a*) Show that angle *ABC* = 1.76 radians, correct to three significant figures.

(4)

(*b*) Find the area of the emblem.

(3)

5. (*a*) Find the positive value of x such that

$$\log_x 64 = 2.$$

(2)

(*b*) Solve for x

$$\log_2 (11 - 6x) = 2 \log_2 (x - 1) + 3.$$

(6)

6. A car was purchased for £18 000 on 1st January.

On 1st January each following year, the value of the car is 80% of its value on 1st January in the previous year.

(*a*) Show that the value of the car exactly 3 years after it was purchased is £9216.

(1)

The value of the car falls below £1000 for the first time *n* years after it was purchased.

(*b*) Find the value of *n*.

(3)

An insurance company has a scheme to cover the cost of maintenance of the car. The cost is £200 for the first year, and for every following year the cost increases by 12% so that for the 3rd year the cost of the scheme is £250.88.

(*c*) Find the cost of the scheme for the 5th year, giving your answer to the nearest penny.

(2)

(*d*) Find the total cost of the insurance scheme for the first 15 years.
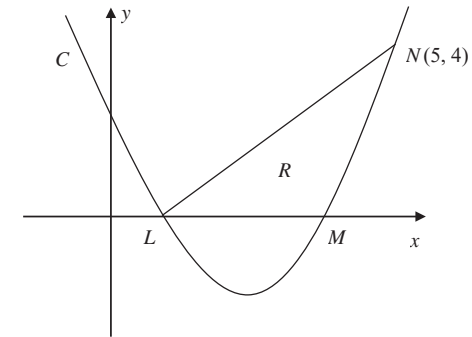
(3)

7.

Figure 2

The curve *C* has equation $y = x^2 - 5x + 4$. It cuts the *x*-axis at the points *L* and *M* as shown in Figure 2.

(*a*) Find the coordinates of the point *L* and the point *M*.

(2)

(*b*) Show that the point *N*(5, 4) lies on *C*.

(1)

(*c*) Find $\int (x^2 - 5x + 4)\ dx$.

(2)

The finite region *R* is bounded by *LN*, *LM* and the curve *C* as shown in Figure 2.

(*d*) Use your answer to part (*c*) to find the exact value of the area of *R*.
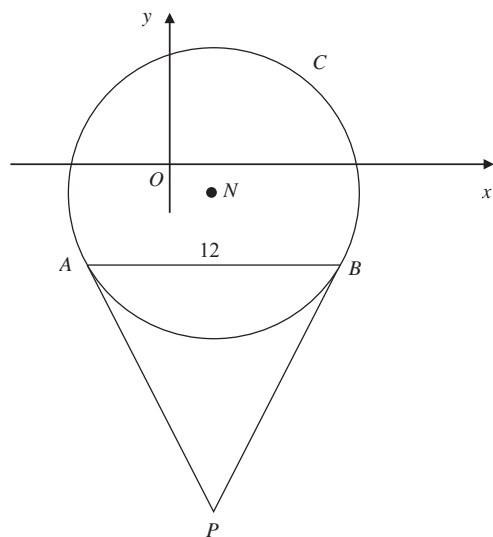
(5)

8.

Figure 3

Figure 3 shows a sketch of the circle C with centre N and equation

$$(x-2)^2 + (y+1)^2 = \frac{169}{4}.$$

(*a*) Write down the coordinates of N.

(2)

(*b*) Find the radius of C.

(1)

The chord AB of C is parallel to the x-axis, lies below the x-axis and is of length 12 units as shown in Figure 3.

(*c*) Find the coordinates of A and the coordinates of B.

(5)

(*d*) Show that angle $ANB = 134.8°$, to the nearest 0.1 of a degree.

(2)

The tangents to C at the points A and B meet at the point P.

(*e*) Find the length AP, giving your answer to 3 significant figures.

(2)

9. The curve C has equation $y = 12\sqrt{(x)} - x^{\frac{3}{2}} - 10$, $x > 0$.

(*a*) Use calculus to find the coordinates of the turning point on C.

(7)

(*b*) Find $\dfrac{d^2 y}{dx^2}$.

(2)

(*c*) State the nature of the turning point.

(1)

TOTAL FOR PAPER: 75 MARKS

END

Edexcel GCE

Core Mathematics C2

Advanced Subsidiary

Wednesday 9 June 2010 − Afternoon

Time: 1 hour 30 minutes

Materials required for examination	**Items included with question papers**
Mathematical Formulae (Pink)	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

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Information for Candidates

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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 not gain full credit.

1.
$$y = 3^x + 2x.$$

(*a*) Complete the table below, giving the values of *y* to 2 decimal places.

x	0	0.2	0.4	0.6	0.8	1
y	1	1.65				5

(2)

(*b*) Use the trapezium rule, with all the values of *y* from your table, to find an approximate value for $\int_0^1 (3^x + 2x) \ dx$.

(4)

2.
$$f(x) = 3x^3 - 5x^2 - 58x + 40.$$

(*a*) Find the remainder when f (*x*) is divided by (*x* − 3) .

(2)

Given that (*x* − 5) is a factor of f(*x*) ,

(*b*) find all the solutions of f(*x*) = 0 .

(5)

3.
$$y = x^2 - k\sqrt{x}, \quad \text{where } k \text{ is a constant.}$$

(*a*) Find $\dfrac{dy}{dx}$.

(2)

(*b*) Given that *y* is decreasing at *x* = 4 , find the set of possible values of *k*.

(2)

---

4. (*a*) Find the first 4 terms, in ascending powers of *x*, of the binomial expansion of $(1 + ax)^7$, where *a* is a constant. Give each term in its simplest form.

(4)

Given that the coefficient of x^2 in this expansion is 525,

(*b*) find the possible values of *a*.

(2)

5. (a) Given that $5 \sin \theta = 2 \cos \theta$, find the value of $\tan \theta$.

(1)

(b) Solve, for $0 \le x < 360°$,

$$5 \sin 2x = 2 \cos 2x,$$
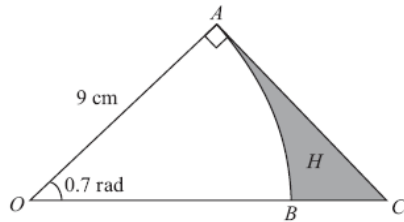
giving your answers to 1 decimal place.

(5)

6.

Figure 1

Figure 1 shows the sector *OAB* of a circle with centre *O*, radius 9 cm and angle 0.7 radians.

(a) Find the length of the arc *AB*.

(2)

(b) Find the area of the sector *OAB*.

(2)

The line *AC* shown in Figure 1 is perpendicular to *OA*, and *OBC* is a straight line.

(c) Find the length of *AC*, giving your answer to 2 decimal places.

(2)

The region *H* is bounded by the arc *AB* and the lines *AC* and *CB*.

(d) Find the area of *H*, giving your answer to 2 decimal places.

(3)

7. (a) Given that

$$2 \log_3 (x - 5) - \log_3 (2x - 13) = 1,$$

show that $x^2 - 16x + 64 = 0$.

(5)

(b) Hence, or otherwise, solve $2 \log_3 (x - 5) - \log_3 (2x - 13) = 1$.

(2)
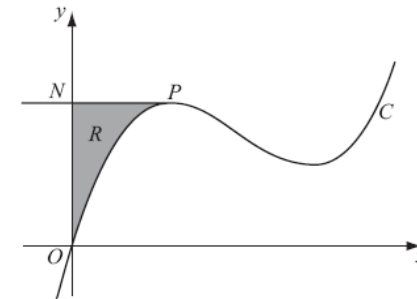
8.

Figure 2

Figure 2 shows a sketch of part of the curve *C* with equation

$$y = x^3 - 10x^2 + kx,$$

where *k* is a constant.

The point *P* on *C* is the maximum turning point.

Given that the *x*-coordinate of *P* is 2,

(a) show that $k = 28$.

(3)

The line through *P* parallel to the *x*-axis cuts the *y*-axis at the point *N*.
The region *R* is bounded by *C*, the *y*-axis and *PN*, as shown shaded in Figure 2.

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

(6)

9. The adult population of a town is 25 000 at the end of Year 1.

A model predicts that the adult population of the town will increase by 3% each year, forming a geometric sequence.

(*a*) Show that the predicted adult population at the end of Year 2 is 25 750.

(1)

(*b*) Write down the common ratio of the geometric sequence.

(1)

The model predicts that Year N will be the first year in which the adult population of the town exceeds 40 000.

(*c*) Show that

$$(N-1) \log 1.03 > \log 1.6$$

(3)

(*d*) Find the value of N.

(2)

At the end of each year, each member of the adult population of the town will give £1 to a charity fund.

Assuming the population model,

(*e*) find the total amount that will be given to the charity fund for the 10 years from the end of Year 1 to the end of Year 10, giving your answer to the nearest £1000.

(3)

10. The circle C has centre $A(2,1)$ and passes through the point $B(10, 7)$.

(*a*) Find an equation for C.

(4)

The line l_1 is the tangent to C at the point B.

(*b*) Find an equation for l_1.

(4)

The line l_2 is parallel to l_1 and passes through the mid-point of AB.

Given that l_2 intersects C at the points P and Q,

(*c*) find the length of PQ, giving your answer in its simplest surd form.

(3)

TOTAL FOR PAPER: 75 MARKS

END

Paper Reference(s)

6664/01

Edexcel GCE

Core Mathematics C2

Advanced Subsidiary

Monday 10 January 2011 – Morning

Time: 1 hour 30 minutes

Materials required for examination	**Items included with question papers**
Mathematical Formulae (Pink)	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 or integration, or have retrievable mathematical formulae stored in them.

Instructions to Candidates

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The marks for the parts of questions are shown in round brackets, e.g. **(2)**.
There are 10 questions in this question paper. The total mark for this paper is 75.

Advice to Candidates

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You must show sufficient working to make your methods clear to the Examiner.
Answers without working may not gain full credit.

1. $$f(x) = x^4 + x^3 + 2x^2 + ax + b,$$

    where a and b are constants.

    When $f(x)$ is divided by $(x - 1)$, the remainder is 7.

    (a) Show that $a + b = 3$.

    (2)

    When $f(x)$ is divided by $(x + 2)$, the remainder is –8.

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

    (5)

2. In the triangle ABC, $AB = 11$ cm, $BC = 7$ cm and $CA = 8$ cm.

    (a) Find the size of angle C, giving your answer in radians to 3 significant figures.

    (3)

    (b) Find the area of triangle ABC, giving your answer in cm^2 to 3 significant figures.

    (3)

3. The second and fifth terms of a geometric series are 750 and –6 respectively.

    Find

    (a) the common ratio of the series,

    (3)

    (b) the first term of the series,

    (2)

    (c) the sum to infinity of the series.
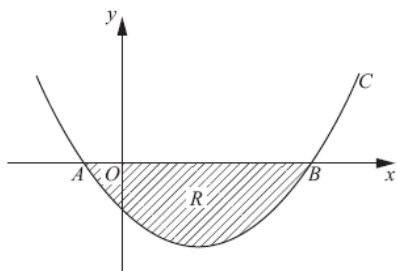
    (2)

4.

Figure 1

Figure 1 shows a sketch of part of the curve C with equation

$$y = (x + 1)(x - 5).$$

The curve crosses the x-axis at the points A and B.

(*a*) Write down the x-coordinates of A and B.

(1)

The finite region R, shown shaded in Figure 1, is bounded by C and the x-axis.

(*b*) Use integration to find the area of R.

(6)

5. Given that $\begin{pmatrix} 40 \\ 4 \end{pmatrix} = \dfrac{40!}{4! b!}$,

(*a*) write down the value of b.

(1)

In the binomial expansion of $(1 + x)^{40}$, the coefficients of x^4 and x^5 are p and q respectively.

(*b*) Find the value of $\dfrac{q}{p}$.

(3)

6.

$$y = \frac{5}{3x^2 - 2}$$

(*a*) Copy and complete the table below, giving the values of y to 2 decimal places.

x	2	2.25	2.5	2.75	3
y	0.5	0.38			0.2

(2)

(*b*) Use the trapezium rule, with all the values of y from your table, to find an approximate value

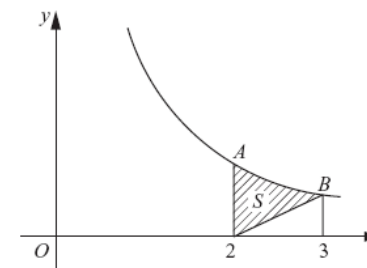for $\displaystyle\int_2^3 \frac{5}{3x^2 - 2}\, dx$.

(4)

Figure 2

Figure 2 shows a sketch of part of the curve with equation $y = \dfrac{5}{3x^2 - 2}$, $x > 1$.

At the points A and B on the curve, $x = 2$ and $x = 3$ respectively.

The region S is bounded by the curve, the straight line through B and $(2, 0)$, and the line through A parallel to the y-axis. The region S is shown shaded in Figure 2.

(*c*) Use your answer to part (*b*) to find an approximate value for the area of S.

(3)

7. (*a*) Show that the equation

$$3 \sin^2 x + 7 \sin x = \cos^2 x - 4$$

can be written in the form

$$4 \sin^2 x + 7 \sin x + 3 = 0.$$

(2)

(*b*) Hence solve, for $0 \le x < 360°$,

$$3 \sin^2 x + 7 \sin x = \cos^2 x - 4$$

giving your answers to 1 decimal place where appropriate.

(5)

8. (*a*) Sketch the graph of $y = 7^x$, $x \in \mathbb{R}$, showing the coordinates of any points at which the graph crosses the axes.

(2)

(*b*) Solve the equation

$$7^{2x} - 4(7^x) + 3 = 0,$$

giving your answers to 2 decimal places where appropriate.

(6)

9. The points *A* and *B* have coordinates (–2, 11) and (8, 1) respectively.

Given that *AB* is a diameter of the circle *C*,

(*a*) show that the centre of *C* has coordinates (3, 6),

(1)

(*b*) find an equation for *C*.

(4)

(*c*) Verify that the point (10, 7) lies on *C*.

(1)

(*d*) Find an equation of the tangent to *C* at the point (10, 7), giving your answer in the form $y = mx + c$, where *m* and *c* are constants.

(4)

10. The volume V cm³ of a box, of height x cm, is given by

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

(*a*) Find $\dfrac{\mathrm{d}V}{\mathrm{d}x}$.

(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)

TOTAL FOR PAPER: 75 MARKS

END

Core Mathematics C2

Advanced Subsidiary

Thursday 26 May 2011 – Morning

Time: 1 hour 30 minutes

Materials required for examination	**Items included with question papers**
Mathematical Formulae (Pink)	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 formulae stored in them..

Instructions to Candidates

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Advice to Candidates

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Answers without working may not gain full credit.

---

1. $$f(x) = 2x^3 - 7x^2 - 5x + 4$$

(*a*) Find the remainder when f(x) is divided by $(x - 1)$.

(2)

(*b*) Use the factor theorem to show that $(x + 1)$ is a factor of f(x).

(2)

(*c*) Factorise f(x) completely.

(4)

---

2.   (*a*) Find the first 3 terms, in ascending powers of x, of the binomial expansion of

$$(3 + bx)^5$$

where b is a non-zero constant. Give each term in its simplest form.

(4)

Given that, in this expansion, the coefficient of x^2 is twice the coefficient of x,

(*b*) find the value of b.

(2)

---

3.   Find, giving your answer to 3 significant figures where appropriate, the value of x for which

(*a*) $5^x = 10$,

(2)

(*b*) $\log_3 (x - 2) = -1$.

(2)

---

4.   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.
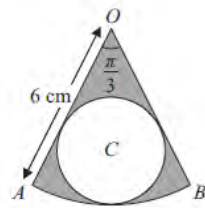
(4)

5.

Figure 1

The shape shown in Figure 1 is a pattern for a pendant. It consists of a sector OAB of a circle centre O, of radius 6 cm, and angle $AOB = \dfrac{\pi}{3}$. The circle C, inside the sector, touches the two straight edges, OA and OB, and the arc AB as shown.

Find

(a) the area of the sector OAB,

(2)

(b) the radius of the circle C.

(3)

The region outside the circle C and inside the sector OAB is shown shaded in Figure 1.

(c) Find the area of the shaded region.

(2)

---

6. The second and third terms of a geometric series are 192 and 144 respectively.

For this series, find

(a) the common ratio,

(2)

(b) the first term,

(2)

(c) the sum to infinity,

(2)

(d) the smallest value of n for which the sum of the first n terms of the series exceeds 1000.

(4)

---

7. (a) Solve for $0 \le x < 360°$, giving your answers in degrees to 1 decimal place,

$$3 \sin (x + 45°) = 2.$$

(4)

(b) Find, for $0 \le x < 2\pi$, all the solutions of

$$2 \sin^2 x + 2 = 7\cos x,$$

giving your answers in radians.

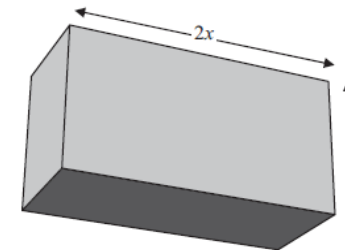You must show clearly how you obtained your answers.

(6)

8.

Figure 2

A cuboid has a rectangular cross-section where the length of the rectangle is equal to twice its width, x cm, as shown in Figure 2.

The volume of the cuboid is 81 cubic centimetres.

(a) Show that the total length, L cm, of the twelve edges of the cuboid is given by

$$L = 12x + \frac{162}{x^2}.$$

(3)

(b) Use calculus to find the minimum value of L.

(6)

(c) Justify, by further differentiation, that the value of L that you have found is a minimum.
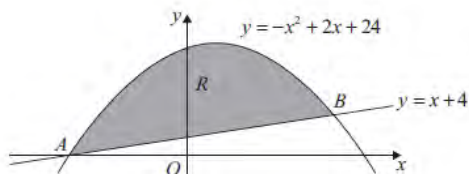
(2)

9.

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)

TOTAL FOR PAPER: 75 MARKS

END

Edexcel GCE

Core Mathematics C2

Advanced Subsidiary

Friday 13 January 2012 – Morning

Time: 1 hour 30 minutes

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 or integration, or have retrievable mathematical formulae stored in them.

Instructions to Candidates

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There are 9 questions in this question paper. The total mark for this paper is 75.

Advice to Candidates

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Answers without working may not gain full credit.

1. A geometric series has first term $a = 360$ and common ratio $r = \dfrac{7}{8}$.

   Giving your answers to 3 significant figures where appropriate, find

   (a) the 20th term of the series,

   (2)

   (b) the sum of the first 20 terms of the series,

   (2)

   (c) the sum to infinity of the series.

   (2)

2. A circle C has centre $(-1, 7)$ and passes through the point $(0, 0)$. Find an equation for C.

   (4)

3. (a) Find the first 4 terms of the binomial expansion, in ascending powers of x, of

   $$\left(1 + \frac{x}{4}\right)^8,$$

   giving each term in its simplest form.

   (4)

   (b) Use your expansion to estimate the value of $(1.025)^8$, giving your answer to 4 decimal places.

   (3)

4. Given that $y = 3x^2$,

   (a) show that $\log_3 y = 1 + 2 \log_3 x$.

   (3)

   (b) Hence, or otherwise, solve the equation

   $$1 + 2 \log_3 x = \log_3 (28x - 9).$$

   (3)

5. $$f(x) = x^3 + ax^2 + bx + 3, \text{ where } a \text{ and } b \text{ are constants.}$$

   Given that when $f(x)$ is divided by $(x + 2)$ the remainder is 7,

   (a) show that $2a - b = 6$.

   (2)

   Given also that when $f(x)$ is divided by $(x - 1)$ the remainder is 4,

   (b) find the value of a and the value of b.
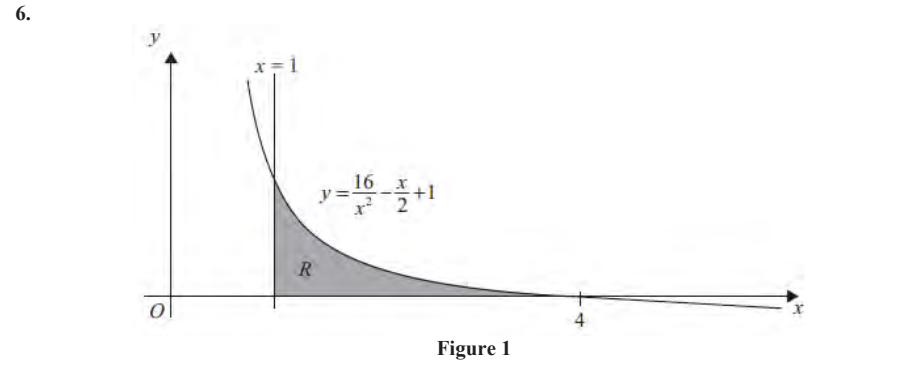
   (4)

6.

Figure 1

   Figure 1 shows the graph of the curve with equation

   $$y = \frac{16}{x^2} - \frac{x}{2} + 1, \qquad x > 0.$$

   The finite region R, bounded by the lines $x = 1$, the x-axis and the curve, is shown shaded in Figure 1. The curve crosses the x-axis at the point $(4, 0)$.

   (a) Complete the table with the values of y corresponding to $x = 2$ and 2.5.

x	1	1.5	2	2.5	3	3.5	4
y	16.5	7.361			1.278	0.556	0

   (2)

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

   (4)

   (c) Use integration to find the exact value for the area of R.
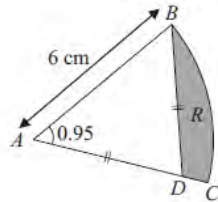
   (5)

7.

Figure 2

Figure 2 shows *ABC*, a sector of a circle of radius 6 cm with centre *A*. Given that the size of angle *BAC* is 0.95 radians, find

(*a*) the length of the arc *BC*,

(2)

(*b*) the area of the sector *ABC*.

(2)

The point *D* lies on the line *AC* and is such that *AD* = *BD*. The region *R*, shown shaded in Figure 2, is bounded by the lines *CD*, *DB* and the arc *BC*.

(*c*) Show that the length of *AD* is 5.16 cm to 3 significant figures.

(2)

Find

(*d*) the perimeter of *R*,

(2)

(*e*) the area of *R*, giving your answer to 2 significant figures.

(4)

8.
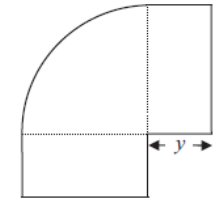
Figure 3

Figure 3 shows a flowerbed. Its shape is a quarter of a circle of radius *x* metres with two equal rectangles attached to it along its radii. Each rectangle has length equal to *x* metres and width equal to *y* metres.

Given that the area of the flowerbed is 4m²,

(*a*) show that

$$y = \frac{16 - \pi x^2}{8x}.$$

(3)

(*b*) Hence show that the perimeter *P* metres of the flowerbed is given by the equation

$$P = \frac{8}{x} + 2x.$$

(3)

(*c*) Use calculus to find the minimum value of *P*.

(5)

(*d*) Find the width of each rectangle when the perimeter is a minimum. Give your answer to the nearest centimetre.

(2)

9. (i) Find the solutions of the equation $\sin(3x - 15°) = \dfrac{1}{2}$, for which $0 \leq x \leq 180°$.
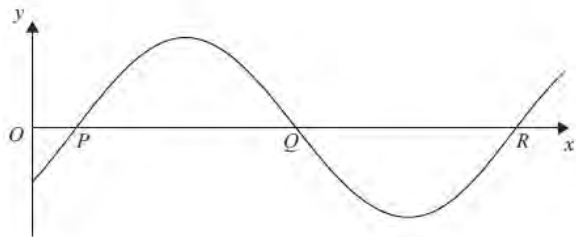
(6)

(ii)

Figure 4

Figure 4 shows part of the curve with equation

$$y = \sin(ax - b), \text{ where } a > 0, \quad 0 < b < \pi.$$

The curve cuts the *x*-axis at the points *P*, *Q* and *R* as shown.

Given that the coordinates of *P*, *Q* and *R* are $\left(\dfrac{\pi}{10}, 0\right)$, $\left(\dfrac{3\pi}{5}, 0\right)$ and $\left(\dfrac{11\pi}{10}, 0\right)$ respectively, find the values of *a* and *b*.

(4)

TOTAL FOR PAPER: 75 MARKS

END

Edexcel GCE

Core Mathematics C2

Advanced Subsidiary

Thursday 24 May 2012 − Morning

Time: 1 hour 30 minutes

Materials required for examination	**Items included with question papers**
Mathematical Formulae (Pink)	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 formulae 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 not gain full credit.

1. Find the first 3 terms, in ascending powers of x, of the binomial expansion of

$$(2 - 3x)^5,$$

giving each term in its simplest form.

(4)

2. Find the values of x such that

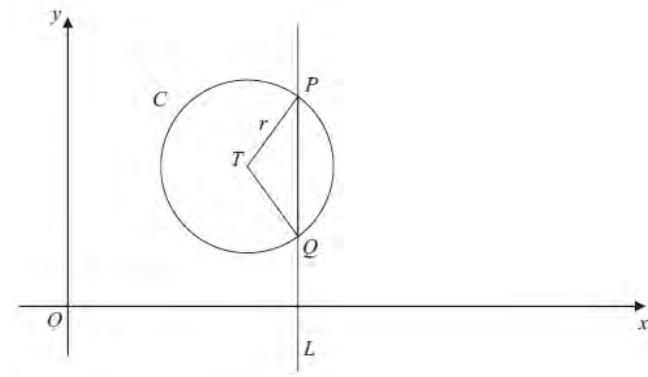$$2 \log_3 x - \log_3(x - 2) = 2$$

(5)

3.

Figure 1

The circle C with centre T and radius r has equation

$$x^2 + y^2 - 20x - 16y + 139 = 0.$$

(*a*) Find the coordinates of the centre of C.

(3)

(*b*) Show that $r = 5$

(2)

The line L has equation $x = 13$ and crosses C at the points P and Q as shown in Figure 1.

(*c*) Find the y coordinate of P and the y coordinate of Q.

(3)

Given that, to 3 decimal places, the angle PTQ is 1.855 radians,

(*d*) find the perimeter of the sector PTQ.

(3)

4. $$f(x) = 2x^3 - 7x^2 - 10x + 24.$$

(*a*) Use the factor theorem to show that $(x + 2)$ is a factor of f(x).

(2)

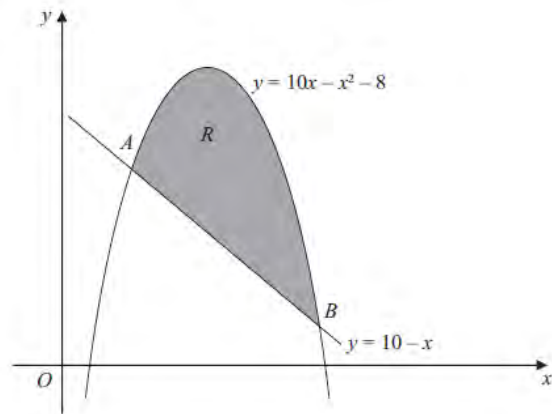(*b*) Factorise f(x) completely.

(4)

5.

Figure 2

Figure 2 shows the line with equation $y = 10 - x$ and the curve with equation $y = 10x - x^2 - 8$.

The line and the curve intersect at the points A and B, and O is the origin.

(a) Calculate the coordinates of A and the coordinates of B.

(5)

The shaded area R is bounded by the line and the curve, as shown in Figure 2.

(b) Calculate the exact area of R.

(7)

---

6. (a) Show that the equation

$$\tan 2x = 5 \sin 2x$$

can be written in the form

$$(1 - 5 \cos 2x) \sin 2x = 0.$$

(2)

(b) Hence solve, for $0 \le x \le 180°$,

$$\tan 2x = 5 \sin 2x,$$

giving your answers to 1 decimal place where appropriate.
You must show clearly how you obtained your answers.

(5)

7.

$$y = \sqrt{(3^x + x)}$$

(a) Complete the table below, giving the values of y to 3 decimal places.

x	0	0.25	0.5	0.75	1
y	1	1.251			2

(2)

(b) Use the trapezium rule with all the values of y from your table to find an approximation for the value of

$$\int_0^1 \sqrt{(3^x + x)}\ dx.$$
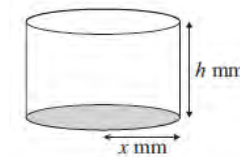
You must show clearly how you obtained your answer.

(4)

8.

Figure 3

A manufacturer produces pain relieving tablets. Each tablet is in the shape of a solid circular cylinder with base radius x mm and height h mm, as shown in Figure 3.

Given that the volume of each tablet has to be 60 mm³,

(a) express h in terms of x,

(1)

(b) show that the surface area, A mm², of a tablet is given by $A = 2\pi x^2 + \dfrac{120}{x}$.

(3)

The manufacturer needs to minimise the surface area A mm², of a tablet.

(c) Use calculus to find the value of x for which A is a minimum.

(5)

(d) Calculate the minimum value of A, giving your answer to the nearest integer.

(2)

(e) Show that this value of A is a minimum.

(2)

9. A geometric series is $a + ar + ar^2 + ...$

(*a*) Prove that the sum of the first *n* terms of this series is given by

$$S_n = \frac{a(1-r^n)}{1-r}$$

(4)

The third and fifth terms of a geometric series are 5.4 and 1.944 respectively and all the terms in the series are positive.

For this series find,

(*b*) the common ratio,

(2)

(*c*) the first term,

(2)

(*d*) the sum to infinity.

(3)

TOTAL FOR PAPER: 75 MARKS

END

Edexcel GCE

Core Mathematics C2

Advanced Subsidiary

Monday 14 January 2013 – Morning

Time: 1 hour 30 minutes

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 or integration, or have retrievable mathematical formulae 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.
The marks for the parts of questions are shown in round brackets, e.g. **(2)**.
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 not gain full credit.

1. Find the first 3 terms, in ascending powers of x, in the binomial expansion of

$$(2 - 5x)^6.$$

Give each term in its simplest form.

(4)

2. $$f(x) = ax^3 + bx^2 - 4x - 3, \text{ where } a \text{ and } b \text{ are constants.}$$

Given that $(x - 1)$ is a factor of $f(x)$,

(*a*) show that $a + b = 7$.

(2)

Given also that, when $f(x)$ is divided by $(x + 2)$, the remainder is 9,

(*b*) find the value of a and the value of b, showing each step in your working.

(4)

3. A company predicts a yearly profit of £120 000 in the year 2013. The company predicts that the yearly profit will rise each year by 5%. The predicted yearly profit forms a geometric sequence with common ratio 1.05.

(*a*) Show that the predicted profit in the year 2016 is £138 915.

(1)

(*b*) Find the first year in which the yearly predicted profit exceeds £200 000.

(5)

(*c*) Find the total predicted profit for the years 2013 to 2023 inclusive, giving your answer to the nearest pound.

(3)

4. Solve, for $0 \leq x < 180°$,

$$\cos (3x - 10°) = -0.4,$$

giving your answers to 1 decimal place. You should show each step in your working.

(7)

5. The circle C has equation

$$x^2 + y^2 - 20x - 24y + 195 = 0.$$

The centre of C is at the point M.

(*a*) Find

(i) the coordinates of the point M,

(ii) the radius of the circle C.

(5)

N is the point with coordinates (25, 32).

(*b*) Find the length of the line MN.

(2)

The tangent to C at a point P on the circle passes through point N.

(*c*) Find the length of the line NP.

(2)

6. Given that $2 \log_2 (x + 15) - \log_2 x = 6$,

(*a*) show that $x^2 - 34x + 225 = 0$.

(5)

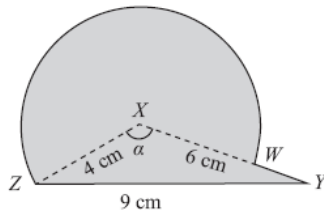(*b*) Hence, or otherwise, solve the equation $2 \log_2 (x + 15) - \log_2 x = 6$.

(2)

7.

Figure 2

The triangle *XYZ* in Figure 1 has *XY* = 6 cm, *YZ* = 9 cm, *ZX* = 4 cm and angle *ZXY* = α.
The point *W* lies on the line *XY*.

The circular arc *ZW*, in Figure 1 is a major arc of the circle with centre *X* and radius 4 cm.

(*a*) Show that, to 3 significant figures, α = 2.22 radians.

(2)

(*b*) Find the area, in cm², of the major sector *XZWX*.

(3)

The region enclosed by the major arc *ZW* of the circle and the lines *WY* and *YZ* is shown shaded in Figure 1.

Calculate

(*c*) the area of this shaded region,

(3)

(*d*) the perimeter *ZWYZ* of this shaded region.

(4)

8. The curve *C* has equation $y = 6 - 3x - \dfrac{4}{x^3}$, $x \neq 0$.

(*a*) Use calculus to show that the curve has a turning point *P* when $x = \sqrt{2}$.

(4)

(*b*) Find the *x*-coordinate of the other turning point *Q* on the curve.

(1)

(*c*) Find $\dfrac{d^2 y}{dx^2}$.

(1)

(*d*) Hence or otherwise, state with justification, the nature of each of these turning points *P* and *Q*.
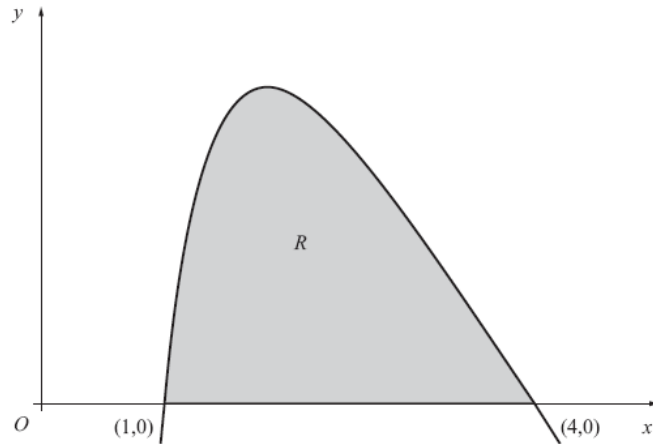
(3)

9.

Figure 2

The finite region *R*, as shown in Figure 2, is bounded by the *x*-axis and the curve with equation

$$y = 27 - 2x - 9\sqrt{x} - \frac{16}{x^2}, \qquad x > 0.$$

The curve crosses the *x*-axis at the points (1, 0) and (4, 0).

(*a*) Copy and complete the table below, by giving your values of *y* to 3 decimal places.

x	1	1.5	2	2.5	3	3.5	4
y	0	5.866		5.210		1.856	0

(2)

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

(4)

(*c*) Use integration to find the exact value for the area of *R*.

(6)

TOTAL FOR PAPER: 75 MARKS

END

6664/01R

Edexcel GCE

Core Mathematics C2 (R)

Advanced Subsidiary

Friday 24 May 2013 – Morning

Time: 1 hour 30 minutes

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 or symbolic differentiation/integration, or have retrievable mathematical formulae stored in them.

This paper is strictly for students outside the UK.

Instructions to Candidates

In the boxes above, write your centre number, candidate number, your surname, initials and signature.
Check that you have the correct question paper.
Answer ALL the questions.
You must write your answer for each question in the space following the question.
When a calculator is used, the answer should be given to an appropriate degree of accuracy.

Information for Candidates

A booklet 'Mathematical Formulae and Statistical Tables' is provided.
Full marks may be obtained for answers to ALL questions.
The marks for the parts of questions are shown in round brackets, e.g. **(2)**.
There are 9 questions in this question paper. The total mark for this paper is 75.
There are 32 pages in this question paper. Any blank pages are indicated.

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 not gain full credit.

1. Using calculus, find the coordinates of the stationary point on the curve with equation

$$y = 2x + 3 + \frac{8}{x^2}, \quad x > 0$$

(6)

2.
$$y = \frac{x}{\sqrt{(1+x)}}$$

(a) Complete the table below with the value of y corresponding to $x = 1.3$, giving your answer to 4 decimal places.

(1)

x	1	1.1	1.2	1.3	1.4	1.5
y	0.7071	0.7591	0.8090		0.9037	0.9487

(b) Use the trapezium rule, with all the values of y in the completed table, to obtain an approximate value for

$$\int_1^{1.5} \frac{x}{\sqrt{(1+x)}} \, dx$$

giving your answer to 3 decimal places.

You must show clearly each stage of your working.

(4)

3. Find the first 4 terms, in ascending powers of x, of the binomial expansion of

$$\left(2 - \frac{1}{2}x\right)^8$$

giving each term in its simplest form.

(4)

4. $\qquad f(x) = ax^3 - 11x^2 + bx + 4,$ 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)

5. 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)

6. Given that $\log_3 x = a$, find in terms of a,

(a) $\log_3 (9x)$

(2)

(b) $\log_3 \left(\frac{x^5}{81}\right)$

(3)

giving each answer in its simplest form.

(c) Solve, for x,

$$\log_3 (9x) + \log_3 \left(\frac{x^5}{81}\right) = 3$$
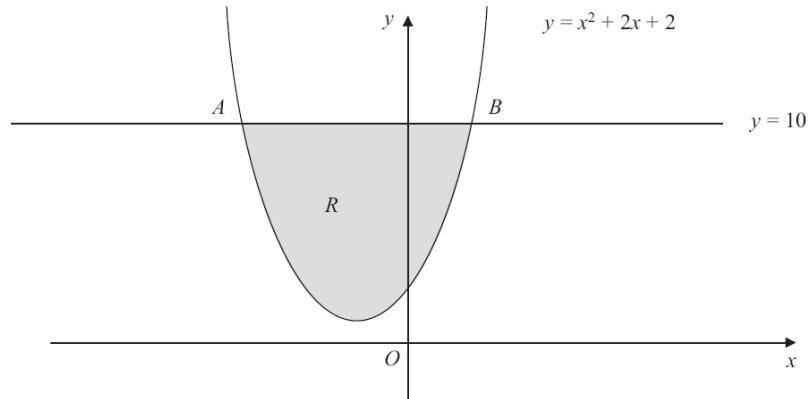
giving your answer to 4 significant figures.

(4)

7.

Figure 1

The line with equation $y = 10$ cuts the curve with equation $y = x^2 + 2x + 2$ at the points A and B as shown in Figure 1. The figure is not drawn to scale.

(*a*) Find by calculation the x-coordinate of A and the x-coordinate of B.

(2)

The shaded region R is bounded by the line with equation $y = 10$ and the curve as shown in Figure 1.
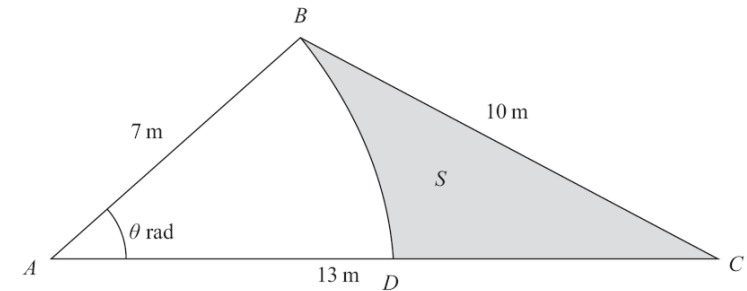
(*b*) Use calculus to find the exact area of R.

(7)

8.

Figure 2

Figure 2 shows the design for a triangular garden ABC where $AB = 7$ m, $AC = 13$ m and $BC = 10$ m.

Given that angle $BAC = \theta$ radians,

(*a*) show that, to 3 decimal places, $\theta = 0.865$

(3)

The point D lies on AC such that BD is an arc of the circle centre A, radius 7 m.

The shaded region S is bounded by the arc BD and the lines BC and DC. The shaded region S will be sown with grass seed, to make a lawned area.

Given that 50 g of grass seed are needed for each square metre of lawn,

(*b*) find the amount of grass seed needed, giving your answer to the nearest 10 g.

(7)

9. (i) Solve, for $0 \leq \theta < 180°$

$$\sin(2\theta - 30°) + 1 = 0.4$$

giving your answers to 1 decimal place.

(5)

(ii) Find all the values of x, in the interval $0 \leq \theta < 360°$, for which

$$9\cos^2 x - 11\cos x + 3\sin^2 x = 0$$

giving your answers to 1 decimal place.

(7)

You must show clearly how you obtained your answers.

TOTAL FOR PAPER: 75 MARKS

END

Edexcel GCE

Core Mathematics C2

Advanced Subsidiary

Friday 24 May 2013 – Morning

Time: 1 hour 30 minutes

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 formulae 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 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 not gain full credit.

1. The first three terms of a geometric series are

$$18, 12 \text{ and } p$$

respectively, where p is a constant.

Find

(a) the value of the common ratio of the series,

(1)

(b) the value of p,

(1)

(c) the sum of the first 15 terms of the series, giving your answer to 3 decimal places.

(2)

2. (a) Use the binomial theorem to find all the terms of the expansion of

$$(2 + 3x)^4.$$

Give each term in its simplest form.

(4)

(b) Write down the expansion of

$$(2 - 3x)^4$$

in ascending powers of x, giving each term in its simplest form.

(1)

3.

$$f(x) = 2x^3 - 5x^2 + ax + 18$$

where a is a constant.

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

(a) show that $a = -9$,

(2)

(b) factorise f(x) completely.

(4)

Given that

$$g(y) = 2(3^{3y}) - 5(3^{2y}) - 9(3^y) + 18,$$

(c) find the values of y that satisfy g(y) = 0, giving your answers to 2 decimal places where appropriate.

(3)

4.

$$y = \frac{5}{(x^2 + 1)}.$$

(a) Copy and complete the table below, giving the missing value of y to 3 decimal places.

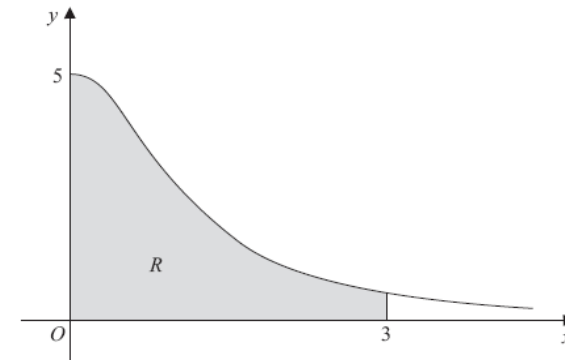| x	0	0.5	1	1.5	2	2.5	3
y	5	4	2.5		1	0.690	0.5

(1)

Figure 1

Figure 1 shows the region R which is bounded by the curve with equation $y = \frac{5}{(x^2 + 1)}$, the x-axis and the lines $x = 0$ and $x = 3$.

(b) Use the trapezium rule, with all the values of y from your table, to find an approximate value for the area of R.

(4)

(c) Use your answer to part (b) to find an approximate value for

$$\int_0^3 4 + \frac{5}{(x^2 + 1)} \, dx,$$
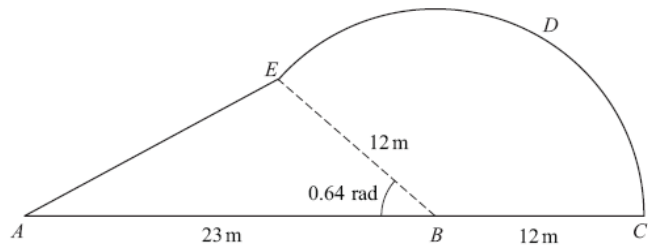
giving your answer to 2 decimal places.

(2)

5.

Figure 2

Figure 2 shows a plan view of a garden.

The plan of the garden *ABCDEA* consists of a triangle *ABE* joined to a sector *BCDE* of a circle with radius 12 m and centre *B*.

The points *A*, *B* and *C* lie on a straight line with *AB* = 23 m and *BC* = 12 m.

Given that the size of angle *ABE* is exactly 0.64 radians, find

(*a*) the area of the garden, giving your answer in m², to 1 decimal place,

(4)

(*b*) the perimeter of the garden, giving your answer in metres, to 1 decimal place.
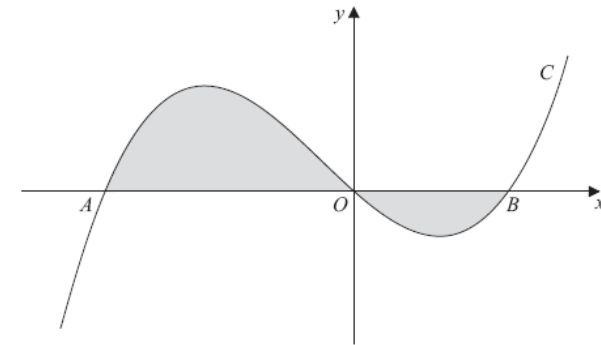
(5)

6.

Figure 3

Figure 3 shows a sketch of part of the curve *C* with equation

$$y = x(x + 4)(x - 2).$$

The curve *C* crosses the *x*-axis at the origin *O* and at the points *A* and *B*.

(*a*) Write down the *x*-coordinates of the points *A* and *B*.

(1)

The finite region, shown shaded in Figure 3, is bounded by the curve *C* and the *x*-axis.

(*b*) Use integration to find the total area of the finite region shown shaded in Figure 3.

(7)

7. (i) Find the exact value of *x* for which

$$\log_2 (2x) = \log_2 (5x + 4) - 3.$$

(4)

(ii) Given that

$$\log_a y + 3 \log_a 2 = 5,$$

express *y* in terms of *a*.

Give your answer in its simplest form.

(3)

8. (i) Solve, for $-180° \leq x < 180°$,

$$\tan(x - 40°) = 1.5,$$

giving your answers to 1 decimal place.

(3)

(ii) (*a*) Show that the equation

$$\sin \theta \tan \theta = 3 \cos \theta + 2$$

can be written in the form

$$4 \cos^2\theta + 2 \cos \theta - 1 = 0.$$

(3)

(*b*) Hence solve, for $0 \leq \theta < 360°$,

$$\sin \theta \tan \theta = 3 \cos \theta + 2,$$

showing each stage of your working.

(5)

9. The curve with equation

$$y = x^2 - 32 \sqrt{x} + 20, \quad x > 0,$$

has a stationary point P.

Use calculus

(*a*) to find the coordinates of P,

(6)

(*b*) to determine the nature of the stationary point P.
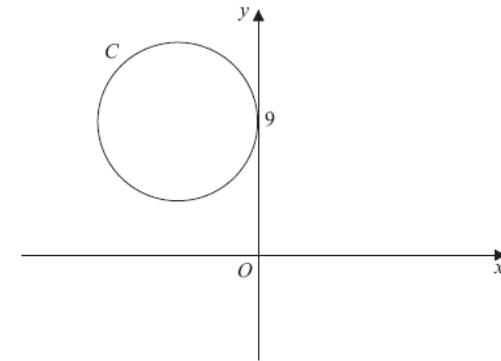
(3)

10.

Figure 4

The circle C has radius 5 and touches the y-axis at the point $(0, 9)$, as shown in Figure 4.

(*a*) Write down an equation for the circle C, that is shown in Figure 4.

(3)

A line through the point $P(8, -7)$ is a tangent to the circle C at the point T.

(*b*) Find the length of PT.

(3)

TOTAL FOR PAPER: 75 MARKS

END

Paper Reference(s)

6664/01R

Edexcel GCE

Core Mathematics C2 (R)

Advanced Subsidiary

Thursday 22 May 2014 – Morning

Time: 1 hour 30 minutes

Materials required for examination	**Items included with question papers**
Mathematical Formulae (Pink)	Nil

Calculators may NOT be used in this examination.

This paper is strictly for students outside the UK.

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 (6664R), your surname, initials and signature.

Information for Candidates

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There are 10 questions in this question paper. The total mark for this paper is 75.

Advice to Candidates

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You must show sufficient working to make your methods clear to the Examiner.
Answers without working may not gain full credit.

---

1.   Find the first 4 terms, in ascending powers of x, of the binomial expansion of

$$\left(1+\frac{3x}{2}\right)^8$$

giving each term in its simplest form.

(4)

2.   A geometric series has first term a, where $a \neq 0$, and common ratio r.
     The sum to infinity of this series is 6 times the first term of the series.

     (a) Show that $r = \dfrac{5}{6}$.

(2)

     Given that the fourth term of this series is 62.5,

     (b) find the value of a,

(2)

     (c) find the difference between the sum to infinity and the sum of the first 30 terms, giving your answer to 3 significant figures.
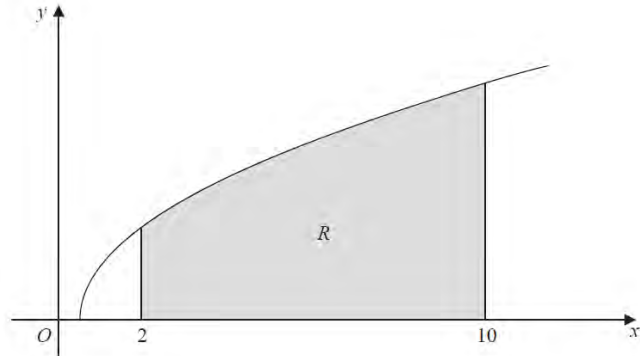
(4)

3.

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)

4. $f(x) = -4x^3 + ax^2 + 9x - 18$,   where a is a constant.

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

(a) find the value of a,

(2)

(b) factorise $f(x)$ completely,

(3)

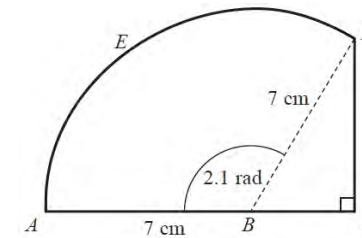(c) find the remainder when $f(x)$ is divided by $(2x - 1)$.

(2)

5.

Figure 2

Figure 2 shows the shape $ABCDEA$ which consists of a right-angled triangle BCD joined to a sector $ABDEA$ of a circle with radius 7 cm and centre B.

A, B and C lie on a straight line with $AB = 7$ cm.

Given that the size of angle ABD is exactly 2.1 radians,

(a) find, in cm, the length of the arc DEA,

(2)

(b) find, in cm, the perimeter of the shape $ABCDEA$, giving your answer to 1 decimal place.
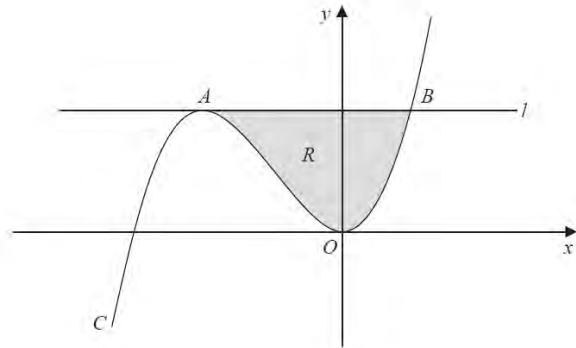
(4)

6.

Figure 3

Figure 3 shows a sketch of part of the curve C with equation

$$y = \frac{1}{8}x^3 + \frac{3}{4}x^2, \qquad x \in$$

The curve C has a maximum turning point at the point A and a minimum turning point at the origin O.

The line l touches the curve C at the point A and cuts the curve C at the point B.

The x coordinate of A is –4 and the x coordinate of B is 2.

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

Use integration to find the area of the finite region R.

(7)

7. (i) Solve, for $0 \le \theta < 180°$, the equation

$$\frac{\sin 2\theta}{(4\sin 2\theta - 1)} = 1$$

giving your answers to 1 decimal place.

(3)

(ii) Solve, for $0 \le x < 2\pi$, the equation

$$5\sin^2 x - 2\cos x - 5 = 0$$

giving your answers to 2 decimal places.
(*Solutions based entirely on graphical or numerical methods are not acceptable.*)

(5)

8. (i) Solve

$$5^y = 8$$

giving your answers to 3 significant figures.

(2)

(ii) Use algebra to find the values of x for which

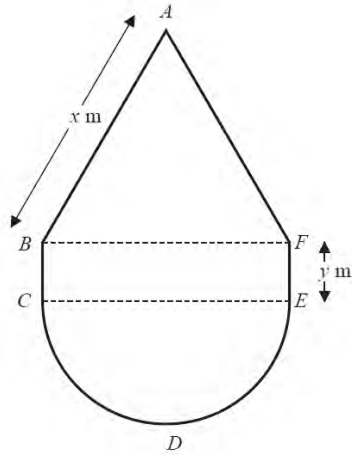$$\log_2 (x+15) - 4 = \frac{1}{2}\log_2 x$$

(6)

9.

Figure 4

Figure 4 shows the plan of a pool.

The shape of the pool *ABCDEFA* consists of a rectangle *BCEF* joined to an equilateral triangle *BFA* and a semi-circle *CDE*, as shown in Figure 4.

Given that $AB = x$ metres, $EF = y$ metres, and the area of the pool is 50 m²,

(a) show that

$$y = \frac{50}{x} - \frac{x}{8}\left(\pi + 2\sqrt{3}\right)$$

(3)

(b) Hence show that the perimeter, *P* metres, of the pool is given by

$$P = \frac{100}{x} + \frac{x}{4}\left(\pi + 8 - 2\sqrt{3}\right)$$

(3)

(c) Use calculus to find the minimum value of *P*, giving your answer to 3 significant figures.

(5)

(d) Justify, by further differentiation, that the value of *P* that you have found is a minimum.

(2)

10. The circle *C*, with centre *A*, passes through the point *P* with coordinates (–9, 8) and the point *Q* with coordinates (15, –10).

Given that *PQ* is a diameter of the circle *C*,

(a) find the coordinates of *A*,

(2)

(b) find an equation for *C*.

(3)

A point *R* also lies on the circle *C*.
Given that the length of the chord *PR* is 20 units,

(c) find the length of the shortest distance from *A* to the chord *PR*. Give your answer as a surd in its simplest form.

(2)

(d) Find the size of the angle *ARQ*, giving your answer to the nearest 0.1 of a degree.

(2)

TOTAL FOR PAPER: 75 MARKS

END

Paper Reference(s)

6664/01

Edexcel GCE

Core Mathematics C2

Advanced Subsidiary

Thursday 22 May 2014 − Morning

Time: 1 hour 30 minutes

Materials required for examination	Items included with question papers
Mathematical Formulae (Pink)	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 or symbolic differentiation/integration, or have retrievable mathematical formulae 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.
The marks for the parts of questions are shown in round brackets, e.g. **(2)**.
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.
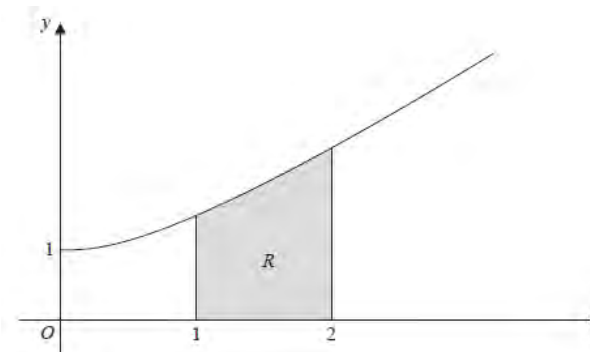Answers without working may not gain full credit.

1.

Figure 1

Figure 1 shows a sketch of part of the curve with equation $y = \sqrt{(x^2 + 1)}$, $x \geq 0$.

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

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

x	1	1.25	1.5	1.75	2
y	1.414		1.803	2.016	2.236

(a) Complete the table above, giving the missing value of y to 3 decimal places.
(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.
(4)

2. $f(x) = 2x^3 - 7x^2 + 4x + 4.$

(a) Use the factor theorem to show that $(x - 2)$ is a factor of $f(x)$.
(2)

(b) Factorise $f(x)$ completely.
(4)

3. (a) Find the first 3 terms, in ascending powers of x, of the binomial expansion of $(2 - 3x)^6$, giving each term in its simplest form.

(4)

(b) Hence, or otherwise, find the first 3 terms, in ascending powers of x, of the expansion of

$$\left(1 + \frac{x}{2}\right)(2 - 3x)^6.$$

(3)

4. Use integration to find

$$\int_1^{\sqrt{3}} \left(\frac{x^3}{6} + \frac{1}{3x^2}\right) dx,$$

giving your answer in the form $a + b\sqrt{3}$, where a and b are constants to be determined.
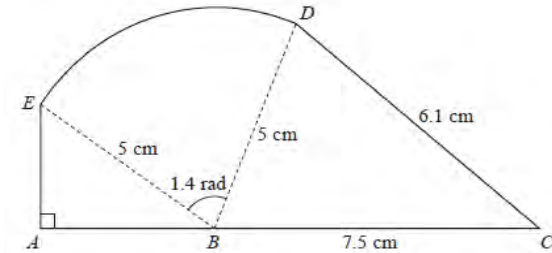
(5)

5.

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

(a) Find, in cm², 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 cm², the area of the shape *ABCDEA*, giving your answer to 3 significant figures.

(5)

6. The first term of a geometric series is 20 and the common ratio is $\frac{7}{8}$. The sum to infinity of the series is S_∞.

(a) Find the value of S_∞.

(2)

The sum to N terms of the series is S_N.

(b) Find, to 1 decimal place, the value of S_{12}.

(2)

(c) Find the smallest value of N, for which $S_\infty - S_N < 0.5$.

(4)

7. (i) Solve, for $0 \le \theta < 360°$, the equation $9 \sin (\theta + 60°) = 4$, giving your answers to 1 decimal place. You must show each step of your working.

(4)

(ii) Solve, for $-\pi \le x < \pi$, the equation $2 \tan x - 3 \sin x = 0$, giving your answers to 2 decimal places where appropriate.

[*Solutions based entirely on graphical or numerical methods are not acceptable.*]

(5)

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8. (a) Sketch the graph of

$$y = 3^x, \ x \in \mathbb{R},$$

showing the coordinates of any points at which the graph crosses the axes.

(2)

(b) Use algebra to solve the equation $3^{2x} - 9(3^x) + 18 = 0$, giving your answers to 2 decimal places where appropriate.
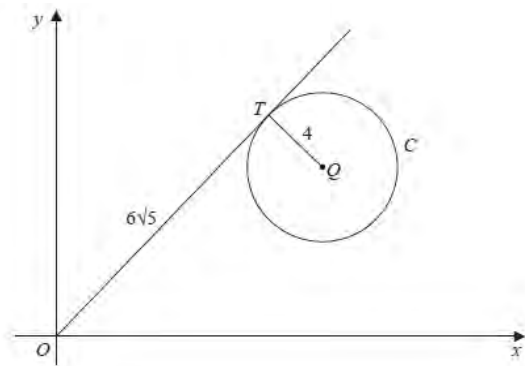
(5)

9.

Figure 3

Figure 3 shows a circle C with centre Q and radius 4 and the point T which lies on C. The tangent to C at the point T passes through the origin O and $OT = 6\sqrt{5}$.

Given that the coordinates of Q are $(11, k)$, where k is a positive constant,

(a) find the exact value of k,

(3)

(b) find an equation for C.
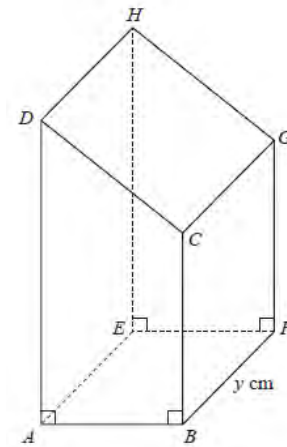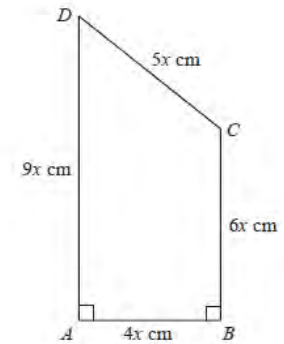
(2)

10.

Figure 4   **Figure 5**

Figure 4 shows a closed letter box *ABFEHGCD*, which is made to be attached to a wall of a house.

The letter box is a right prism of length y cm as shown in Figure 4. The base *ABFE* of the prism is a rectangle. The total surface area of the six faces of the prism is S cm².

The cross section *ABCD* of the letter box is a trapezium with edges of lengths $DA = 9x$ cm, $AB = 4x$ cm, $BC = 6x$ cm and $CD = 5x$ cm as shown in Figure 5.

The angle $DAB = 90°$ and the angle $ABC = 90°$. The volume of the letter box is 9600 cm³.

(a) Show that $y = \dfrac{320}{x^2}$.

(2)

(b) Hence show that the surface area of the letter box, S cm², is given by $S = 60x^2 + \dfrac{7680}{x}$.

(4)

(c) Use calculus to find the minimum value of S.

(6)

(d) Justify, by further differentiation, that the value of S you have found is a minimum.

(2)

TOTAL FOR PAPER: 75 MARKS

END