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Surname

Other names

Pearson Edexcel
International
Advanced Level

Centre Number

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Candidate Number

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Core Mathematics C12

Advanced Subsidiary

Wednesday 20 May 2015 – Morning

Time: 2 hours 30 minutes

Paper Reference

WMA01/01

You must have:

Mathematical Formulae and Statistical Tables (Blue)

Total Marks

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

- Use **black** ink or ball-point pen.
- If pencil is used for diagrams/sketches/graphs it must be dark (HB or B). Coloured pencils and highlighter pens must not be used.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions and ensure that your answers to parts of questions are clearly labelled.
- Answer the questions in the spaces provided
– *there may be more space than you need.*
- You should show sufficient working to make your methods clear. Answers without working may not gain full credit.
- When a calculator is used, the answer should be given to an appropriate degree of accuracy.

Information

- The total mark for this paper is 125.
- The marks for **each** question are shown in brackets
– *use this as a guide as to how much time to spend on each question.*

Advice

- Read each question carefully before you start to answer it.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ►

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Q1

2.

$$f(x) = x^4 - x^3 + 3x^2 + ax + b$$

where a and b are constants.

When $f(x)$ is divided by $(x - 1)$ the remainder is 4

When $f(x)$ is divided by $(x + 2)$ the remainder is 22

Find the value of a and the value of b .

(5)



(Total 5 marks)



3. Given that

$$y = \frac{1}{27}x^3$$

express each of the following in the form kx^n where k and n are constants.

$$(a) \ y^{\frac{1}{3}} \tag{1}$$

$$(b) \ 3y^{-1} \tag{1}$$

$$(c) \sqrt{(27y)} \tag{1}$$



Q3

(Total 3 marks)



4. (a) Sketch the graph of $y = \frac{1}{x}$, $x > 0$

(2)

The table below shows corresponding values of x and y for $y = \frac{1}{x}$, with the values for y rounded to 3 decimal places where necessary.

x	1	1.5	2	2.5	3
y	1	0.667	0.5	0.4	0.333

- (b) Use the trapezium rule with all the values of y from the table to find an

approximate value, to 2 decimal places, for $\int_1^3 \frac{1}{x} dx$

(4)



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Q4

5. (i) Find, giving your answer to 3 significant figures, the value of y for which

$$3^y = 12$$

(2)

(ii) Solve, giving an exact answer, the equation

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

(You should show each step in your working.)

(4)

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Q5

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

$$(2 + ax)^6$$

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

(4)

Given that, in the expansion, the coefficient of x is equal to the coefficient of x^2

- (b) find the value of a .

(2)

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This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

(Total 6 marks)

Q6

[illegible]

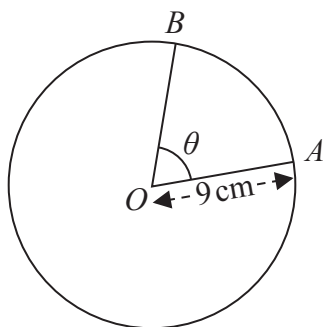


Figure 1 shows a circle with centre O and radius 9 cm. The points A and B lie on the circumference of this circle. The minor sector OAB has perimeter 30 cm and the angle between the radii OA and OB of this sector is θ radians.

(a) the length of the arc AB ,

(1)

(b) the value of θ ,

(2)

(c) the area of the minor sector OAB ,

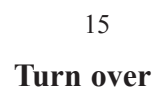
(2)

(d) the area of triangle OAB , giving your answer to 3 significant figures.

(2)

[illegible]

(Total 7 marks)



(a) the number of houses built in 1986, the first year of the building programme,

(5)

(b) the total number of houses built in the 25 years of the programme.

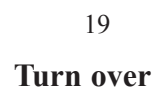
(2)

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Q8

This image shows a full page of blank, lined paper. It features approximately 20 evenly spaced horizontal gray lines across the entire width of the page, providing a guide for writing. The background is a clean, solid white color. There are no margins, text, or other markings present on the sheet.

(Total 7 marks)





This image shows a full page of blank, lined paper. It features approximately 28 horizontal grey lines spaced evenly apart, typical of standard notebook paper. The lines extend across the entire width of the page, leaving small margins at the top and bottom. There are no vertical lines, text, or other markings present.

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

(Total 8 marks)

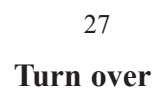






[illegible]

(Total 11 marks)



12.

Diagram not
drawn to scale

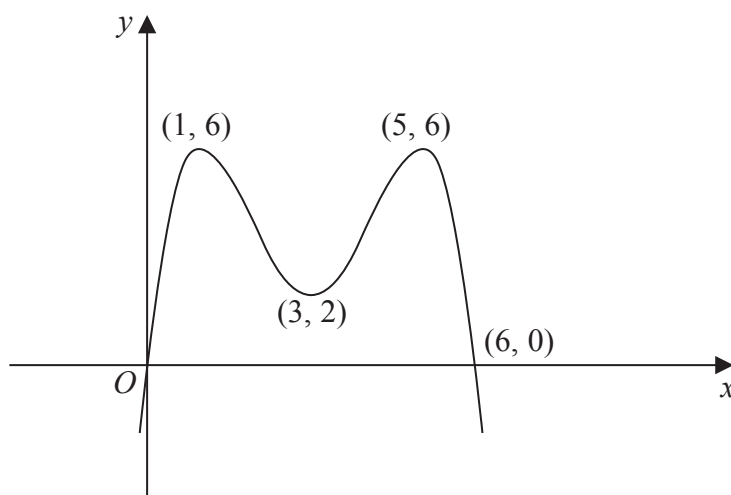


Figure 2

Figure 2 shows a sketch of part of the curve with equation $y = f(x)$.

The curve crosses the x -axis at the origin and at the point $(6, 0)$. The curve has maximum points at $(1, 6)$ and $(5, 6)$ and has a minimum point at $(3, 2)$.

On **separate** diagrams sketch the curve with equation

(a) $y = -f(x)$ (3)

(b) $y = f\left(\frac{1}{2}x\right)$ (3)

(c) $y = f(x + 4)$ (3)

On each diagram show clearly the coordinates of the maximum and minimum points, and the coordinates of the points where the curve crosses the x -axis.



Question 12 continued



Question 12 continued



Question 12 continued

Q12

(Total 9 marks)







[illegible]

(Total 9 marks)



14.

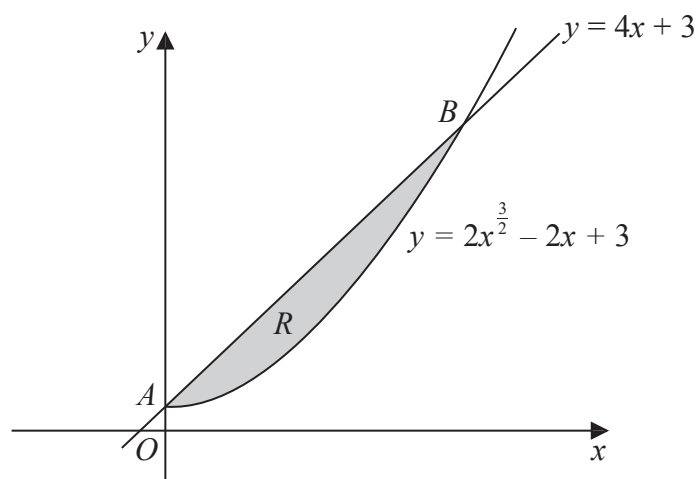


Figure 3

The finite region R , which is shown shaded in Figure 3, is bounded by the straight line l with equation $y = 4x + 3$ and the curve C with equation $y = 2x^{\frac{3}{2}} - 2x + 3, x \geq 0$

The line l meets the curve C at the point A on the y -axis and l meets C again at the point B , as shown in Figure 3.

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

(4)

- (b) Use integration to find the area of the shaded region R .

(6)

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(Total 10 marks)



15.

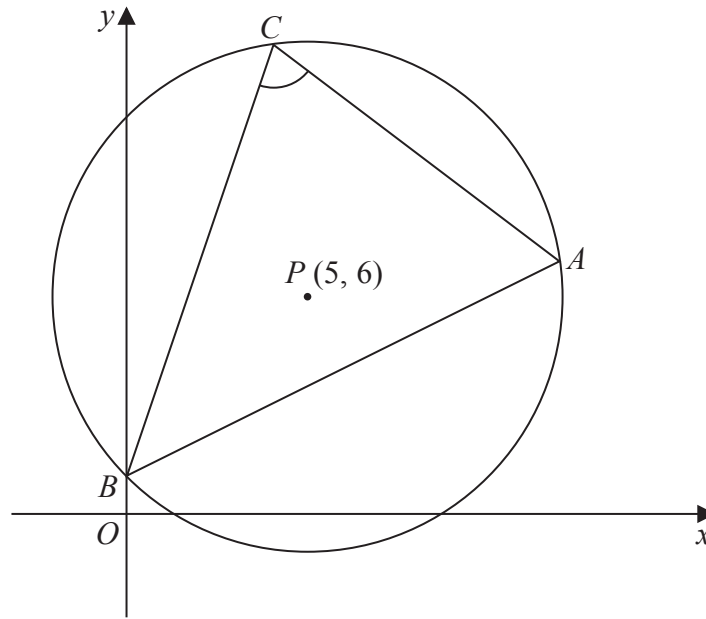


Diagram not
drawn to scale

Figure 4

The circle shown in Figure 4 has centre $P(5, 6)$ and passes through the point $A(12, 7)$.

Find

(a) the exact radius of the circle, (2)

(b) an equation of the circle, (3)

(c) an equation of the tangent to the circle at the point A . (4)

The circle also passes through the points $B(0, 1)$ and $C(4, 13)$.

(d) Use the cosine rule on triangle ABC to find the size of the angle BCA , giving your answer in degrees to 3 significant figures. (5)



[illegible]



(Total 14 marks)

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16. [In this question you may assume the formula for the area of a circle and the following formulae:

a **sphere** of radius r has volume $V = \frac{4}{3}\pi r^3$ and surface area $S = 4\pi r^2$

a **cylinder** of radius r and height h has volume $V = \pi r^2 h$ and curved surface area $S = 2\pi r h$

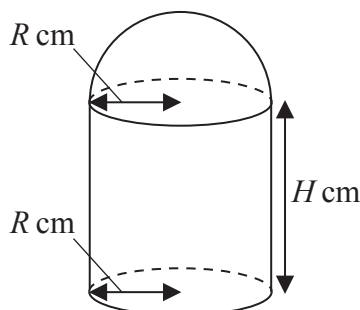


Figure 5

Figure 5 shows the model for a building. The model is made up of three parts. The roof is modelled by the curved surface of a hemisphere of radius R cm. The walls are modelled by the curved surface of a circular cylinder of radius R cm and height H cm. The floor is modelled by a circular disc of radius R cm. The model is made of material of negligible thickness, and the walls are perpendicular to the base.

It is given that the volume of the model is 800π cm³ and that $0 < R < 10.6$

- (a) Show that

$$H = \frac{800}{R^2} - \frac{2}{3}R \quad (2)$$

- (b) Show that the surface area, A cm², of the model is given by

$$A = \frac{5\pi R^2}{3} + \frac{1600\pi}{R} \quad (3)$$

- (c) Use calculus to find the value of R , to 3 significant figures, for which A is a minimum.

(5)

- (d) Prove that this value of R gives a minimum value for A .

(2)

- (e) Find, to 3 significant figures, the value of H which corresponds to this value for R .

(1)





[illegible]



(Total 13 marks)

TOTAL FOR PAPER: 125 MARKS

END

