

OXFORD CAMBRIDGE AND RSA EXAMINATIONS
AS GCE
4752/01
MATHEMATICS (MEI)
Concepts for Advanced Mathematics (C2)
QUESTION PAPER
WEDNESDAY 7 JUNE 2017:
Morning
DURATION: 1 hour 30 minutes
plus your additional time allowance
MODIFIED ENLARGED 24pt

Candidates answer on the Printed Answer Book or any suitable paper provided by the centre. The Printed Answer Book may be enlarged by the centre.

OCR SUPPLIED MATERIALS:

Insert for Question 3(ii)

OTHER MATERIALS REQUIRED:

Scientific or graphical calculator

READ INSTRUCTIONS OVERLEAF



INSTRUCTIONS TO CANDIDATES

Write your name, centre number and candidate number in the spaces provided on the Printed Answer Book or on the paper provided. Please write clearly and in capital letters.

If you use the Printed Answer Book, write your answer to each question in the space provided. If additional space is required, you should use the lined page(s) at the end of this booklet. The question number(s) must be clearly shown.

Use black ink. HB pencil may be used for graphs and diagrams only.

Read each question carefully. Make sure you know what you have to do before starting your answer.

Answer **all** the questions.

You are permitted to use a scientific or graphical calculator in this paper.

Final answers should be given to a degree of accuracy appropriate to the context.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets [] at the end of each question or part question on the Question Paper.

You are advised that an answer may receive **no marks** unless you show sufficient detail of the working to indicate that a correct method is being used.

The total number of marks for this paper is **72**.

Any blank pages are indicated.

INSTRUCTION TO EXAMS OFFICER/INVIGILATOR

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Section A (36 marks)

1 (i) Calculate $\sum_{r=1}^5 (3r + 2)$. [2]

(ii) An arithmetic progression (AP) has first term 4.2 and sixth term 1.8. Find the common difference of this AP. [2]

2 (i) Find $\int_1^5 4x \, dx$. [3]

(ii) Find $\int 6x^{\frac{1}{2}} \, dx$. [2]

3 Fig. 3

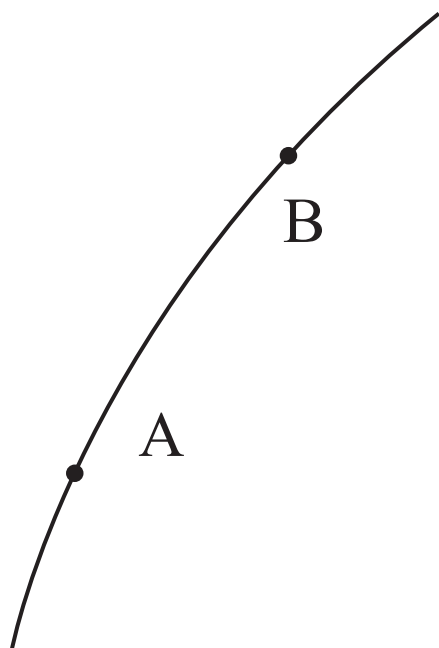


Fig. 3 shows two points A and B on the curve $y = \log_{10}x$. At A, $x = 0.1$ and at B, $x = 0.2$.

- (i) Calculate the gradient of the chord AB. **[2]**
- (ii) The gradient of the chord AB gives an estimate for the gradient of the curve at A. On Fig. 3 in the answer book or in the insert, mark a point C on the curve such that the gradient of the chord AC would give a better estimate. **[1]**

- 4** Find the equation of the normal to the curve $y = 2x^3$ at the point on the curve where $x = 2$. Give your answer in the form $ax + by = c$. **[5]**
- 5** (i) Describe fully the single transformation that maps the curve $y = x^2 + 3$ onto the curve $y = 2x^2 + 6$. **[2]**
- (ii) Describe fully the single transformation that maps the curve $y = 2x^2$ onto the curve $y = 2(x - 3)^2$. **[2]**
- 6** A curve passes through the point (2, 10) and has gradient $\frac{dy}{dx} = 12x^3 - 7$. Find the equation of the curve. **[5]**

7 (i) Sketch the curve $y = 2^x$. **[2]**

(ii) You are given that

$$\log_a w = 3 + \log_a x^5 - \log_a 2x + \log_a 6.$$

Find an expression for w in terms of x and a , giving your answer as simply as possible. **[3]**

8 You are given that $6 \cos^2 x = 5 - \sin x$, where x is in radians. Show that $6 \sin^2 x - \sin x - 1 = 0$. Solve this equation for $0 \leq x \leq 2\pi$. **[5]**

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Section B (36 marks)

- 9 The standard formulae for the volume V and total surface area A of a solid cylinder of radius r and height h are

$$V = \pi r^2 h \text{ and } A = 2\pi r^2 + 2\pi r h.$$

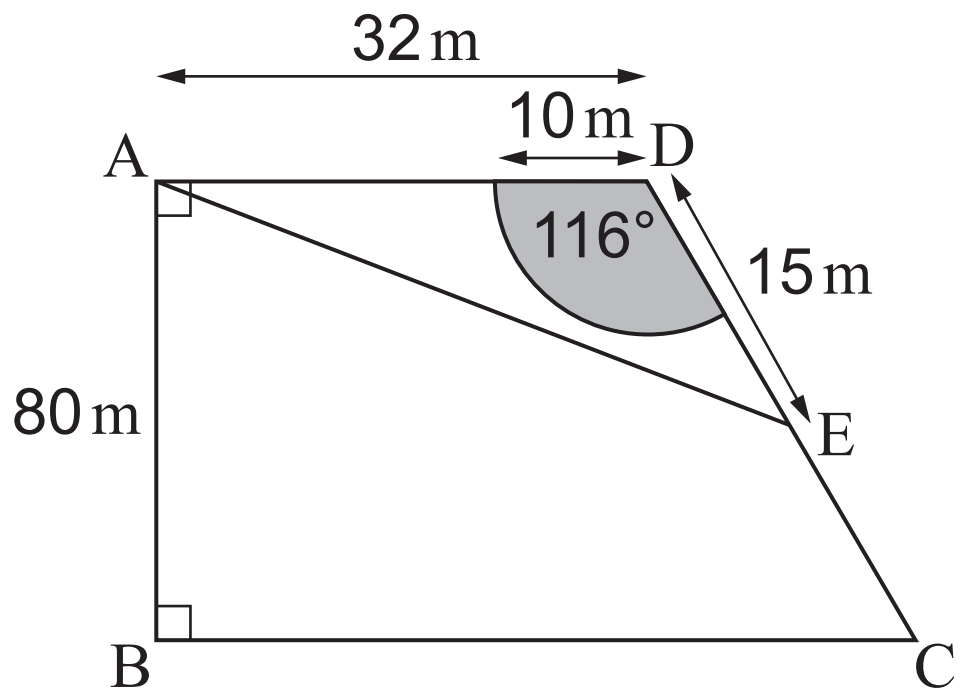
You are given that $V = 400$.

- (i) Show that $A = 2\pi r^2 + \frac{800}{r}$. [2]
- (ii) Find $\frac{dA}{dr}$ and $\frac{d^2A}{dr^2}$. [4]
- (iii) Hence find the value of r which gives the minimum surface area. Find also the value of the surface area in this case. [4]

- 10** A field is to be turned into a car park, a pond and a meadow. Fig. 10 shows one possible design.

Fig. 10

Not to scale



The field ABCD is a trapezium, with sides AD and BC parallel. $AD = 32\text{ m}$, $AB = 80\text{ m}$, angle $B = 90^\circ$ and angle $D = 116^\circ$. The pond, shown shaded, is a sector of a circle, centre D and radius 10 m. The point E is on DC, with $DE = 15\text{ m}$.

(i) Calculate the length of AE . **[2]**

(ii) Calculate the perpendicular distance of AE from D . Hence verify that the pond lies entirely within triangle ADE . **[3]**

The meadow is the triangle ADE except for the pond.

(iii) Calculate the area of the pond and the area of the meadow. **[4]**

(iv) Show that the car park, $AECB$, uses over 90% of the area of the field. **[4]**

- 11** A firm takes on two new employees, Arif and Bettina.

Arif starts on an annual salary of £30 000, and his salary increases by £1000 each year after that.

Bettina starts on an annual salary of £25 000, and her salary then increases by 5% each year after that. (So, for example, Bettina's salary in year 3 is 5% greater than her salary in year 2.)

- (i) Show that Arif earns more than Bettina in year 10 of their employment, but Arif earns less than Bettina in year 11. **[4]**
- (ii) Show that the total amounts earned by each of Arif and Bettina during their employment up to the end of year 17, correct to the nearest £100, are equal. **[4]**

- (iii) At the end of year n , the total that Bettina has earned during this employment is greater than $\text{£}M$.

Show that

$$n > \frac{\log_{10}(M + 500\,000) - \log_{10} 500\,000}{\log_{10} 1.05}.$$

Hence find in which year the total that Bettina has earned during this employment is first greater than $\text{£}1.2$ million. **[5]**

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