

Wednesday 7 June 2017 - Morning

AS GCE MATHEMATICS (MEI)

4752/01 Concepts for Advanced Mathematics (C2)

QUESTION PAPER

Candidates answer on the Printed Answer Book.

OCR supplied materials:

Other materials required:

- Printed Answer Book 4752/01
- MEI Examination Formulae and Tables (MF2)

Duration: 1 hour 30 minutes

Scientific or graphical calculator

INSTRUCTIONS TO CANDIDATES

These instructions are the same on the Printed Answer Book and the Question Paper.

- The Question Paper will be found inside the Printed Answer Book.
- Write your name, centre number and candidate number in the spaces provided on the Printed Answer Book. Please write clearly and in capital letters.
- Write your answer to each question in the space provided in the Printed Answer **Book.** 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.
- Do **not** write in the barcodes.
- 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

This information is the same on the Printed Answer Book and the Question Paper.

- 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**.
- The Printed Answer Book consists of **12** pages. The Question Paper consists of **8** pages. 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 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.
- (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, mark a point C on the curve such that the gradient of the chord AC would give a better estimate.
 [1]

[2]

- 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 $y = 2^x$.
 - (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 $0 \le x \le 2\pi$. [5]

[2]

Section B (36 marks)

4

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

$$V = \pi r^2 h$$
 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.
- 10 A field is to be turned into a car park, a pond and a meadow. Fig. 10 shows one possible design.





The field ABCD is a trapezium, with sides AD and BC parallel. AD = 32 m, AB = 80 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 m.

- (i) Calculate the length of AE.
- (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]

[2]

- 11 A firm takes on two new employees, Arif and Bettina.
 - Arif starts on an annual salary of £30000, and his salary increases by £1000 each year after that.
 - Bettina starts on an annual salary of £25000, 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 $\pounds M$.

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 $\pounds 1.2$ million. [5]

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