Please check the examination details below before entering your candidate information

Candidate surname	Other names

MME Edexcel
Level 3 GCE

Centre Number | Candidate Number

MME Edexcel Practice Papers

Morning (Time: 2 hours)	Paper Reference **2MME**

Mathematics (A-A*)
Advanced
Paper 2: Pure Mathematics 2

You must have:
Mathematical Formulae and Statistical Tables, Calculator

Total Marks

Candidates may use any approved calculator.
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).
- **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.
- Inexact answers should be given to three significant figures unless otherwise stated.

Information
- The total mark for this paper is 100.
- 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

1.

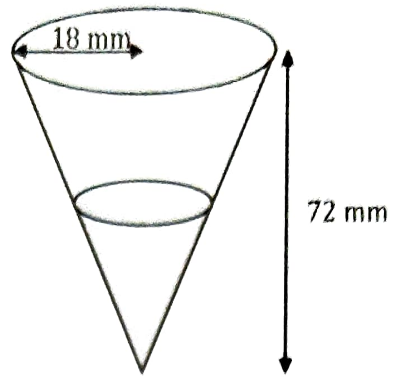

Figure 1

Figure 1 shows an ice cream cone with a height of 72 mm and radius of 18 mm.

The hollow cone, which is initially empty, is placed with it's vertical axis under the ice cream machine.

The ice cream flows at a constant rate of k mm^{3}s^{-1}.

The rate at which the height of the ice cream is rising 12.5 minutes after it was placed under the machine is $\frac{2}{75}$ mms^{-1}.

Determine the exact value of k.

(12)

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2. A sequence is defined for $n \geq 1$ by the recurrence relation,

$$u_{n+1} = \frac{10u_n}{1 + 16u_n}, \qquad u_1 = \frac{1}{5}$$

Determine an expression for u_n in the form

$$u_n = \frac{a^{n-1}}{c + ka^{n-1}}$$

where a, c and k are constants to be found.

(12)

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3. Use a substitution to evaluate the following integral,

$$\int \frac{(\ln(x^2+1) - 2\ln x)\sqrt{x^2+1}}{x^4}\,dx$$

Give your answer in its simplest form.

(12)

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4. A curve C has equation,

$$y^2 = \frac{x^2}{x-1}, \qquad x \in \mathbb{R}, \qquad x > 1$$

(a) Show that there exist exactly two tangents to C which pass through the point $(1,2)$.

(11)

(b) Find the equations of the two tangents to C that pass through the point $(1,2)$, in the form $ax + by + c = 0$, where a, b and c are constants to be determined.

(5)

5. The function f is defined as,

$$f(x) \equiv \frac{e^{\sin x \cos x} + 1}{e^{\sin x \cos x} - 1}, \qquad x \in \mathbb{R}.$$

Prove that $f(-x) = -f(x)$

(7)

(Total for Question 5 is 7 marks)

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6. The vertices of the triangle OAB have coordinates $A(12, -36, -12)$, $B(14, -2, 6)$, where O is a fixed origin.

The point N lies on OA such that $ON : NA = 1 : 2$

The point M is the midpoint of OB.

The point P is the intersection of AM and BN.

By using vector methods, or otherwise, determine the coordinates of P.

(11)

Turn over ▶

7.

$$S = 1 + \frac{2}{4} + \frac{2 \times 3}{4 \times 8} + \frac{2 \times 3 \times 4}{4 \times 8 \times 12} + \frac{2 \times 3 \times 4 \times 5}{4 \times 8 \times 12 \times 16} + \cdots$$

By considering a suitable binomial series, or otherwise, find the sum to infinity of S.

(5)

(Total for Question 7 is 5 marks)

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8. A curve C has equation,

$$y = 2|x^2 - 16| + 4(x - 4), \qquad x \in \mathbb{R}$$

(a) Sketch a detailed graph of C in the space below, including the coordinates of any points of intersection or turning points.

You must show your working when finding the x-intercepts.

(9)

(b) Hence, or otherwise, find the area of the finite region bounded by C and the x-axis, for which $y < 0$.

(5)

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9. The functions f and g are defined by

$$f(x) = 4x + 2, \qquad x \in \mathbb{R}, \qquad x \leq 16$$

$$g(x) = 2\sqrt{x - 1}, \qquad x \in \mathbb{R}, \qquad x \geq 12$$

(a) Find an expression for the composite function $fg(x)$, stating it's domain and range.

(7)

The domain of $g(x)$ is now restricted to $x < \alpha$.

(b) Given now that $gf(x)$ cannot be formed, determine the smallest possible value of the constant α.

(4)

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