Set A

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 1MME

Mathematics
Advanced
Paper 1: Pure Mathematics 1

You must have:	Total Marks
Mathematical Formulae and Statistical Tables, Calculator	

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 ▶

MME

MME

1. Find the coordinates and the nature of the stationary points of the function,

$$f(x) = 2x^3 - 3x^2 - 36x + 2\,, \qquad x \in \mathbb{R}$$

(7)

(Total for Question 1 is 7 marks)

2. Given that angle x is small and is measured in radians, use the small angle approximations to find an approximate value of

$$\frac{\sin x \cos 2x - \sin x}{x^2 \tan 4x}$$

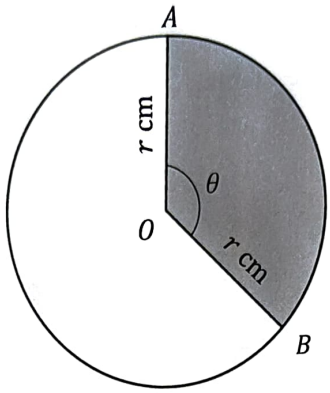
Express your answer in its simplest form.

(4)

(Total for Question 2 is 4 marks)

3. **Figure 1** shows a circle with a centre O and radius r cm

The angle in the shaded sector AOB shown is θ.



Not drawn accurately

Figure 1

(a) The length of the **chord** $AB = 1.5r$

Find angle θ in radians.

Give your answer to 3 decimal places.

(3)

(b) The area of the sector is 16π cm^2

Find the perimeter of the shaded sector.
Give your answer to 2 decimal places.

(4)

Question 3 continued

(Total for Question 3 is 7 marks)

4. A curve C has the parametric equations,

$$x = 2\sin t - 1, \qquad y = 4 + 2\cos 2t, \qquad 0 \leq t \leq 2\pi$$

(a) Show that the cartesian equation of C is:

$$y = 6 - (x + 1)^2$$

(3)

(b) The line $y = \frac{1}{3}x + k$, where k is a constant, crosses the curve C at two distinct points.

Find the range of possible values of k.

(5)

Question 4 continued

(Total for Question 4 is 8 marks)

5. **(a)** Using binomial expansion, show that:

$$\sqrt{\frac{4-x}{1+3x}} \approx 2 - \frac{13}{4}x + \frac{455}{64}x^2$$

(6)

(b) Hence, or otherwise show that an approximation for $\sqrt{3}$ can be written as $\frac{k}{256}$, where k is an integer to be found.

(3)

(c) Explain why $x = \frac{11}{6}$ and the binomial expansion above, should not be used to find an approximation for $\sqrt{\frac{1}{3}}$

(2)

Question 5 continued

(Total for Question 5 is 11 marks)

6. **(a)** Find the values of θ for which,

$$\tan^2\theta = 9, \qquad -\pi \leq \theta \leq \pi$$

Give your solution to 2 decimal places.

(2)

(b) Solve the equation,

$$4\cos^2 t = 3 - \sin t, \qquad 0 \leq t \leq 2\pi$$

Give your solution to 2 decimal places.

(4)

Question 6 continued

(Total for Question 6 is 6 marks)

7. Lewis is training for a half-marathon, which takes place in just over 3 weeks time. He is going to follow a training plan where he increases the distance by 4% each day.

The first day he runs 10 miles.

(a) How far will Lewis run on the 7th day?

(3)

(b) Over the 21 days of the plan how far will Lewis have run altogether?

Give your answer to the nearest mile.

(4)

(Total for Question 7 is 7 marks)

8. **Figure 2** shows a sketch of the curve C with equation $y = xe^x$.

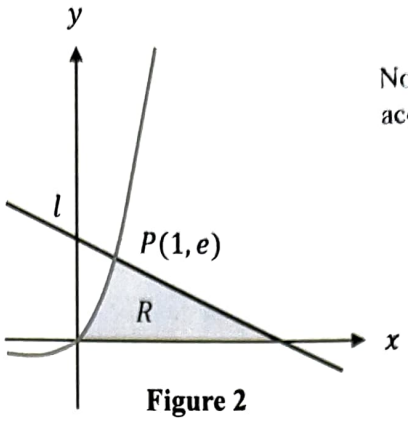


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Figure 2

The line l is the normal to C at the point $(1, e)$.

(a) Find the equation of the normal, l, in the form $y = mx + c$.

(5)

(b) Find the area of the region, R, enclosed by the curve C, the line l and the x-axis.

(5)

Question 8 continued

(Total for Question 8 is 10 marks)

9. The number of bacteria, B, in a petri dish after, t minutes, can be modelled by the following exponential equation,

$$B = ae^{kt}$$

where a and k are constants.

At the start of the experiment, there are 20 bacteria in the petri dish.

After one hour there are 54 bacteria in the petri dish.

(a) Calculate the value of k to 2 significant figures.

(2)

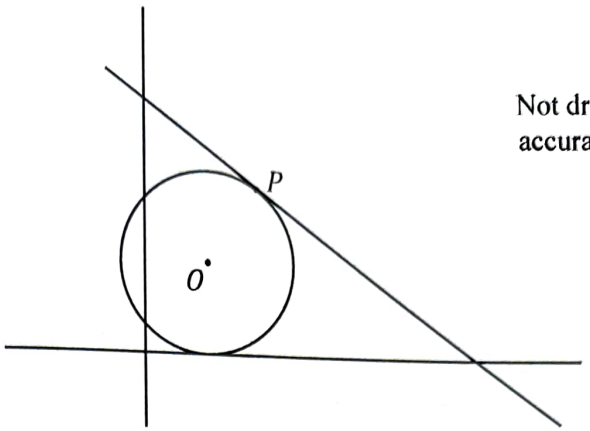
(b) The petri dish is left on the side in the lab at 15: 00, what time, to the nearest minute, does the number of bacteria in the dish exceed 3000?

(3)

Question 9 continued

(Total for Question 9 is 5 marks)

10. The circle, C, has centre at O, (3,5)



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The line between O and the point P on the circle has the equation,

$$y = \frac{3}{4}x + \frac{11}{4}$$

At P, $x = 7$

(a) Show that the tangent to C at the point P has equation,

$$y = -\frac{4}{3}x + \frac{52}{3}$$

(3)

(b) Find the equation of the circle, C.

(3)

(c) Find the equation of the second tangent of the circle with the same gradient in the form:

$$y = -\frac{4}{3}x + k \text{ where } k \neq \frac{52}{3}$$

(3)

Question 10 continued

(Total for Question 10 is 9 marks)

11. Prime integers, p_i , are labelled in ascending order such that,

$$p_1 = 2 , p_2 = 3 , \ldots \; p_5 = 11 \ldots$$

Show that there is no largest prime number.

(6)

(Total for Question 11 is 6 marks)

12. Show that,

$$\frac{\sin\theta}{\cos\theta}+\frac{\cos\theta}{\sin\theta}\equiv 2\operatorname{cosec}2\theta$$

(4)

(Total for Question 12 is 4 marks)

13. (a) Show that $(2x + 1)$ is a factor of $f(x) = 2x^3 - 3x^2 + 4x + 3$

(3)

(b) Express $(x^3 - 3x^2 - 7x + 2)$ in the form $(x + 2)(Ax^2 + Bx + C) + R$

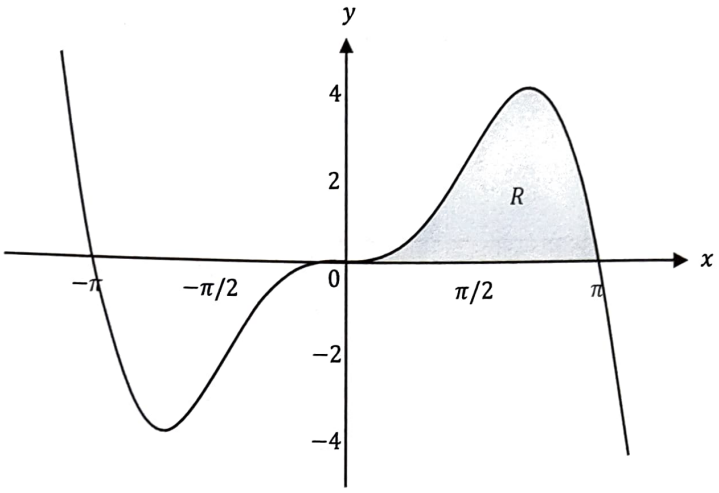
Where A, B, C and R are integer constants to be determined

(4)

(Total for Question 13 is 7 marks)

14. Consider the graph of

$$f(x) = x^2 \sin x$$



Find the area of the region, R, enclosed between $f(x)$ and the x-axis for $0 \leq x \leq \pi$

(9)