

Pearson Edexcel Level 3

GCE Mathematics

Advanced Level

Paper 1 or 2: Pure Mathematics

Practice Paper D

Time: 2 hours

Paper Reference(s)

9MA0/01 or 9MA0/02

You must have:

Mathematical Formulae and Statistical Tables, calculator

Candidates may use any calculator permitted by Pearson regulations. Calculators must not have the facility for algebraic 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).
- 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

- A booklet 'Mathematical Formulae and Statistical Tables' is provided.
- There are 13 questions in this paper. The total mark 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.
- If you change your mind about an answer, cross it out and put your new answer and any working underneath.

Answer ALL questions.

1. Given that

$$\frac{x^2 - 36}{x^2 - 11x + 30} \times \frac{25 - x^2}{Ax^2 + Bx + C} \times \frac{6x^2 + 7x - 3}{3x^2 + 17x - 6} \equiv \frac{x + 5}{6 - x},$$

find the values of the constants A , B and C , where A , B and C are integers.

(5 marks)

2. (a) Use proof by contradiction to show that if n^2 is an even integer then n is also an even integer.

(4 marks)

(b) Prove that $\sqrt{2}$ is irrational.

(6 marks)

3. Given that in the expansion of $\frac{1}{(1+ax)^2}$ the coefficient of the x^2 term is 75, find

(a) the possible values of a ,

(4 marks)

(b) the corresponding coefficients of the x^3 term.

(2 marks)

4. (a) Given that $f(x) = \sin x$, show that

$$f'(x) = \lim_{h \rightarrow 0} \left(\left(\frac{\cos h - 1}{h} \right) \sin x + \frac{\sin h}{h} \cos x \right)$$

(4 marks)

(b) Hence prove that $f'(x) = \cos x$.

(2 marks)

5. Given that $\int_a^4 (10 - 2x)^4 dx = \frac{211}{10}$, find the value of a .

(5 marks)

6. $f(x) = x^4 - 8x^2 + 2$

- (a) Show that the equation $f(x) = 0$ can be written as $x = \sqrt{ax^4 + b}$, $x > 0$, where a and b are constants to be found. (2 marks)

Let $x_0 = 1.5$.

- (b) Use the iteration formula $x_{n+1} = \sqrt{ax_n^4 + b}$, together with your values of a and b from part (a), to find, to 4 decimal places, the values of x_1, x_2, x_3 and x_4 . (2 marks)

A root of $f(x) = 0$ is α . By choosing a suitable interval,

- (c) prove that $\alpha = -2.782$ to 3 decimal places. (3 marks)
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7. The functions f and g are defined by $f(x) = e^{2x} + 4$, $x \in \mathbb{R}$ and $g(x) = \ln(x + 1)$, $x \in \mathbb{R}$, $x > -1$.

- (a) Find $fg(x)$ and state its range. (4 marks)

- (b) Solve $fg(x) = 85$ (3 marks)
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8. For an arithmetic sequence $a_4 = 98$ and $a_{11} = 56$.

- (a) Find the value of the 20th term. (4 marks)

Given that the sum of the first n terms is 78,

- (b) find the value of n . (4 marks)
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9. Figure 1 shows the right-angled triangles $\triangle ABC$, $\triangle ABD$ and $\triangle BDC$, with $AB = 1$ and $\angle BAD = \theta$.

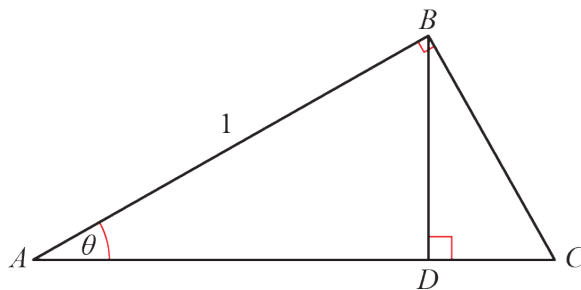


Figure 1

Prove that $1 + \tan^2 \theta = \sec^2 \theta$. (8 marks)

10. A particle of mass 3 kg is acted on by three forces, $F_1 = (2\mathbf{i} + 6\mathbf{j} - 3\mathbf{k})\text{N}$, $F_2 = (7\mathbf{i} + 8\mathbf{k})\text{N}$ and $F_3 = (-3\mathbf{i} - 3\mathbf{j} - 2\mathbf{k})\text{N}$.

(a) Find the resultant force R acting on the particle. (2 marks)

(b) Find the acceleration of the particle, giving your answer in the form $(p\mathbf{i} + q\mathbf{j} + r\mathbf{k})\text{ms}^{-2}$ (2 marks)

(c) Find the magnitude of the acceleration. (2 marks)

(d) Given that the particle starts at rest, find the exact distance travelled by the particle in the first 10 s. (3 marks)

11. Find the values of the constants A, B, C, D and E in the following identity:

$$5x^4 - 4x^3 + 17x^2 - 5x + 7 \equiv (Ax^2 + Bx + C)(x^2 + 2) + Dx + E$$

(5 marks)

12.
$$f(x) = \frac{21 - 14x}{(1 - 4x)(2x + 3)}, x \neq \frac{1}{4}, x \neq -\frac{3}{2}$$

(a) Given that $f(x) = \frac{A}{1 - 4x} + \frac{B}{2x + 3}$, find the values of the constants A and B . (5 marks)

(b) Find the exact value of $\int_{-1}^0 f(x) dx$ (5 marks)

13. Figure 2 shows the curve C with parametric equations $x = t + 2, y = \frac{t-1}{t+2}, t \neq -2$. The curve passes through the x -axis at P .

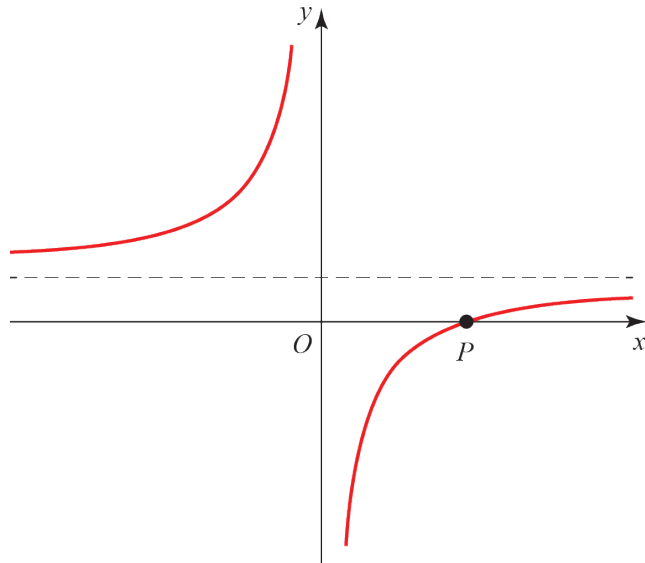


Figure 2

- (a) Find the coordinate of P . (2 marks)
- (b) Find the cartesian equation of the curve. (2 marks)
- (c) Find the equation of the normal to the curve at the point $t = -1$. Give your answer in the form $ax + by + c = 0$. (6 marks)
- (d) Find the coordinates of the point where the normal meets C . (4 marks)

TOTAL FOR PAPER IS 100 MARKS

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