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)

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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)

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3. Given that in the expansion of $\dfrac{1}{(1+ax)^2}$ 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)

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

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

(4 marks)

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

(2 marks)

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

(5 marks)

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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 $\angle BAD = \theta$.

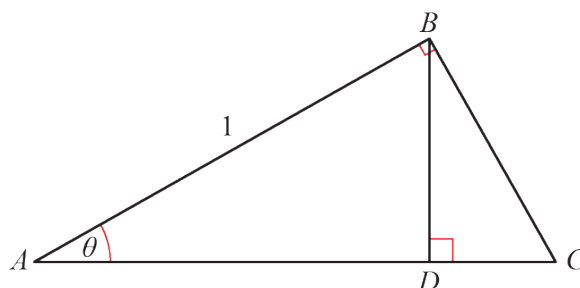**Figure 1**

Prove that $1 + \tan^2 \theta = \sec^2 \theta$.

(8 marks)

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3

10. A particle of mass $3\,\text{kg}$ 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 $10\,\text{s}$.

(3 marks)

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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)

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

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

(5 marks)

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

(5 marks)

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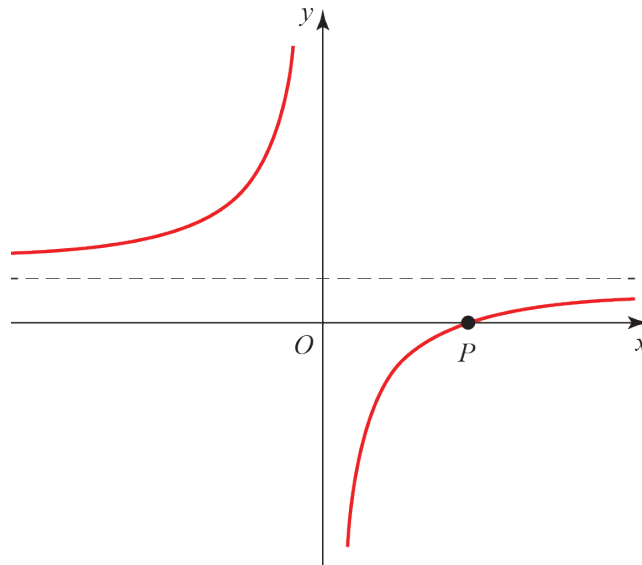

Figure 2

(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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