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INTERNATIONAL A LEVEL MATHEMATICS • PURE 2 (WMA12)

Pure 2 Practice Paper 2

Edexcel IAL Pure Mathematics 2

AIMING FOR A

Written in the style of the Pearson Edexcel International Advanced Level paper (WMA12/01) • Calculator allowed

A full 75-mark paper, harder than a typical real series, with fewer steps given and topics combined in every question

Time	Total	You must have
1 hour 30 minutes	**75 marks**	**Mathematical Formulae and Statistical Tables, calculator**

Instructions

- Use black ink or ball-point pen. Pencil may be used for diagrams and sketches.
- Answer **all** questions, in the spaces provided.
- Show enough working to make your method clear. Answers without working may not gain full credit.
- Give inexact answers to **three significant figures** unless the question says otherwise.

Information

- There are 9 questions in this paper. The total mark is 75.
- The marks for each question are shown in brackets.

Advice

- Sit the paper in one go, in 1 hour 30 minutes, with the mark scheme closed.
- Read each question carefully and try every question. Check your answers if you have time.
- Then mark it line by line with the mark scheme and fill in your score.

Track your score

Q	Topic	Marks	Score
1	Binomial coefficients in an arithmetic sequence	8	
2	Factor theorem, trigonometric equation	8	
3	Stationary points and a circle	9	
4	Logarithms of a geometric sequence	8	
5	Exponential and trigonometric equations	8	
6	Increasing functions, area	9	
7	Trapezium rule, exponential curve	8	
8	Binomial expansion with surds, proof	8	
9	Area between a chord and a curve	9	
	Total	**75**	

Rough grade guide (out of 75): A **49** • B **42** • C **35**

Based on recent WMA12 grade boundaries. Real boundaries change every series, so treat this as a guide, not a grade.

Mark scheme **Exam questions by topic** **More practice papers**

Name ..... Date .....

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1. In this question you must show all stages of your working.

Solutions relying on calculator technology are not acceptable.

In the binomial expansion of

$$(1+kx)^7$$

where k is a non-zero constant, the coefficients of x, x^2 and x^3 are the first three terms of an arithmetic sequence.

(a) Find the possible values of k.

(5)

(b) Given that the arithmetic sequence is decreasing, find the sum of its first 20 terms.

(3)

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Question 1 continued

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(Total for Question 1 is 8 marks)

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2. In this question you must show all stages of your working.
Solutions relying on calculator technology are not acceptable.

$$f(x) = 6x^3 - 7x^2 - 7x + 6$$

(a) Factorise $f(x)$ completely.

(3)

(b) Hence solve, for $0 \leqslant \theta < 360^\circ$,

$$6\cos^3\theta + 7\sin^2\theta = 7\cos\theta + 1$$

giving your answers to one decimal place where appropriate.

(5)

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Question 2 continued

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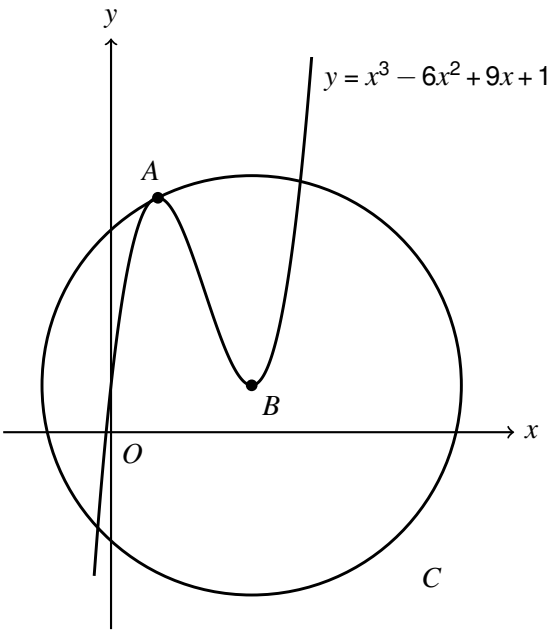

Figure 1

In this question you must show all stages of your working.

Solutions relying on calculator technology are not acceptable.

Figure 1 shows a sketch of the curve with equation

$$y = x^3 - 6x^2 + 9x + 1$$

The curve has a maximum turning point at A and a minimum turning point at B.

(a) Use calculus to find the coordinates of A and the coordinates of B.

(3)

The circle C has centre B and passes through A, as shown in Figure 1.

(b) Find an equation for C.

(2)

The tangent to C at A meets the curve again at two points.

(c) Find the exact x coordinates of these two points.

(4)

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Question 3 continued

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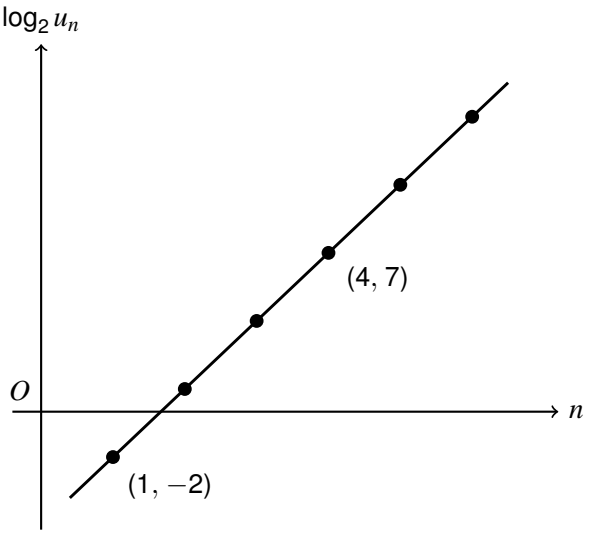

Figure 2

A geometric sequence $u_1, u_2, u_3, \ldots$ has positive terms.

Figure 2 shows the points with coordinates $(n, \log_2 u_n)$ for $n = 1, 2, \ldots, 6$

The points lie on a straight line, which passes through $(1, -2)$ and $(4, 7)$.

(a) Find the first term and the common ratio of the geometric sequence.

(3)

(b) Find the value of $\sum_{n=1}^{20} \log_2 u_n$

(2)

(c) Find the least value of n for which the sum of the first n terms of the geometric sequence exceeds 10^9

(3)

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Question 4 continued

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5. In this question you must show all stages of your working.

Solutions relying on calculator technology are not acceptable.

(i) Solve, for $0 \leqslant x < 2\pi$,

$$9^{\sin^2 x} = 27^{\cos x}$$

giving your answers as exact multiples of π.

(4)

(ii) Solve, for $0 \leqslant \theta < 180^\circ$,

$$3\sin\left(2\theta + 40^\circ\right) = 2\cos\left(2\theta + 40^\circ\right)$$

giving your answers to one decimal place.

(4)

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Question 5 continued

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6. In this question you must show all stages of your working.

Solutions relying on calculator technology are not acceptable.

$$f(x) = x^3 + ax^2 + 3x$$

where a is a constant.

(a) Find the set of values of a for which $f(x)$ is an increasing function for all values of x.

(3)

Given now that $a = -4$

(b) sketch the curve with equation $y = f(x)$, showing the coordinates of the points where the curve meets the x-axis.

(2)

(c) Find the exact total area of the regions enclosed between the curve and the x-axis.

(4)

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Question 6 continued

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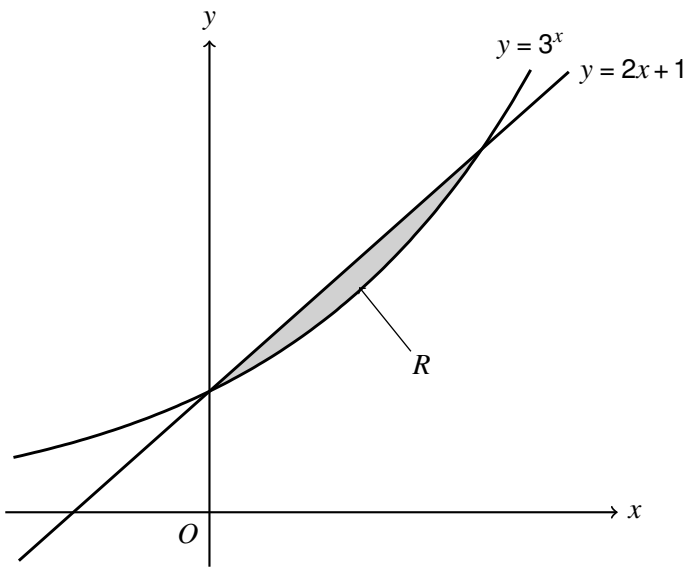

Figure 3

Figure 3 shows the curve with equation $y = 3^x$ and the line with equation $y = 2x + 1$

The region R, shown shaded in Figure 3, is bounded by the curve and the line.

(a) Show that the curve and the line meet where $x = 0$ and where $x = 1$

(1)

(b) Use the trapezium rule with four strips of equal width to find an estimate for

$$\int_0^1 3^x \, dx$$

giving your answer to 4 significant figures.

(3)

(c) Hence find an estimate for the area of R.

(2)

(d) State, with a reason, whether your answer to part (c) is an overestimate or an underestimate of the area of R.

(2)

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Question 7 continued

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8. In this question you must show all stages of your working.

Solutions relying on calculator technology are not acceptable.

(a) Use the binomial expansion to write $\left(1+\sqrt{2}\right)^5$ in the form $a+b\sqrt{2}$, where a and b are integers.

(3)

(b) Prove that, for every positive integer n,

$$\left(1+\sqrt{2}\right)^n+\left(1-\sqrt{2}\right)^n$$

is an integer.

(3)

(c) Using your answer to part (a), explain why $\frac{41}{29}$ is an approximation to $\sqrt{2}$ that is correct to within 0.001

(2)

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Question 8 continued

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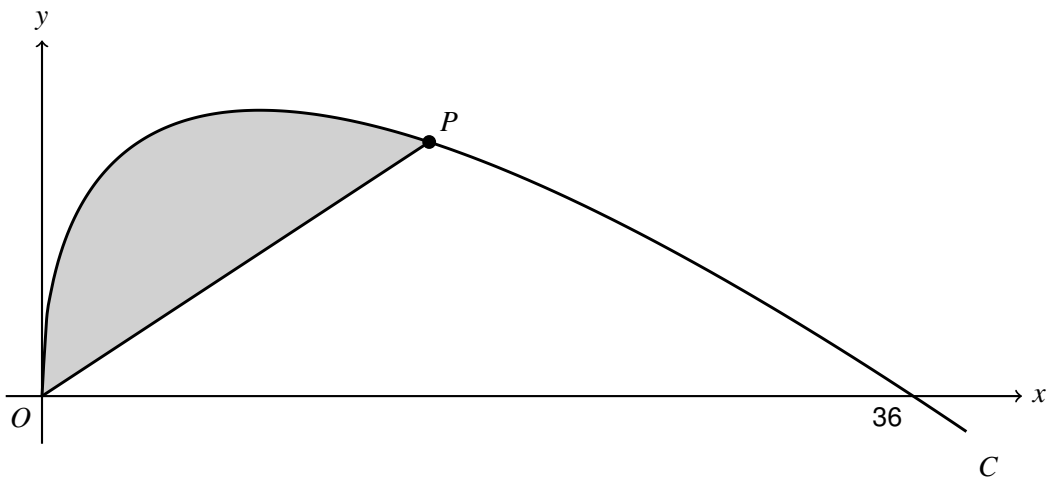

Figure 4

In this question you must show all stages of your working.

Solutions relying on calculator technology are not acceptable.

Figure 4 shows part of the curve C with equation

$$y = 6\sqrt{x} - x \qquad x \geqslant 0$$

The curve meets the x-axis at O and at the point where $x = 36$

The point P, with x coordinate p, where $0 < p < 36$, lies on C.

The region shown shaded in Figure 4 is bounded by C and the straight line OP.

(a) Find, in terms of p, the area of the shaded region, giving your answer in its simplest form.

(5)

(b) Find the value of p for which the area of the shaded region is one eighth of the area of the region bounded by C and the x-axis.

(2)

(c) Show that, for this value of p, the point P is the maximum point of C.

(2)

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Question 9 continued

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TOTAL FOR PAPER IS 75 MARKS

END

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