Write your name here

Surname	Other names

Pearson Edexcel
International Advanced Level

Centre Number | Candidate Number

Core Mathematics C12

Advanced Subsidiary

Monday 13 January 2014 – Morning
Time: 2 hours 30 minutes

Paper Reference
WMA01/01

You must have:
Mathematical Formulae and Statistical Tables (Blue)

Total Marks

Candidates may use any calculator allowed by the regulations of the Joint Council for Qualifications. 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). Coloured pencils and highlighter pens must not be used.
- **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.
- When a calculator is used, the answer should be given to an appropriate degree of accuracy.

Information

- The total mark for this paper is 125.
- 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 ▶

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1. Find the first 3 terms in ascending powers of x of

$$\left(2 - \frac{x}{2}\right)^6$$

giving each term in its simplest form.

(4)

Leave blank

Question 1 continued

Q1

(Total 4 marks)

Leave blank

2.

$$f(x) = \frac{8}{x^2} - 4\sqrt{x} + 3x - 1, \qquad x > 0$$

Giving your answers in their simplest form, find

(a) $f'(x)$

(3)

(b) $\int f(x)\,dx$

(4)

Leave blank

Question 2 continued

Q2

(Total 7 marks)

Leave blank

3.

$$f(x) = 10x^3 + 27x^2 - 13x - 12$$

(a) Find the remainder when $f(x)$ is divided by

(i) $x - 2$

(ii) $x + 3$

(3)

(b) Hence factorise $f(x)$ completely.

(4)

Leave blank

Question 3 continued

Q3

(Total 7 marks)

Leave blank

4. Answer this question without the use of a calculator and show all your working.

(i) Show that

$$\frac{4}{2\sqrt{2}-\sqrt{6}} = 2\sqrt{2}(2+\sqrt{3})$$

(4)

(ii) Show that

$$\sqrt{27}+\sqrt{21}\times\sqrt{7}-\frac{6}{\sqrt{3}} = 8\sqrt{3}$$

(3)

Leave blank

Question 4 continued

Q4

(Total 7 marks)

Leave blank

5. A sequence is defined by

$$u_1 = 3$$
$$u_{n+1} = 2 - \frac{4}{u_n}, \quad n \geqslant 1$$

Find the exact values of

(a) u_2, u_3 and u_4 **(3)**

(b) u_{61} **(1)**

(c) $\sum_{i=1}^{99} u_i$ **(3)**

P 4 3 2 3 1 A 0 1 0 4 4

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Question 5 continued

Q5

(Total 7 marks)

Leave blank

6. Given that a and b are positive constants, solve the simultaneous equations

$$ab = 25$$

$$\log_4 a - \log_4 b = 3$$

Show each step of your working, giving exact values for a and b.

(6)

Leave blank

Question 6 continued

Q6

(Total 6 marks)

Leave blank

7. (a) Show that

$$12\sin^2 x - \cos x - 11 = 0$$

may be expressed in the form

$$12\cos^2 x + \cos x - 1 = 0$$

(1)

(b) Hence, using trigonometry, find all the solutions in the interval $0 \leqslant x \leqslant 360°$ of

$$12\sin^2 x - \cos x - 11 = 0$$

Give each solution, in degrees, to 1 decimal place.

(4)

Leave blank

Question 7 continued

Q7

(Total 5 marks)

Leave blank

8. Find the range of values of k for which the quadratic equation

$$kx^2 + 8x + 2(k + 7) = 0$$

has no real roots.

(7)

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Question 8 continued

Q8

(Total 7 marks)

Leave blank

9. In the first month after opening, a mobile phone shop sold 300 phones. A model for future sales assumes that the number of phones sold will increase by 5% per month, so that 300×1.05 will be sold in the second month, 300×1.05^2 in the third month, and so on.

Using this model, calculate

(a) the number of phones sold in the 24th month,

(2)

(b) the total number of phones sold over the whole 24 months.

(2)

This model predicts that, in the Nth month, the number of phones sold in that month exceeds 3000 for the first time.

(c) Find the value of N.

(3)

Leave blank

Question 9 continued

Leave blank

Question 9 continued

Leave blank

Question 9 continued

Q9

(Total 7 marks)

Leave blank

10. The curve C has equation $y = \cos\left(x - \frac{\pi}{3}\right)$, $0 \leqslant x \leqslant 2\pi$

(a) In the space below, sketch the curve C.

(2)

(b) Write down the exact coordinates of the points at which C meets the coordinate axes.

(3)

(c) Solve, for x in the interval $0 \leqslant x \leqslant 2\pi$,

$$\cos\left(x - \frac{\pi}{3}\right) = \frac{1}{\sqrt{2}}$$

giving your answers in the form $k\pi$, where k is a rational number.

(4)

Leave blank

Question 10 continued

Leave blank

Question 10 continued

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Question 10 continued

Q10

(Total 9 marks)

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11. The first three terms of an arithmetic series are 60, $4p$ and $2p - 6$ respectively.

(a) Show that $p = 9$

(2)

(b) Find the value of the 20th term of this series.

(3)

(c) Prove that the sum of the first n terms of this series is given by the expression

$$12n\,(6 - n)$$

(3)

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Question 11 continued

Q11

(Total 8 marks)

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12.

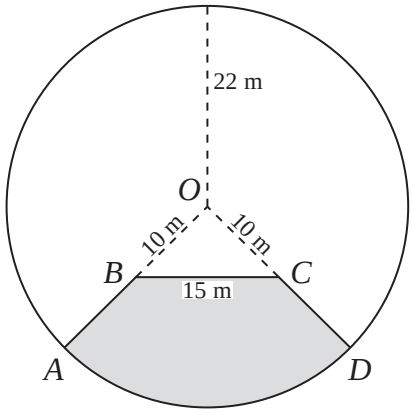

Diagram **NOT** drawn to scale

Figure 1

Figure 1 shows the plan for a pond and platform. The platform is shown shaded in the figure and is labelled *ABCD*.

The pond and platform together form a circle of radius 22 m with centre *O*.

OA and *OD* are radii of the circle. Point *B* lies on *OA* such that the length of *OB* is 10 m and point *C* lies on *OD* such that the length of *OC* is 10 m. The length of *BC* is 15 m.

The platform is bounded by the arc *AD* of the circle, and the straight lines *AB*, *BC* and *CD*.

Find

(a) the size of the angle *BOC*, giving your answer in radians to 3 decimal places,
(3)

(b) the perimeter of the platform to 3 significant figures,
(4)

(c) the area of the platform to 3 significant figures.
(4)

Leave blank

Question 12 continued

Leave blank

Question 12 continued

Leave blank

Question 12 continued

Q12

(Total 11 marks)

Leave blank

13. The curve C has equation

$$y = \frac{(x-3)(3x-25)}{x}, \quad x > 0$$

(a) Find $\frac{dy}{dx}$ in a fully simplified form.

(3)

(b) Hence find the coordinates of the turning point on the curve C.

(4)

(c) Determine whether this turning point is a minimum or maximum, justifying your answer.

(2)

The point P, with x coordinate $2\frac{1}{2}$, lies on the curve C.

(d) Find the equation of the normal at P, in the form $ax + by + c = 0$, where a, b and c are integers.

(5)

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Question 13 continued

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Question 13 continued

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Question 13 continued

Q13

(Total 14 marks)

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14.

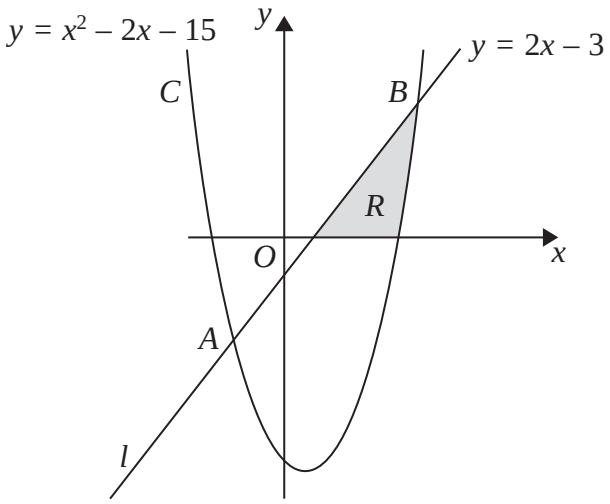

Diagram **NOT** drawn to scale

Figure 2

Figure 2 shows part of the line l with equation $y = 2x - 3$ and part of the curve C with equation $y = x^2 - 2x - 15$

The line l and the curve C intersect at the points A and B as shown.

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

(5)

In Figure 2, the shaded region R is bounded by the line l, the curve C and the positive x-axis.

(b) Use integration to calculate an exact value for the area of R.

(7)

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Question 14 continued

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Question 14 continued

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Question 14 continued

Q14

(Total 12 marks)

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15.

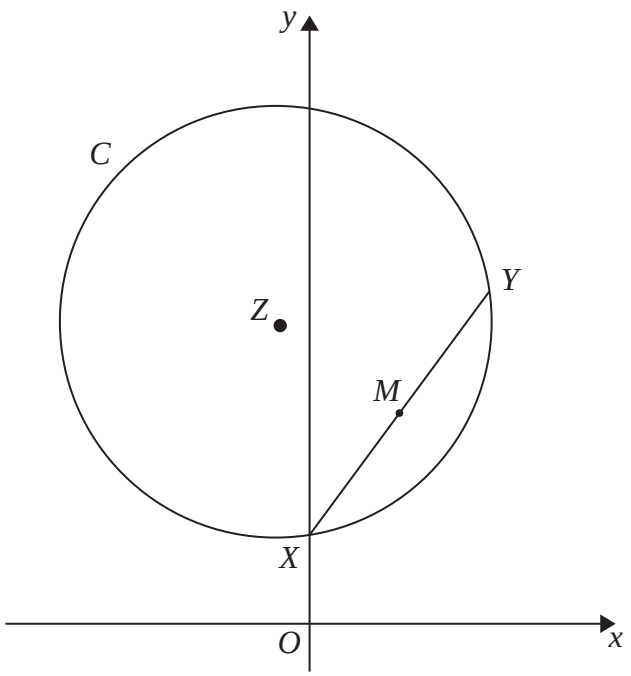

Diagram **NOT** drawn to scale

Figure 3

The points X and Y have coordinates (0, 3) and (6, 11) respectively. XY is a chord of a circle C with centre Z, as shown in Figure 3.

(a) Find the gradient of XY.

(2)

The point M is the midpoint of XY.

(b) Find an equation for the line which passes through Z and M.

(5)

Given that the y coordinate of Z is 10,

(c) find the x coordinate of Z,

(2)

(d) find the equation of the circle C, giving your answer in the form

$$x^2 + y^2 + ax + by + c = 0$$

where a, b and c are constants.

(5)

Leave blank

Question 15 continued

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Question 15 continued

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Question 15 continued

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Question 15 continued

Q15

(Total 14 marks)

TOTAL FOR PAPER: 125 MARKS

END