Write your name here

Surname	Other names

Pearson Edexcel
International Advanced Level

Centre Number | Candidate Number

Core Mathematics C12

Advanced Subsidiary

Tuesday 9 January 2018 – 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. Given that

$$y = \frac{2x^{\frac{2}{3}} + 3}{6}, \quad x > 0$$

find, in the simplest form,

(a) $\frac{dy}{dx}$

(2)

(b) $\int y \, dx$

(3)

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Question 1 continued

Q1

(Total 5 marks)

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2. A sequence is defined by

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

(a) Find the value of u_2 and the value of u_3

(2)

(b) Calculate the value of $\sum_{r=1}^{4}(r - u_r)$

(3)

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Question 2 continued

(Total 5 marks)

Q2

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3. Simplify fully

(a) $\left(3x^{\frac{1}{2}}\right)^4$

(2)

(b) $\dfrac{2y^7 \times (4y)^{-2}}{3y}$

(2)

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Question 3 continued

Q3

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4. The equation

$$(p - 2)x^2 + 8x + (p + 4) = 0, \quad \text{where } p \text{ is a constant}$$

has no real roots.

(a) Show that p satisfies $p^2 + 2p - 24 > 0$

(3)

(b) Hence find the set of possible values of p.

(4)

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Question 4 continued

Q4

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5. (*In this question, solutions based entirely on graphical or numerical methods are not acceptable.*)

(i) Solve, for $0 < \theta < \frac{\pi}{2}$

$$5\sin 3\theta - 7\cos 3\theta = 0$$

Give each solution, in radians, to 3 significant figures.

(5)

(ii) Solve, for $0 < x < 360°$

$$9\cos^2 x + 5\cos x = 3\sin^2 x$$

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

(6)

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Question 5 continued

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Question 5 continued

(Total 11 marks)

Q5

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6.

$$f(x) = ax^3 - 8x^2 + bx + 6$$

where a and b are constants.

When $f(x)$ is divided by $(x + 1)$ there is no remainder.

When $f(x)$ is divided by $(x - 2)$ the remainder is -12

(a) Find the value of a and the value of b.

(5)

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

(4)

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Question 6 continued

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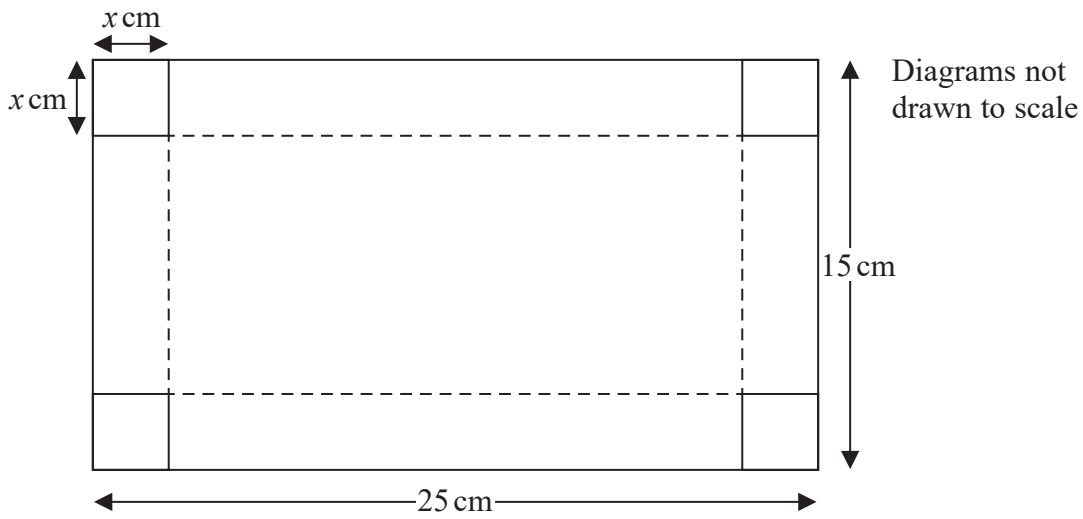

Figure 1

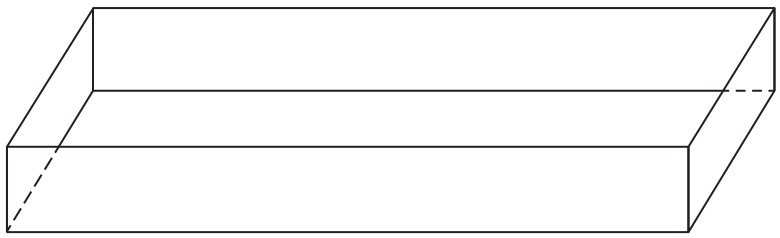

Figure 2

Figure 1 shows a rectangular sheet of metal of negligible thickness, which measures 25 cm by 15 cm. Squares of side x cm are cut from each corner of the sheet and the remainder is folded along the dotted lines to make an open cuboid box, as shown in Figure 2.

(a) Show that the volume, V cm^3, of the box is given by

$$V = 4x^3 - 80x^2 + 375x$$

(2)

(b) Use calculus to find the value of x, to 3 significant figures, for which the volume of the box is a maximum.

(4)

(c) Justify that this value of x gives a maximum value for V.

(2)

(d) Find, to 3 significant figures, the maximum volume of the box.

(2)

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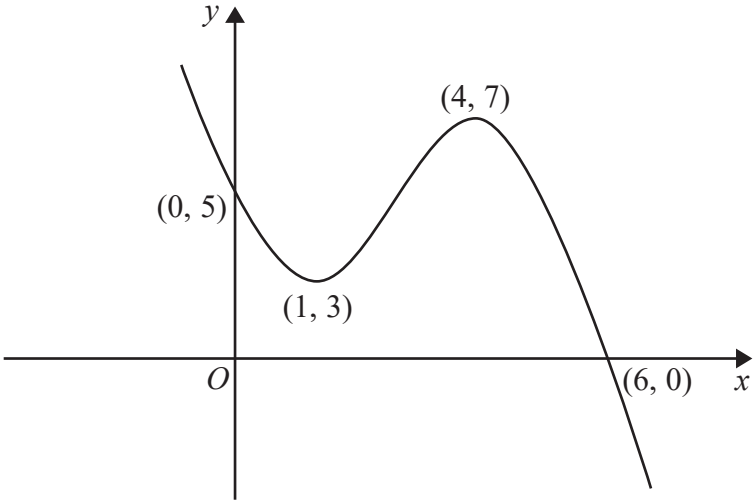

Figure 3

Figure 3 shows a sketch of the curve with equation $y = \mathrm{f}(x),\ x \in \mathbb{R}$.

The curve crosses the y-axis at the point (0, 5) and crosses the x-axis at the point (6, 0).

The curve has a minimum point at (1, 3) and a maximum point at (4, 7).

On separate diagrams, sketch the curve with equation

(a) $y = \mathrm{f}(-x)$

(3)

(b) $y = \mathrm{f}(2x)$

(3)

On each diagram, show clearly the coordinates of any points of intersection of the curve with the two coordinate axes and the coordinates of the stationary points.

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Question 8 continued

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9. The first term of a geometric series is 20 and the common ratio is 0.9

(a) Find the value of the fifth term.

(2)

(b) Find the sum of the first 8 terms, giving your answer to one decimal place.

(2)

Given that $S_\infty - S_N < 0.04$, where S_N is the sum of the first N terms of this series,

(c) show that $0.9^N < 0.0002$

(4)

(d) Hence find the smallest possible value of N.

(2)

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Question 9 continued

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10. (i) Use the laws of logarithms to solve the equation

$$3\log_8 2 + \log_8(7 - x) = 2 + \log_8 x$$

(5)

(ii) Using algebra, find, in terms of logarithms, the exact value of y for which

$$3^{2y} + 3^{y+1} = 10$$

(5)

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11. The circle C has equation

$$x^2 + y^2 - 8x - 10y + 16 = 0$$

The centre of C is at the point T.

(a) Find

(i) the coordinates of the point T,

(ii) the radius of the circle C.

(4)

The point M has coordinates (20, 12).

(b) Find the exact length of the line MT.

(2)

Point P lies on the circle C such that the tangent at P passes through the point M.

(c) Find the exact area of triangle MTP, giving your answer as a simplified surd.

(3)

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Question 11 continued

Q11

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12. The line l_1 has equation $x + 3y - 11 = 0$

The point A and the point B lie on l_1

Given that A has coordinates $(-1, p)$ and B has coordinates $(q, 2)$, where p and q are integers,

(a) find the value of p and the value of q,

(2)

(b) find the length of AB, giving your answer as a simplified surd.

(2)

The line l_2 is perpendicular to l_1 and passes through the midpoint of AB.

(c) Find an equation for l_2 giving your answer in the form $y = mx + c$, where m and c are constants to be found.

(5)

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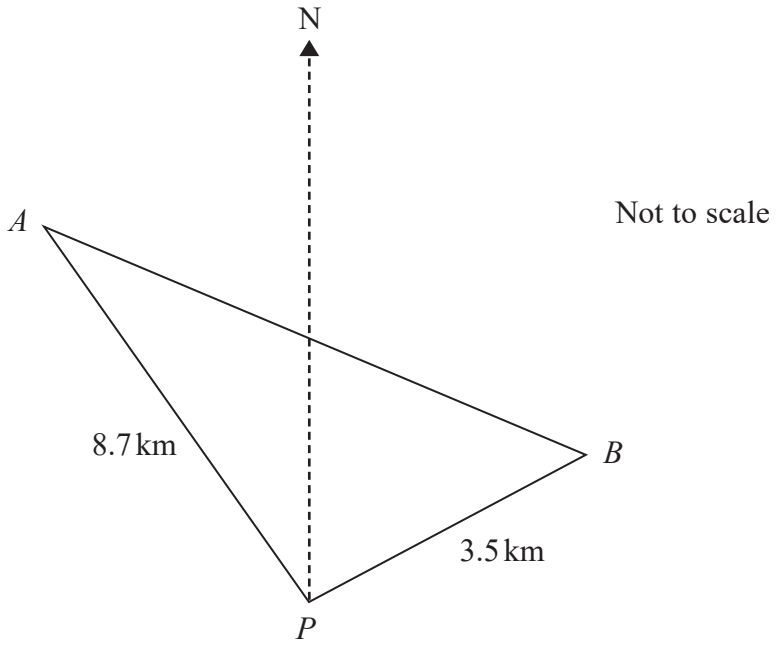

Figure 4

Figure 4 shows the position of two stationary boats, A and B, and a port P which are assumed to be in the same horizontal plane.

Boat A is 8.7 km on a bearing of 314° from port P.

Boat B is 3.5 km on a bearing of 052° from port P.

(a) Show that angle APB is 98°

(1)

(b) Find the distance of boat B from boat A, giving your answer to one decimal place.

(2)

(c) Find the bearing of boat B from boat A, giving your answer to the nearest degree.

(4)

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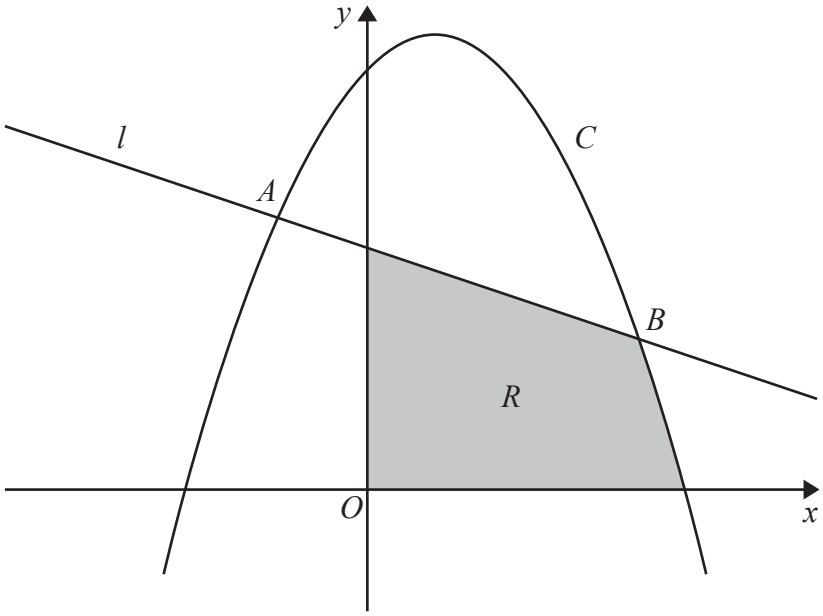

Figure 5

Figure 5 shows a sketch of part of the line l with equation $y = 8 - x$ and part of the curve C with equation $y = 14 + 3x - 2x^2$

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

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

(5)

The region R, shown shaded in Figure 5, is bounded by the coordinate axes, the line l, and the curve C.

(b) Use algebraic integration to calculate the exact area of R.

(8)

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15. The binomial expansion, in ascending powers of x, of $(1 + kx)^n$ is

$$1 + 36x + 126kx^2 + \ldots$$

where k is a non-zero constant and n is a positive integer.

(a) Show that $nk(n - 1) = 252$

(2)

(b) Find the value of k and the value of n.

(5)

(c) Using the values of k and n, find the coefficient of x^3 in the binomial expansion of $(1 + kx)^n$

(3)

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