Write your name here

Surname	Other names

Pearson Edexcel
International
Advanced Level

Centre Number | Candidate Number

Core Mathematics C12

Advanced Subsidiary

Sample Assessment Material
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 ▶

S44999A

S 4 4 9 9 9 A 0 1 4 4

PEARSON

Leave blank

1. Simplify fully

(a) $(25x^4)^{\frac{1}{2}}$,

(1)

(b) $(25x^4)^{-\frac{3}{2}}$.

(2)

Q1

(Total 3 marks)

Leave blank

2. Find the first 3 terms, in ascending powers of x, of the binomial expansion of

$$(3 - x)^6$$

and simplify each term.

(4)

Q2

(Total 4 marks)

Leave blank

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

(i) Show that

$$(5 - \sqrt{8})(1 + \sqrt{2}) \equiv a + b\sqrt{2}$$

giving the values of the integers a and b.

(3)

(ii) Show that

$$\sqrt{80} + \frac{30}{\sqrt{5}} \equiv c\sqrt{5}\text{, where } c \text{ is an integer.}$$

(3)

Leave blank

Question 3 continued

Q3

(Total 6 marks)

PMT

Leave blank

4. Given that $y = 2x^5 + 7 + \dfrac{1}{x^3}$, $x \neq 0$, find, in their simplest form,

(a) $\dfrac{dy}{dx}$,

(3)

(b) $\displaystyle\int y \, dx$.

(4)

PMT

Leave blank

Question 4 continued

Q4

(Total 7 marks)

Leave blank

5.

$$y = \frac{5}{3x^2 - 2}$$

The table below gives values of y rounded to 3 decimal places where necessary.

x	2	2.25	2.5	2.75	3
y	0.5	0.379	0.299	0.242	0.2

Use the trapezium rule, with all the values of y from the table above, to find an approximate value for

$$\int_2^3 \frac{5}{3x^2 - 2}\,dx$$

(4)

Leave blank

Question 5 continued

Q5

(Total 4 marks)

PMT

Leave blank

6. $$f(x) = x^4 + x^3 + 2x^2 + ax + b,$$

where a and b are constants.

When $f(x)$ is divided by $(x - 1)$, the remainder is 7

(a) Show that $a + b = 3$

(2)

When $f(x)$ is divided by $(x + 2)$, the remainder is -8

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

(5)

Leave blank

Question 6 continued

Q6

(Total 7 marks)

Leave blank

7. A sequence $a_1, a_2, a_3, \ldots$ is defined by

$$a_1 = 2$$
$$a_{n+1} = 3a_n - c$$

where c is a constant.

(a) Find an expression for a_2 in terms of c.

(1)

Given that $\sum_{i=1}^{3} a_i = 0$

(b) find the value of c.

(4)

Leave blank

Question 7 continued

(Total 5 marks)

Q7

Leave blank

8. The equation

$$(k + 3)x^2 + 6x + k = 5, \quad \text{where } k \text{ is a constant,}$$

has two distinct real solutions for x.

(a) Show that k satisfies

$$k^2 - 2k - 24 < 0$$

(4)

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

(3)

Leave blank

Question 8 continued

Q8

(Total 7 marks)

Leave blank

9. Given that $y = 3x^2$,

(a) show that $\log_3 y = 1 + 2\log_3 x$

(3)

(b) Hence, or otherwise, solve the equation

$$1 + 2\log_3 x = \log_3 (28x - 9)$$

(3)

PMT

Leave blank

Question 9 continued

Q9

(Total 6 marks)

Leave blank

10.

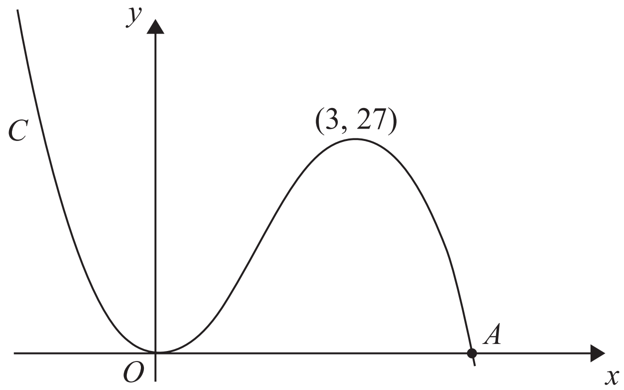

Figure 1

Figure 1 shows a sketch of the curve C with equation $y = \mathrm{f}(x)$, where

$$\mathrm{f}(x) = x^2(9 - 2x).$$

There is a minimum at the origin, a maximum at the point (3, 27) and C cuts the x-axis at the point A.

(a) Write down the coordinates of the point A.

(1)

(b) On separate diagrams sketch the curve with equation

(i) $y = \mathrm{f}(x + 3)$,

(ii) $y = \mathrm{f}(3x)$.

On each sketch you should indicate clearly the coordinates of the maximum point and any points where the curves cross or meet the coordinate axes.

(6)

The curve with equation $y = \mathrm{f}(x) + k$, where k is a constant, has a maximum point at (3, 10).

(c) Write down the value of k.

(1)

Leave blank

Question 10 continued

Leave blank

Question 10 continued

Leave blank

Question 10 continued

Q10

(Total 8 marks)

Leave blank

11.

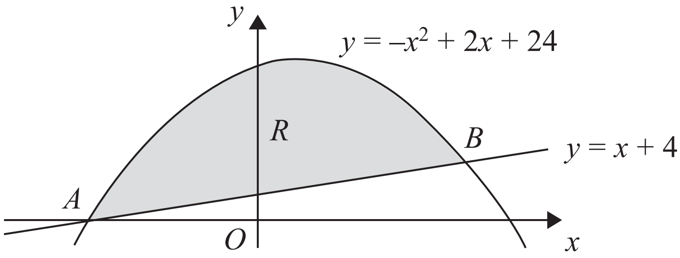

Figure 2

The straight line with equation $y = x + 4$ cuts the curve with equation $y = -x^2 + 2x + 24$ at the points A and B, as shown in Figure 2.

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

(4)

The finite region R is bounded by the straight line and the curve and is shown shaded in Figure 2.

(b) Use calculus to find the exact area of R.

(7)

PMT

Leave blank

Question 11 continued

Q11

(Total 11 marks)

Leave blank

12. The circle C has centre $A(2, 1)$ and passes through the point $B(10, 7)$

(a) Find an equation for C.

(4)

The line l_1 is the tangent to C at the point B.

(b) Find an equation for l_1

(4)

The line l_2 is parallel to l_1 and passes through the mid-point of AB.

Given that l_2 intersects C at the points P and Q,

(c) find the length of PQ, giving your answer in its simplest surd form.

(3)

Leave blank

Question 12 continued

Leave blank

Question 12 continued

Leave blank

Question 12 continued

Q12

(Total 11 marks)

Leave blank

13.

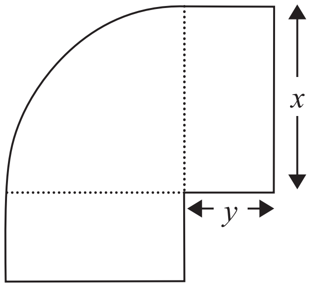

Figure 3

Figure 3 shows a flowerbed. Its shape is a quarter of a circle of radius x metres with two equal rectangles attached to it along its radii. Each rectangle has length equal to x metres and width equal to y metres.

Given that the area of the flowerbed is 4 m^2,

(a) show that

$$y = \frac{16 - \pi x^2}{8x}$$

(3)

(b) Hence show that the perimeter P metres of the flowerbed is given by the equation

$$P = \frac{8}{x} + 2x$$

(3)

(c) Use calculus to find the minimum value of P.

(5)

Leave blank

Question 13 continued

Leave blank

Question 13 continued

Leave blank

Question 13 continued

Q13

(Total 11 marks)

Leave blank

14. In this question you must show all stages of your working.
(Solutions based entirely on graphical or numerical methods are not acceptable.)

(a) Solve for $0 \leqslant x < 360°$, giving your answers in degrees to 1 decimal place,

$$3\sin(x + 45°) = 2$$

(4)

(b) Find, for $0 \leqslant x < 2\pi$, all the solutions of

$$2\sin^2 x + 2 = 7\cos x$$

giving your answers in radians.

(6)

Leave blank

Question 14 continued

Leave blank

Question 14 continued

Leave blank

Question 14 continued

Q14

(Total 10 marks)

PMT

Leave blank

15.

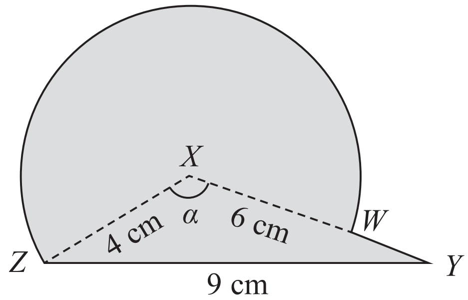

Figure 4

The triangle XYZ in Figure 4 has $XY = 6$ cm, $YZ = 9$ cm, $ZX = 4$ cm and angle $ZXY = \alpha$. The point W lies on the line XY.

The circular arc ZW, in Figure 4 is a major arc of the circle with centre X and radius 4 cm.

(a) Show that, to 3 significant figures, $\alpha = 2.22$ radians.

(2)

(b) Find the area, in cm^2, of the major sector $XZWX$.

(3)

The region enclosed by the major arc ZW of the circle and the lines WY and YZ is shown shaded in Figure 4.

Calculate

(c) the area of this shaded region,

(3)

(d) the perimeter $ZWYZ$ of this shaded region.

(4)

Leave blank

Question 15 continued

Leave blank

Question 15 continued

Leave blank

Question 15 continued

Q15

(Total 12 marks)

Leave blank

16. Maria trains for a triathlon, which involves swimming, cycling and running.
On the first day of training she swims 1.5 km and then she swims 1.5 km on each of the following days.

(a) Find the **total** distance that Maria swims in the first 17 days of training.
(1)

Maria also runs 1.5 km on the first day of training and on each of the following days she runs 0.25 km further than on the previous day. So she runs 1.75 km on the second day and 2 km on the third day and so on.

(b) Find how far Maria runs on the 17th day of training.
(2)

Maria also cycles 1.5 km on the first day of training and on each of the following days she cycles 5% further than on the previous day.

(c) Find the **total** distance that Maria cycles in the first 17 days of training.
(3)

(d) Find the **total** distance Maria travels by swimming, running and cycling in the first 17 days of training.
(3)

Maria needs to cycle 40 km in the triathlon.

(e) On which day of training does Maria first cycle more than 40 km?
(4)

Leave blank

Question 16 continued

Leave blank

Question 16 continued

Leave blank

Question 16 continued

PMT

Leave blank

Question 16 continued

Q16

(Total 13 marks)

TOTAL FOR PAPER: 125 MARKS

END