Cambridge International AS & A Level

Cambridge International Examinations
Cambridge International Advanced Subsidiary and Advanced Level

MATHEMATICS **9709/11**

Paper 1 Pure Mathematics 1 **(P1)** **October/November 2014**

1 hour 45 minutes

Additional Materials: Answer Booklet/Paper
Graph Paper
List of Formulae (MF9)

* 1 3 9 5 2 3 3 4 9 6 *

READ THESE INSTRUCTIONS FIRST

If you have been given an Answer Booklet, follow the instructions on the front cover of the Booklet.
Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** the questions.
Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place in the case of angles in degrees, unless a different level of accuracy is specified in the question.
The use of an electronic calculator is expected, where appropriate.
You are reminded of the need for clear presentation in your answers.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.
The total number of marks for this paper is 75.
Questions carrying smaller numbers of marks are printed earlier in the paper, and questions carrying larger numbers of marks later in the paper.

This document consists of **4** printed pages.

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1 In the expansion of $(2 + ax)^7$, the coefficient of x is equal to the coefficient of x^2. Find the value of the non-zero constant a. [3]

2 Find the value of x satisfying the equation $\sin^{-1}(x - 1) = \tan^{-1}(3)$. [3]

3 Solve the equation $\dfrac{13\sin^2\theta}{2 + \cos\theta} + \cos\theta = 2$ for $0° \leqslant \theta \leqslant 180°$. [4]

4 The line $4x + ky = 20$ passes through the points $A\,(8, -4)$ and $B\,(b, 2b)$, where k and b are constants.

(i) Find the values of k and b. [4]

(ii) Find the coordinates of the mid-point of AB. [1]

5 Find the set of values of k for which the line $y = 2x - k$ meets the curve $y = x^2 + kx - 2$ at two distinct points. [5]

6 Relative to an origin O, the position vector of A is $3\mathbf{i} + 2\mathbf{j} - \mathbf{k}$ and the position vector of B is $7\mathbf{i} - 3\mathbf{j} + \mathbf{k}$.

(i) Show that angle OAB is a right angle. [4]

(ii) Find the area of triangle OAB. [3]

7 **(i)** A geometric progression has first term a ($a \neq 0$), common ratio r and sum to infinity S. A second geometric progression has first term a, common ratio $2r$ and sum to infinity $3S$. Find the value of r. [3]

(ii) An arithmetic progression has first term 7. The nth term is 84 and the $(3n)$th term is 245. Find the value of n. [4]

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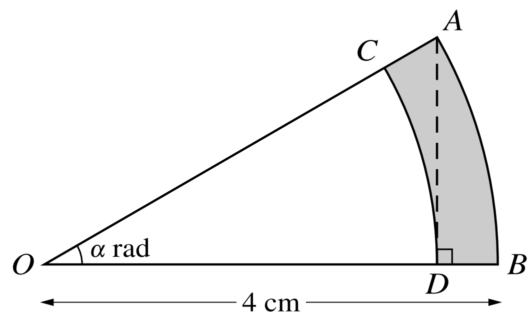
8



In the diagram, AB is an arc of a circle with centre O and radius 4 cm. Angle AOB is α radians. The point D on OB is such that AD is perpendicular to OB. The arc DC, with centre O, meets OA at C.

(i) Find an expression in terms of α for the perimeter of the shaded region $ABDC$. [4]

(ii) For the case where $\alpha = \frac{1}{6}\pi$, find the area of the shaded region $ABDC$, giving your answer in the form $k\pi$, where k is a constant to be determined. [4]

9 The function f is defined for $x > 0$ and is such that $f'(x) = 2x - \frac{2}{x^2}$. The curve $y = f(x)$ passes through the point $P(2, 6)$.

(i) Find the equation of the normal to the curve at P. [3]

(ii) Find the equation of the curve. [4]

(iii) Find the x-coordinate of the stationary point and state with a reason whether this point is a maximum or a minimum. [4]

10 **(i)** Express $x^2 - 2x - 15$ in the form $(x + a)^2 + b$. [2]

The function f is defined for $p \leqslant x \leqslant q$, where p and q are positive constants, by

$$f : x \mapsto x^2 - 2x - 15.$$

The range of f is given by $c \leqslant f(x) \leqslant d$, where c and d are constants.

(ii) State the smallest possible value of c. [1]

For the case where $c = 9$ and $d = 65$,

(iii) find p and q, [4]

(iv) find an expression for $f^{-1}(x)$. [3]

[Question 11 is printed on the next page.]

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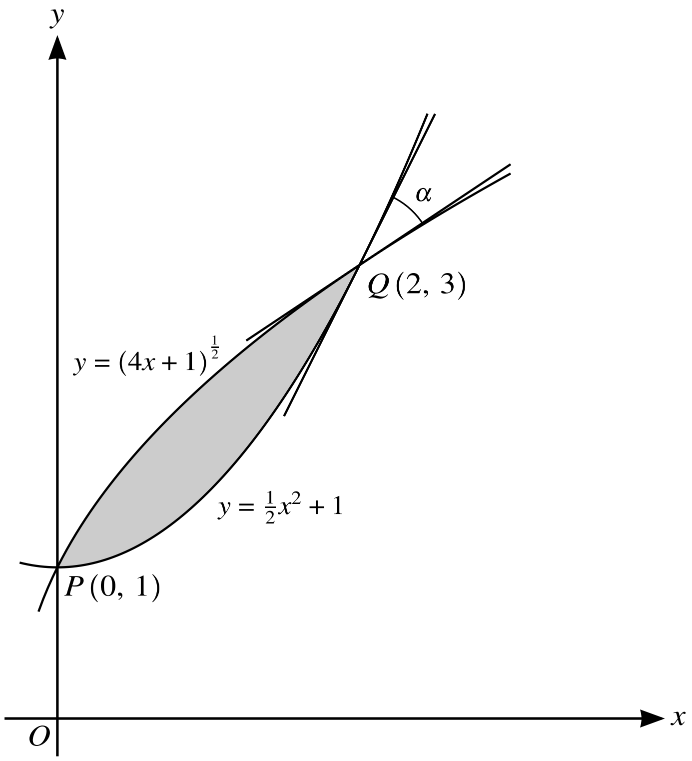
11



The diagram shows parts of the curves $y = (4x + 1)^{\frac{1}{2}}$ and $y = \frac{1}{2}x^2 + 1$ intersecting at points $P\,(0,\ 1)$ and $Q\,(2,\ 3)$. The angle between the tangents to the two curves at Q is α.

(i) Find α, giving your answer in degrees correct to 3 significant figures. [6]

(ii) Find by integration the area of the shaded region. [6]

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