Cambridge International AS & A Level

Cambridge International Examinations
Cambridge International Advanced Subsidiary and Advanced Level

MATHEMATICS **9709/12**

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 6 0 3 3 2 8 3 1 3 *

READ THESE INSTRUCTIONS FIRST

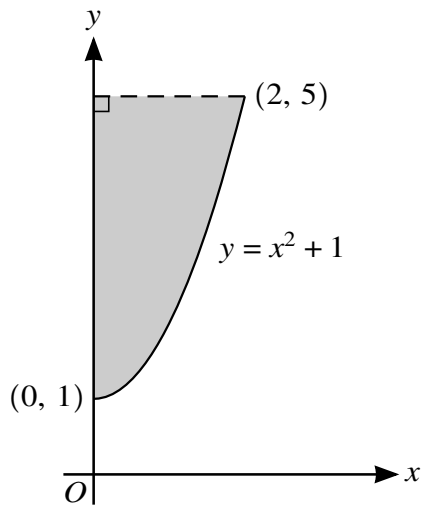
If you have been given an Answer Booklet, follow the instructions on the front cover of the Booklet.
Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips,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

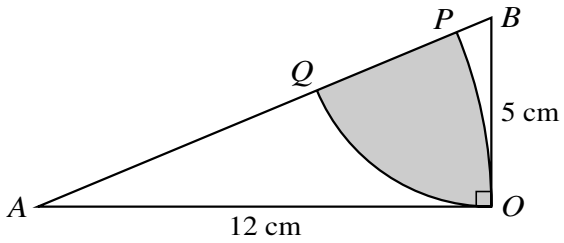
© UCLES 2014

1



The diagram shows part of the curve $y = x^2 + 1$. Find the volume obtained when the shaded region is rotated through 360° about the ***y*-axis**. [4]

2



The diagram shows a triangle AOB in which OA is 12 cm, OB is 5 cm and angle AOB is a right angle. Point P lies on AB and OP is an arc of a circle with centre A. Point Q lies on AB and OQ is an arc of a circle with centre B.

(i) Show that angle BAO is 0.3948 radians, correct to 4 decimal places. [1]

(ii) Calculate the area of the shaded region. [5]

3 **(i)** Find the first 3 terms, in ascending powers of x, in the expansion of $(1 + x)^5$. [2]

The coefficient of x^2 in the expansion of $\left(1 + (px + x^2)\right)^5$ is 95.

(ii) Use the answer to part **(i)** to find the value of the positive constant p. [3]

4 A curve has equation $y = \dfrac{12}{3 - 2x}$.

(i) Find $\dfrac{\mathrm{d}y}{\mathrm{d}x}$. [2]

A point moves along this curve. As the point passes through A, the x-coordinate is increasing at a rate of 0.15 units per second and the y-coordinate is increasing at a rate of 0.4 units per second.

(ii) Find the possible x-coordinates of A. [4]

© UCLES 2014

5 **(i)** Show that the equation $1 + \sin x \tan x = 5 \cos x$ can be expressed as

$$6\cos^2 x - \cos x - 1 = 0.$$ [3]

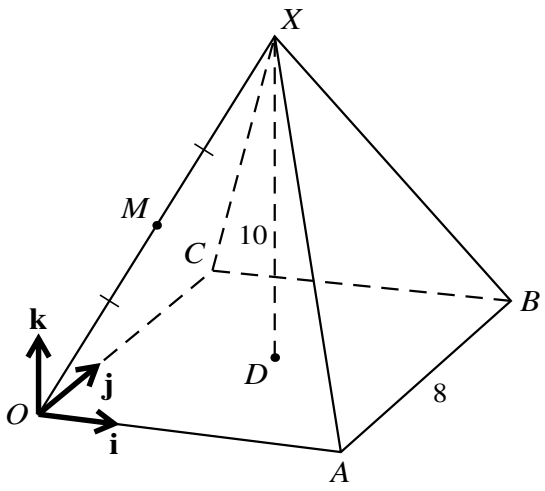
(ii) Hence solve the equation $1 + \sin x \tan x = 5 \cos x$ for $0° \leqslant x \leqslant 180°$. [3]

6 The equation of a curve is $y = x^3 + ax^2 + bx$, where a and b are constants.

(i) In the case where the curve has no stationary point, show that $a^2 < 3b$. [3]

(ii) In the case where $a = -6$ and $b = 9$, find the set of values of x for which y is a decreasing function of x. [3]

7



The diagram shows a pyramid $OABCX$. The horizontal square base $OABC$ has side 8 units and the centre of the base is D. The top of the pyramid, X, is vertically above D and $XD = 10$ units. The mid-point of OX is M. The unit vectors **i** and **j** are parallel to $\overrightarrow{OA}$ and $\overrightarrow{OC}$ respectively and the unit vector **k** is vertically upwards.

(i) Express the vectors $\overrightarrow{AM}$ and $\overrightarrow{AC}$ in terms of **i**, **j** and **k**. [3]

(ii) Use a scalar product to find angle MAC. [4]

8 **(a)** The sum, S_n, of the first n terms of an arithmetic progression is given by $S_n = 32n - n^2$. Find the first term and the common difference. [3]

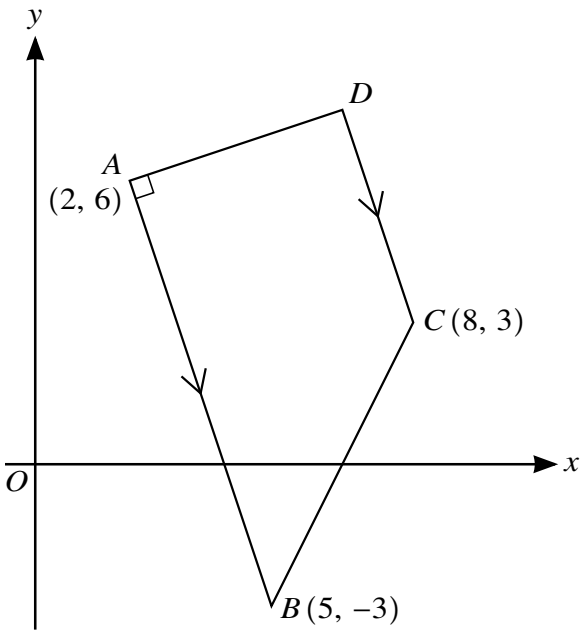
(b) A geometric progression in which all the terms are positive has sum to infinity 20. The sum of the first two terms is 12.8. Find the first term of the progression. [5]

[Questions 9, 10 and 11 are printed on the next page.]

© UCLES 2014

[Turn over

9



The diagram shows a trapezium $ABCD$ in which AB is parallel to DC and angle BAD is 90°. The coordinates of A, B and C are (2, 6), (5, −3) and (8, 3) respectively.

(i) Find the equation of AD. [3]

(ii) Find, by calculation, the coordinates of D. [3]

The point E is such that $ABCE$ is a parallelogram.

(iii) Find the length of BE. [2]

10 A curve is such that $\frac{\mathrm{d}^2y}{\mathrm{d}x^2} = \frac{24}{x^3} - 4$. The curve has a stationary point at P where $x = 2$.

(i) State, with a reason, the nature of this stationary point. [1]

(ii) Find an expression for $\frac{\mathrm{d}y}{\mathrm{d}x}$. [4]

(iii) Given that the curve passes through the point (1, 13), find the coordinates of the stationary point P. [4]

11 The function $\mathrm{f} : x \mapsto 6 - 4\cos\left(\frac{1}{2}x\right)$ is defined for $0 \leqslant x \leqslant 2\pi$.

(i) Find the exact value of x for which $\mathrm{f}(x) = 4$. [3]

(ii) State the range of f. [2]

(iii) Sketch the graph of $y = \mathrm{f}(x)$. [2]

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

Permission to reproduce items where third-party owned material protected by copyright is included has been sought and cleared where possible. Every reasonable effort has been made by the publisher (UCLES) to trace copyright holders, but if any items requiring clearance have unwittingly been included, the publisher will be pleased to make amends at the earliest possible opportunity.

Cambridge International Examinations is part of the Cambridge Assessment Group. Cambridge Assessment is the brand name of University of Cambridge Local Examinations Syndicate (UCLES), which is itself a department of the University of Cambridge.

© UCLES 2014