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CAMBRIDGE A LEVEL PROGRAMME

AS TRIAL EXAMINATION AUGUST/SEPTEMBER 2010

(January and March 2010 Intakes)

Thursday 2 September 2010 8.30 am – 10.15 am

MATHEMATICS 9709/13

PAPER 1 Pure Mathematics 1 (P1) 1 hour 45 minutes

Additional materials: Answer Booklet/Paper
List of formulae (MF9)

READ THESE INSTRUCTIONS FIRST

If you have been given an Answer Booklet, follow the instructions on the front cover of the Booklet.
Write your name and class on all the work you hand in.
Write in dark blue or black pen on both sides of the paper.
You may use a soft pencil for any diagrams or graphs.
Do not use staples, paper clips, highlighters, glue or correction fluid.

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.
At the end of the examination, fasten all your work securely together.

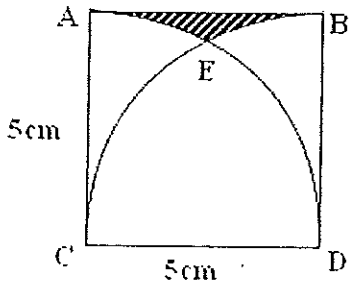
The number of marks is given in brackets [ ] at the end of each question or part question.
The total marks for this paper is 75.
Questions carrying smaller numbers of marks are printed earlier in the paper, and questions carrying larger numbers of marks later in the paper.
The use of an electronic calculator is expected, where appropriate.
You are reminded of the need for clear presentation in your answers.

This document consists of 6 printed pages.

[Turn over

1 By using the substitution $y = (x-2)^2$, find the real roots of the equation $(x-2)^4 + 2(x-2)^2 - 8 = 0$. [4]

2



In the diagram, $ABCD$ is a square of sides 5 cm. AD and BC are the arcs of circles with centres C and D respectively. Find the

(i) angle EDB in radians. [1]

(ii) area of the shaded region. [4]

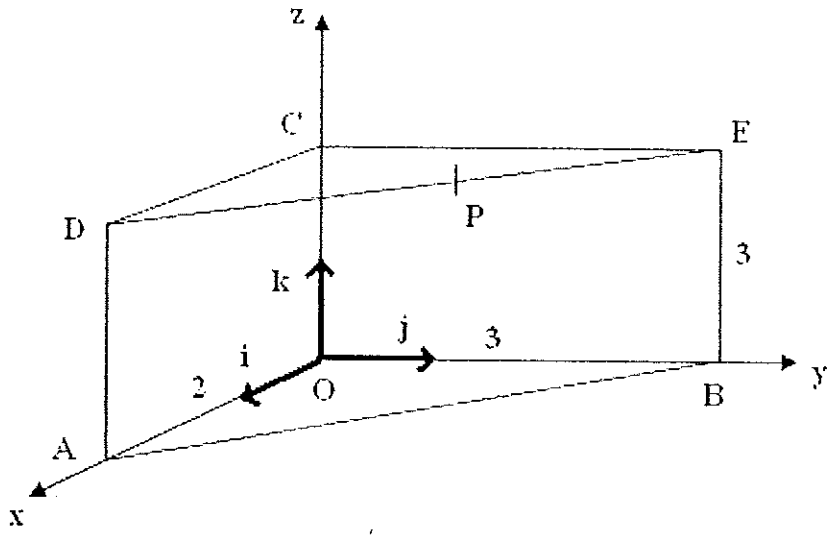
3 (i) Find the first three terms of the expansion in ascending powers of x, of $(1-2x)^{12}$. [3]

(ii) Hence find the coefficient of x^2 in the expansion $(1+3x)(1-2x)^{12}$. [3]

4 (i) Show that the equation $5\cos^2 x = 3(1+\sin x)$ can be written as a quadratic equation in $\sin x$. [2]

(ii) Hence solve the equation $5\cos^2 x = 3(1+\sin x)$, for $0^0 \le x \le 360^0$, giving your answer to 1 decimal place where appropriate. [5]

5



The figure shows a right prism with its bottom base lying in the xy-plane. The point P divides DE in the ratio 2:1. Given i, j, k are the unit vectors along the directions OA, OB, OC respectively, and that the $OA = 2$ cm, $OB = 3$ cm and $OC = 3$ cm, find

(i) $\overrightarrow{AB}$ and $\overrightarrow{OP}$ in terms of i, j, k. [4]

(ii) the angle between $\overrightarrow{OP}$ and $\overrightarrow{AB}$. [4]

6 Sketch the curve $y = 9 - x^2$ with the axes intercepts. Shade the finite region bounded by the curve and the x-axis denoted by R. [2]

(i) Find the area of region R. [3]

(ii) Find the volume of the solid generated when R is rotated 180^0 about the y-axis. [3]

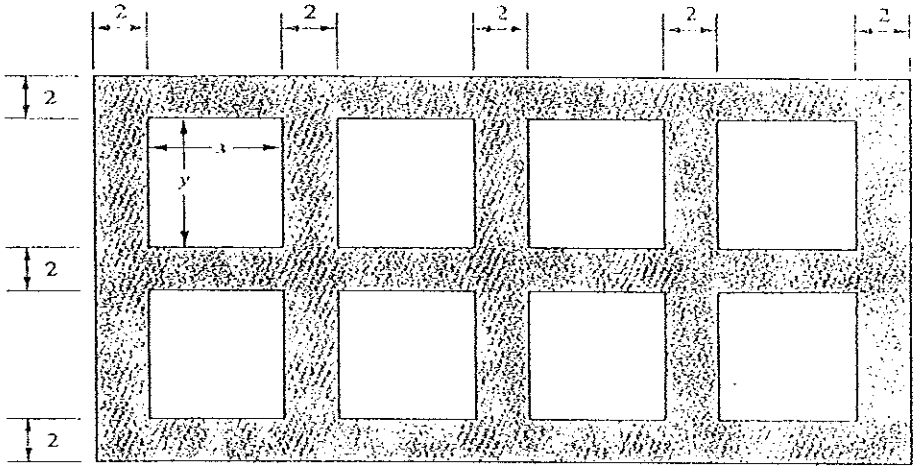
7 (i) John aims to pay a certain amount of money each month into a pension fund. He plans to pay £100 in the first month, and then to increase the amount paid by £5 each month.
John continues making payment according to this plan for 240 months, calculate

(a) how much he will pay in the final month. [2]

(b) how much he will pay altogether over the whole period. [2]

(ii) Rachel also plans to pay money monthly into a pension fund over a period of 240 months, starting with £100 in the first month. Her monthly payments will form a geometric progression, and she will pay £1500 in the final month.
Show that the common ratio is 1.0114. Hence calculate how much Rachel will pay altogether over the whole period. [5]

8



The diagram, where all dimensions are in metres, shows a rectangular wall with 8 rectangular windows, each x m by y m, set 2 m apart and 2 m from the boundaries of the wall.
Given that the total area of the 8 windows is 240 m^2,

(i) Show that the area, A m^2, of the brickwork, shaded in the diagram, is given by $A = 60 + \frac{600}{x} + 24x$. [4]

Given also that x and y vary, find

(ii) the value of x and y for which A is a minimum. [4]

(iii) the minimum value of A. [1]

9 The function f is defined by

$$f(x) = 2x^2 + 12x + 13, \qquad x \leq k$$

(i) Express the function of f in the form $a(x-b)^2 + c$, where a, b and c are constants. [2]

(ii) State the greatest value of k for which f is a one-to-one function. [1]

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

(iv) Sketch, on a single diagram, the graphs of $y = f(x)$ and $y = f^{-1}(x)$, making clear the relationship between the two graphs. [3]

10 The points A (-1,-2), B (7,2) and C (k,4), where k is a constant, are the vertices of ΔABC. Angle ABC is a right angle.

(i) Calculate the value of k. [3]

(ii) Show that the length of AB may be written in the form $p\sqrt{5}$, where p is an integer to be found. [2]

(iii) Find the exact value of the area of ΔABC. [2]

(iv) Find the equation of the perpendicular bisector of AB in the form $ax + by = c$. [3]