UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

MATHEMATICS **0580/04**
0581/04

Paper 4 (Extended)

May/June 2004

Additional Materials: Answer Booklet/Paper   **2 hours 30 minutes**
Electronic calculator
Geometrical instruments
Graph paper (2 sheets)
Mathematical tables (optional)
Tracing paper (optional)

READ THESE INSTRUCTIONS FIRST

Write your answers and working on the separate Answer Booklet/Paper provided.
Write your name, Centre number and candidate number 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** questions.
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.

All working must be clearly shown. It should be done on the same sheet as the rest of the answer.
Marks will be given for working which shows that you know how to solve the problem even if you get the answer wrong.
The total of the marks for this paper is 130.
Electronic calculators should be used.
If the degree of accuracy is not specified in the question, and if the answer is not exact, give the answer to three significant figures.
Answers in degrees should be given to one decimal place.
For π use either your calculator value or 3.142.

This document consists of **9** printed pages and **3** blank pages.

UNIVERSITY *of* CAMBRIDGE
International Examinations

[Turn over

1   Fatima and Mohammed each buys a bike.

   (a) Fatima buys a city-bike which has a price of $120.
      She pays 60% of this price and then pays $10 per month for 6 months.

      (i) How much does Fatima pay altogether? [2]

      (ii) Work out your answer to **part (a)(i)** as a percentage of the original price of $120. [2]

   (b) Mohammed pays $159.10 for a mountain-bike in a sale.
      The original price had been reduced by 14%.
      Calculate the original price of the mountain-bike. [2]

   (c) Mohammed's height is 169 cm and Fatima's height is 156 cm.
      The frame sizes of their bikes are in the same ratio as their heights.
      The frame size of Mohammed's bike is 52 cm.
      Calculate the frame size of Fatima's bike. [2]

   (d) Fatima and Mohammed are members of a school team which takes part in a bike ride for charity.

      (i) Fatima and Mohammed ride a total distance of 36 km.
         The ratio distance Fatima rides : distance Mohammed rides is 11 : 9.
         Work out the distance Fatima rides. [2]

      (ii) The distance of 36 km is only $\frac{2}{23}$ of the total distance the team rides.

         Calculate this total distance. [2]

        0580/4, 0581/4 Jun/04

2   Answer all of this question on a sheet of graph paper.

(a) $f(x) = x^2 - x - 3$.

x	-3	-2	-1	0	1	2	3	4
$f(x)$	p	3	-1	-3	q	-1	3	r

    (i) Find the values of p, q and r.   [3]

  (ii) Draw the graph of $y = f(x)$ for $-3 \leqslant x \leqslant 4$.
       Use a scale of 1 cm to represent 1 unit on each axis.   [4]

 (iii) By drawing a suitable line, estimate the gradient of the graph at the point where $x = -1$.   [3]

(b) $g(x) = 6 - \dfrac{x^3}{3}$.

x	-2	-1	0	1	2	3
$g(x)$	8.67	u	v	5.67	3.33	-3

   **(i)** Find the values of u and v.   [2]

  (ii) On the same grid as **part (a) (ii)** draw the graph of $y = g(x)$ for $-2 \leqslant x \leqslant 3$.   [4]

(c) (i) Show that the equation $f(x) = g(x)$ simplifies to $x^3 + 3x^2 - 3x - 27 = 0$.   [1]

  (ii) Use your graph to write down a solution of the equation $x^3 + 3x^2 - 3x - 27 = 0$.   [1]

0580/4, 0581/4 Jun/04   **[Turn over**

3 The depth, d centimetres, of a river was recorded each day during a period of one year (365 days).
The results are shown by the cumulative frequency curve.
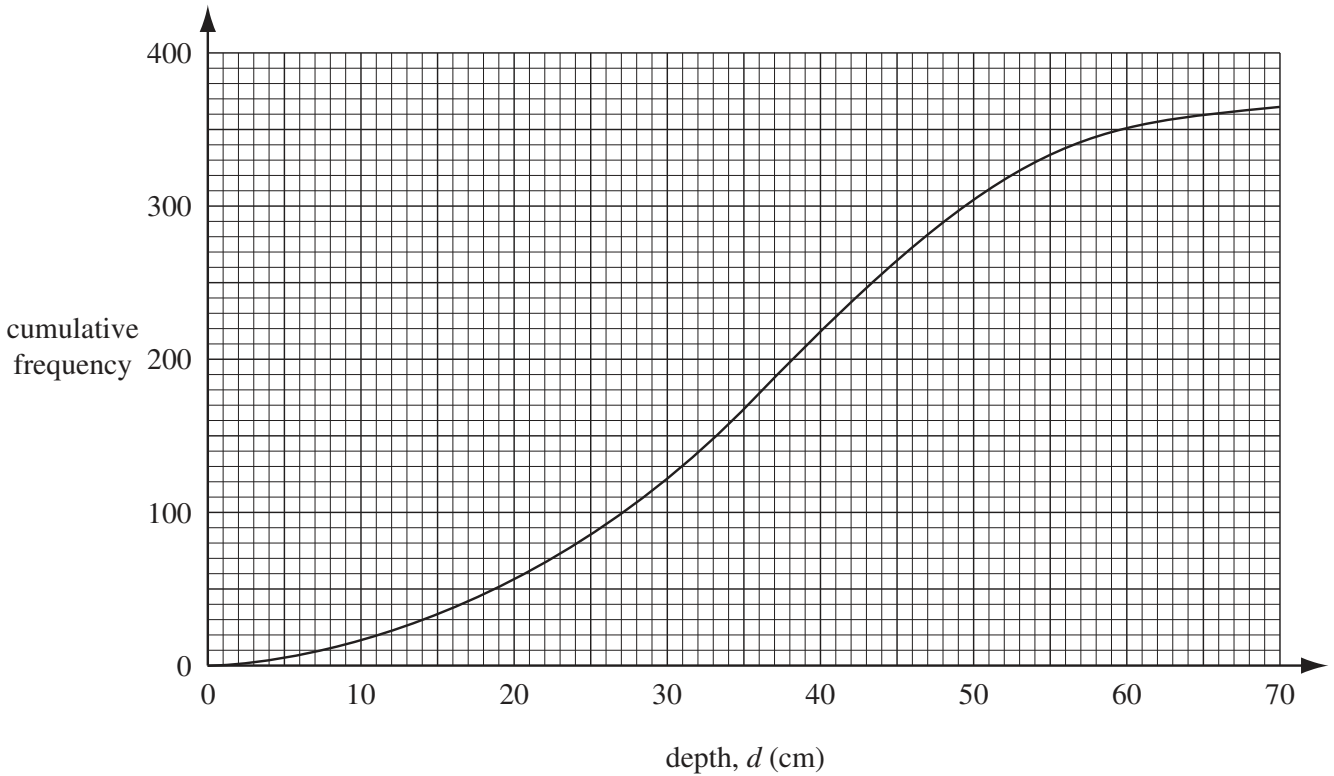
(a) Use the cumulative frequency curve to find

(i) the median depth, [1]

(ii) the inter-quartile range, [2]

(iii) the depth at the 40$^{\text{th}}$ percentile, [2]

(iv) the number of days when the depth of the river was **at least** 25 cm. [2]

(b)

d	$0<d\leqslant10$	$10<d\leqslant20$	$20<d\leqslant30$	$30<d\leqslant40$	$40<d\leqslant50$	$50<d\leqslant60$	$60<d\leqslant70$
Number of days	17	41	62	98	85	p	q

(i) Show that $p = 47$ and $q = 15$. [2]

(ii) Use the information in the table and the values of p and q to calculate an estimate of the mean depth of the river. [4]

(c) The following information comes from the table in **part (b)**.

d	$0<d\leqslant20$	$20<d\leqslant40$	$40<d\leqslant70$
Number of days	58	160	147

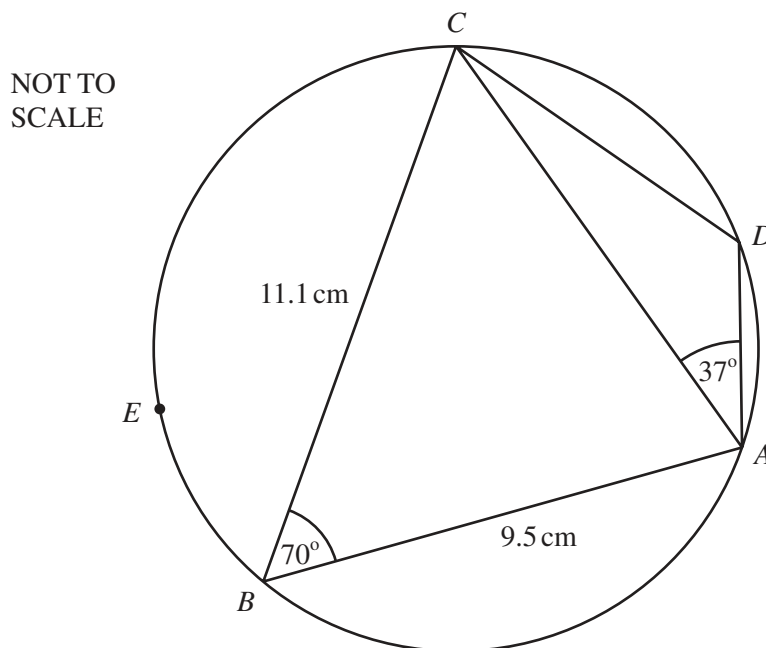A histogram was drawn to show this information.
The height of the column for the interval $20 < d \leqslant 40$ was $8\,\text{cm}$.
Calculate the height of each of the other two columns.
[Do not draw the histogram.] [3]

4

NOT TO SCALE

11.1 cm

37°

E •

A

9.5 cm

70°

B

C

D

ABCD is a cyclic quadrilateral.
$AB = 9.5\,\text{cm}$, $BC = 11.1\,\text{cm}$, angle $ABC = 70^\text{o}$ and angle $CAD = 37^\text{o}$.

(a) Calculate the length of AC. [4]

(b) Explain why angle $ADC = 110^\text{o}$. [1]

(c) Calculate the length of AD. [4]

(d) A point E lies on the circle such that triangle ACE is isosceles, with $EA = EC$.

   (i) Write down the size of angle AEC. [1]

   (ii) Calculate the area of triangle ACE. [3]

 [Turn over

5 Maria walks 10 kilometres to a waterfall at an average speed of x kilometres per hour.

(a) Write down, in terms of x, the time taken in hours. [1]

(b) Maria returns from the waterfall but this time she walks the 10 kilometres at an average speed of $(x + 1)$ kilometres per hour. The time of the return journey is 30 minutes less than the time of the first journey.
Write down an equation in x and show that it simplifies to $x^2 + x - 20 = 0$. [4]

(c) Solve the equation $x^2 + x - 20 = 0$. [2]

**(d)** Find the time Maria takes to walk **to** the waterfall. [2]

6
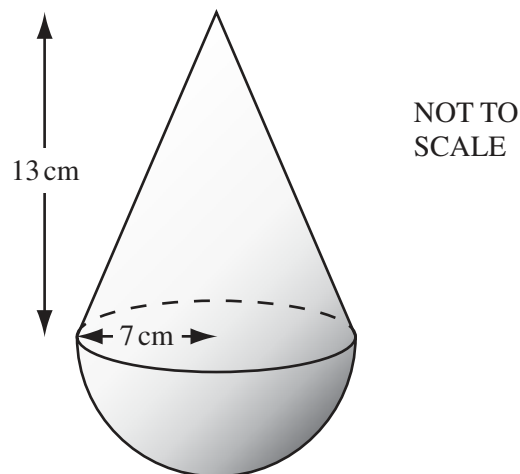
The diagram shows a solid made up of a hemisphere and a cone.
The base radius of the cone and the radius of the hemisphere are each 7 cm.
The height of the cone is 13 cm.

(a) (i) Calculate the total volume of the solid.

[The volume of a hemisphere of radius r is given by $V = \frac{2}{3}\pi r^3$.]

[The volume of a cone of radius r and height h is given by $V = \frac{1}{3}\pi r^2 h$.] [2]

(ii) The solid is made of wood and 1 cm^3 of this wood has a mass of 0.94 g.
Calculate the mass of the solid, in kilograms, correct to 1 decimal place. [3]

(b) Calculate the curved surface area of the cone.
[The curved surface area of a cone of radius r and sloping edge l is given by $A = \pi r l$.] [3]

(c) The cost of covering all the solid with gold plate is $411.58.
Calculate the cost of this gold plate per square centimetre.

[The curved surface area of a **hemisphere** is given by $A = 2\pi r^2$.] [5]

---

7 (a) There are 30 students in a class.
20 study Physics, 15 study Chemistry and 3 study neither Physics nor Chemistry.
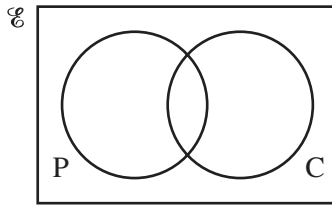
(i) Copy and complete the Venn diagram to show this information. [2]

(ii) Find the number of students who study both Physics **and** Chemistry. [1]

(iii) A student is chosen at random. Find the probability that the student studies Physics but not Chemistry. [2]

(iv) A student who studies Physics is chosen at random. Find the probability that this student does not study Chemistry. [2]

(b)
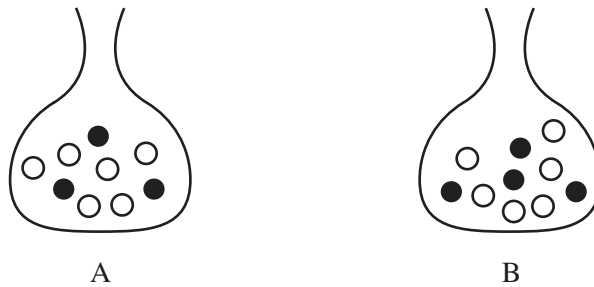
Bag A contains 6 white beads and 3 black beads.
Bag B contains 6 white beads and 4 black beads.
One bead is chosen at random from each bag.
Find the probability that

(i) both beads are black, [2]

(ii) at least one of the two beads is white. [2]

The beads are not replaced.
A second bead is chosen at random from each bag.
Find the probability that

(iii) all four beads are white, [3]

(iv) the beads are not all the same colour. [3]

8
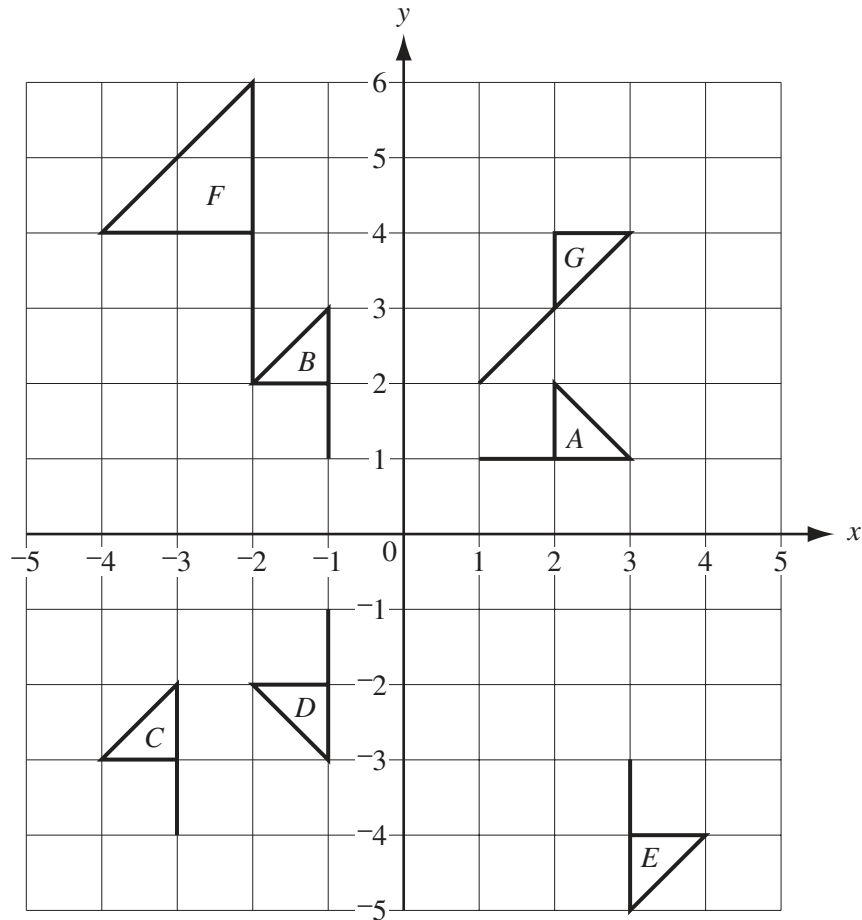
(a) Describe fully the **single** transformation which maps

    (i) shape *A* onto shape *B*, [2]

    (ii) shape *B* onto shape *C*, [2]

    (iii) shape *A* onto shape D, [2]

    (iv) shape *B* onto shape *E*, [2]

    (v) shape *B* onto shape *F*, [2]

    (vi) shape *A* onto shape *G*. [2]

(b) A transformation is represented by the matrix $\begin{pmatrix} 0 & -1 \\ 1 & 0 \end{pmatrix}$.

  Which shape above is the image of shape *A* after this transformation? [2]

(c) Find the 2 by 2 matrix representing the transformation which maps

    (i) shape *B* onto shape *D*, [2]

    (ii) shape *A* onto shape *G*. [2]

         0580/4, 0581/4 Jun/04

9 **Answer all of this question on a sheet of graph paper.**

A shop buys x pencils and y pens.
Pencils cost 15 cents each and pens cost 25 cents each.

(a) There is a maximum of $20 to spend.
Show that $3x + 5y \leqslant 400$. [1]

(b) The number of pens must not be greater than the number of pencils.
Write down an inequality, in terms of x and y, to show this information. [2]

(c) There must be at least 35 pens.
Write down an inequality to show this information. [1]

(d) **(i)** Using a scale of 1 cm to represent 10 units on each axis, draw an x-axis for $0 \leqslant x \leqslant 150$ and a y-axis for $0 \leqslant y \leqslant 100$. [1]

   (ii) Draw three lines on your graph to show the inequalities in **parts (a)**, **(b) and (c)**.
   Shade the **unwanted** regions. [5]

(e) When 70 pencils are bought, what is the largest possible number of pens? [1]

(f) The profit on each pencil is 5 cents and the profit on each pen is 7 cents.
Find the largest possible profit. [3]

BLANK PAGE

BLANK PAGE

BLANK PAGE