International General Certificate of Secondary Education

UNIVERSITY OF CAMBRIDGE LOCAL EXAMINATIONS SYNDICATE

MATHEMATICS

0580/4, 0581/4

PAPER 4

Friday   **5 NOVEMBER 1999**   Morning   2 hours 30 minutes

Additional materials:
  Answer paper
  Electronic calculator
  Geometrical instruments
  Graph paper (2 sheets)
  Mathematical tables (optional)

TIME   2 hours 30 minutes

INSTRUCTIONS TO CANDIDATES

Write your name, Centre number and candidate number in the spaces provided on the answer paper/ answer booklet.

Answer **all** questions.

Write your answers on the separate answer paper provided.

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.

If you use more than one sheet of paper, fasten the sheets together.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets [ ] at the end of each question or part question.

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, the answer should be given 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 question paper consists of 9 printed pages and 3 blank pages.

[Turn over

1   Anna, Bella and Carla enter competitions together. When they win a prize they divide it in the ratio 3 : 2 : 1 respectively.

**(a)**   In one competition, Bella's share of the prize was $30.

How much did Anna and Carla each receive?   [2]

(b)   In another competition, the prize which they won was $40 cash and 2 books worth $55 and $25.

(i)   Anna, Bella and Carla managed to divide the prize so that the value of their shares was still in the ratio 3 : 2 : 1. What exactly did each girl receive?   [3]

(ii)   The total value of the prize ($120) was a 25% increase on its total value last year.

Calculate the value of the prize last year.   [3]

2
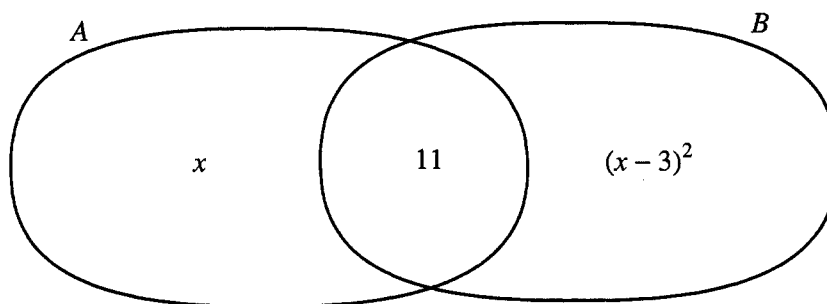
The Venn diagram above shows two intersecting sets A and B, and the number of elements in each region. There are 70 elements in $A \cup B$.

(a)   **(i)**   Write down an equation in x.   [2]

(ii)   Show that your equation simplifies to $x^2 - 5x - 50 = 0$.   [2]

(b)   **(i)**   Factorise $x^2 - 5x - 50$.   [2]

(ii)   Solve $x^2 - 5x - 50 = 0$.   [1]

(c)   When $n(A \cap B') = x$,

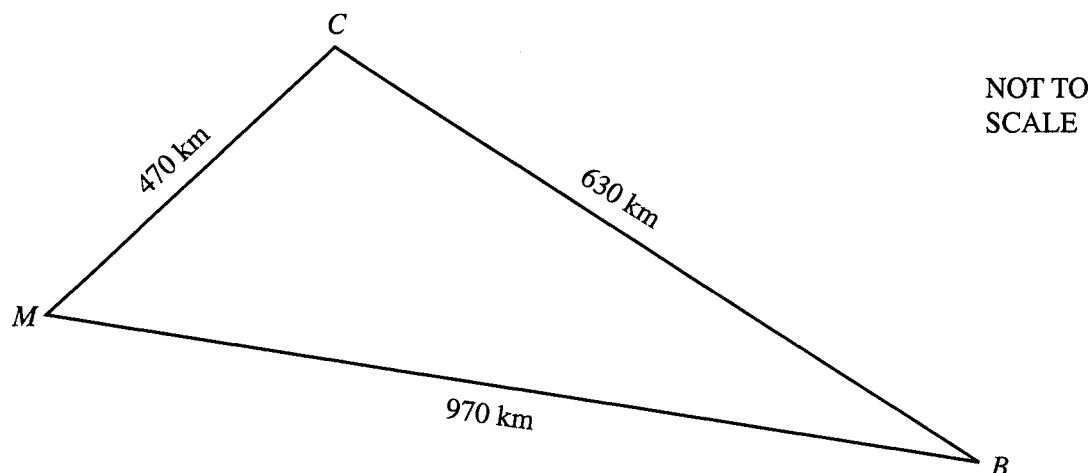**(i)**   write down the value of x,   [1]

(ii)   find $n(B)$.   [1]

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3 On December 21st, the sun rises in Buenos Aires at 05 42 and sets at 20 13.

(a) Find the length of time between sunrise and sunset in hours and minutes. [2]

(b)

NOT TO
SCALE

A plane flies from Buenos Aires (*B*) to Cordoba (*C*). It continues to Mendoza (*M*) before returning to Buenos Aires. The flight distances are shown on the diagram above.

(i) Showing all your working, calculate angle *MCB* to the nearest degree. [5]

(ii) The bearing of Buenos Aires from Cordoba is 124°. Write down the bearing of Mendoza from Cordoba. [2]

(c) The average speed of the plane was 500 kilometres per hour. The times spent at Cordoba and at Mendoza were 1 hour 30 minutes and 2 hours respectively.

(i) Calculate the total time from leaving Buenos Aires until landing there again.

Give your answer in hours and minutes to the nearest minute. [3]

(ii) The plane left Buenos Aires on December 21st at 12 40. Will it land in Buenos Aires before sunset? [1]

[Turn over

4
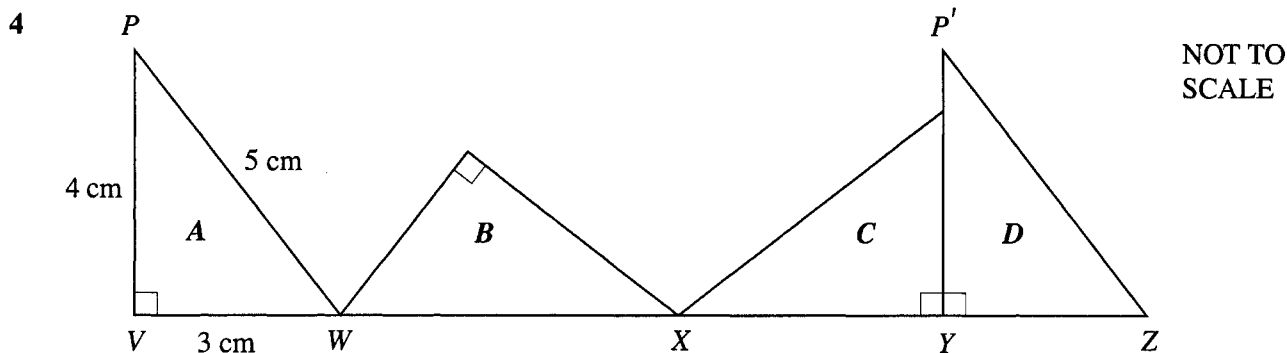
VWXYZ is a straight line. A triangle has sides of length 3 cm, 4 cm and 5 cm. It starts in position *A* and is rotated about its vertices through positions *B* and *C* to position *D*, as shown in the diagram above.

(a) Construct the diagram accurately. [4]

(b) Construct accurately the locus of vertex *P* as it moves from *P* to *P'*. [2]

(c) Describe fully the rotation which maps triangle *B* onto triangle *C*. [3]

(d) Describe fully the **single** transformation which would map triangle *A* onto triangle *D* directly. [2]

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5 **Answer the whole of this question on a sheet of graph paper.**

The table below gives some values of *x* and *y* for the function $y = f(x)$.

x	−2	−1.5	−1	−0.5	0	0.5	1	1.5	2	2.5	3	3.5	4
y	−13	−3.6	2	4.6	5	3.9	2	0.1	−1	−0.6	2	7.6	17

(a) The graph of $y = f(x)$ is a smooth curve. Using 2 cm to represent 1 unit on the *x*-axis and 2 cm to represent 5 units on the *y*-axis, draw this graph for $-2 \leqslant x \leqslant 4$. [6]

(b) Use your graph to solve the equation $f(x) = 0$, giving your answers correct to 1 decimal place. [3]

(c) Write down a **positive** integer value of *k* such that the equation $f(x) = k$ has 3 solutions. [2]

(d) Write down the order of rotational symmetry of this graph and the coordinates of the centre of rotation. [3]

(e) **(i)** By drawing a suitable tangent, estimate the gradient of the curve at $(-1, 2)$. [3]

(ii) Write down the coordinates of the other point where the curve has this gradient. [1]

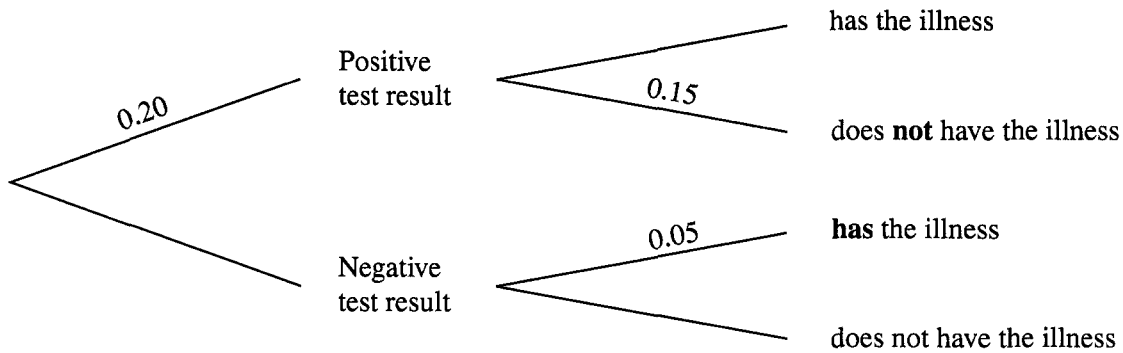6   Doctors use a test to find who has a certain illness.

The probability of a positive test result is 0.20.

However 15% of those with positive test results do **not** have the illness;
       5% of those with negative test results **do** have the illness.
       (This means that these people are given an incorrect test result.)

(a)   **Copy** and **complete** the tree diagram below.

```
                                                      ___ has the illness
                          Positive          _____/
                          test result  <_____ 0.15
                 ___0.20                             \___ does not have the illness
           ____/
      <____
           \____
                          Negative          ___0.05____ has the illness
                          test result  <_____
                                                     \___ does not have the illness
```

[3]

(b)   Find the probability that a person chosen at random

    (i)   has a positive test result and has the illness,   [2]

    (ii)   has the illness,   [2]

    (iii)   is given an incorrect test result.   [3]

(c)   In a certain town, 10 000 people, chosen at random, are given this test.
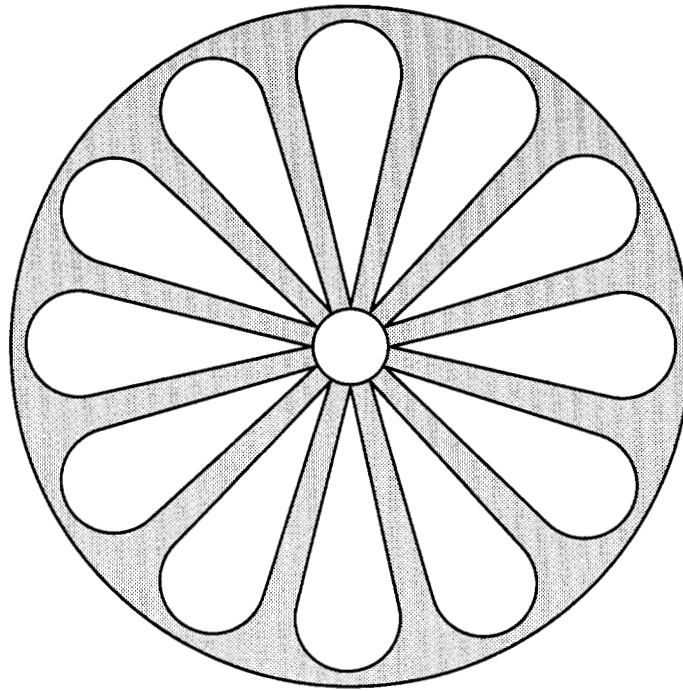   Estimate how many of these people will

    (i)   be told they have the illness,   [1]

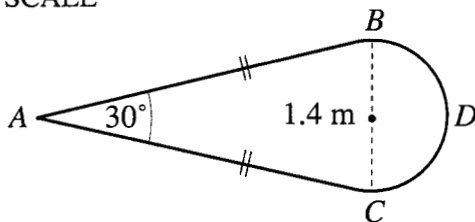   **(ii)**   actually have the illness.   [2]

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A large circular window is shown in the diagram. The unshaded part is glass and is made up of a small circle and 12 identical shapes. The shaded part is stone.

[For π, use either your calculator value or 3.142.]

(a)

NOT TO
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B

A 30°   1.4 m D

C

The diagram shows one of the 12 identical shapes.

ABC is an isosceles triangle and BCD is a semicircle.

$BC = 1.4$ m and angle $BAC = 30°$.

Calculate

    (i) the area of the semicircle BCD,   [2]

   (ii) the length of AC, showing that it rounds off to 2.705 m,   [4]

  (iii) the area of triangle ABC,   [4]

  (iv) the area of the shape $ABDC$.   [1]

(b) The radius of the small circle is 0.3 m.

Calculate the total area of glass, including the small circle.   [3]

(c) The radius of the large circular window is 4 m.

Calculate the percentage of the window's area which is stone.   [3]

8
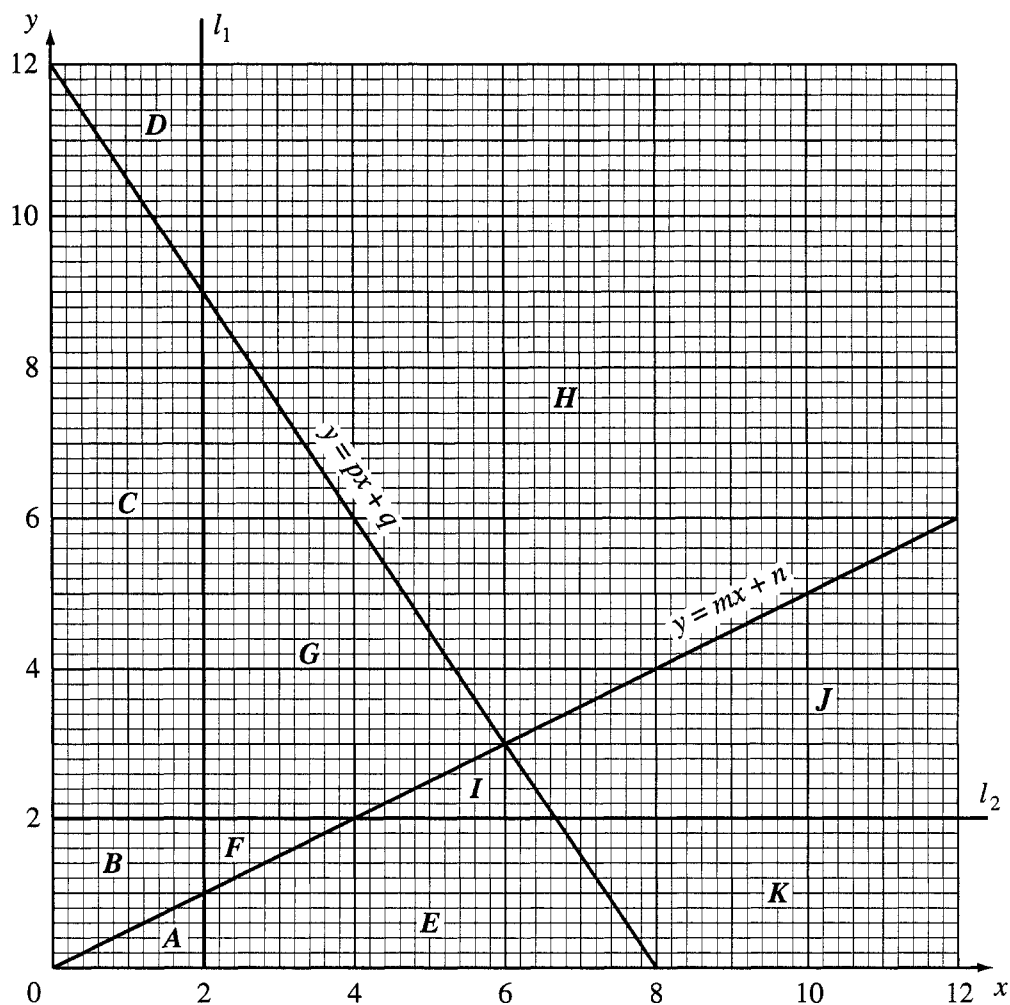
Four lines are shown on the grid above.

(a) **(i)** Write down the equation of the line l_1. [1]

   (ii) Write down the equation of the line l_2. [1]

   (iii) Write down the value of m and the value of n for the line $y = mx + n$. [2]

   (iv) Write down the value of p and the value of q for the line $y = px + q$. [3]

(b) Which of the letters A to K lie in the region where

   (i) $x \geqslant 2$, $y \geqslant mx + n$ and $y \geqslant px + q$, [2]

   (ii) $y \leqslant 2$, $y \leqslant mx + n$ and $y \leqslant px + q$? [2]

(c) What is the maximum value of $x + y$ in region G? [2]

9 Ricardo asks 200 people how much they spend each year on books.
He puts his results in the table below.

Amount (x)	Frequency
$0 < x \leqslant 20$	50
$20 < x \leqslant 40$	40
$40 < x \leqslant 60$	48
$60 < x \leqslant 80$	30
$80 < x \leqslant 120$	32

(a)   **(i)** Write down the modal class. [1]

     (ii) Calculate an estimate of the mean. [4]

     (iii) Explain briefly why, although you have done an exact calculation to find the mean, it is still an "estimate". [1]

(b)   **Answer the rest of this question on a sheet of graph paper.**

     (i) Make a **cumulative** frequency table for the data above. [2]

     (ii) Using 2 cm to represent $20 on the horizontal axis and 2 cm to represent 20 people on the vertical axis, draw the cumulative frequency diagram. [4]

(c)   Use your graph to find

     (i) the median, [1]

     (ii) the upper and lower quartiles, [2]

     (iii) the interquartile range. [1]

10 The height of a cylinder is 10 cm and its radius is 2.5 cm.

[For π, use either your calculator value or 3.142.]

(a)
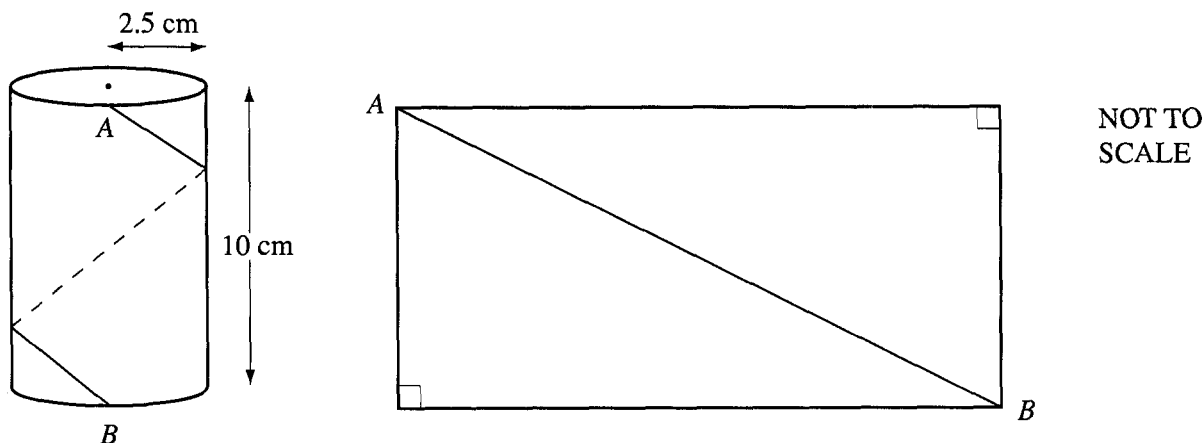
A piece of string is wound evenly once around the curved surface of the cylinder, starting at a point A on the circumference of the top circular face and finishing at B, vertically below A.

A sketch of the net of the curved surface of the cylinder, together with the string AB, is shown above in the diagram on the right. Calculate the length of the string, AB. [4]

(b)
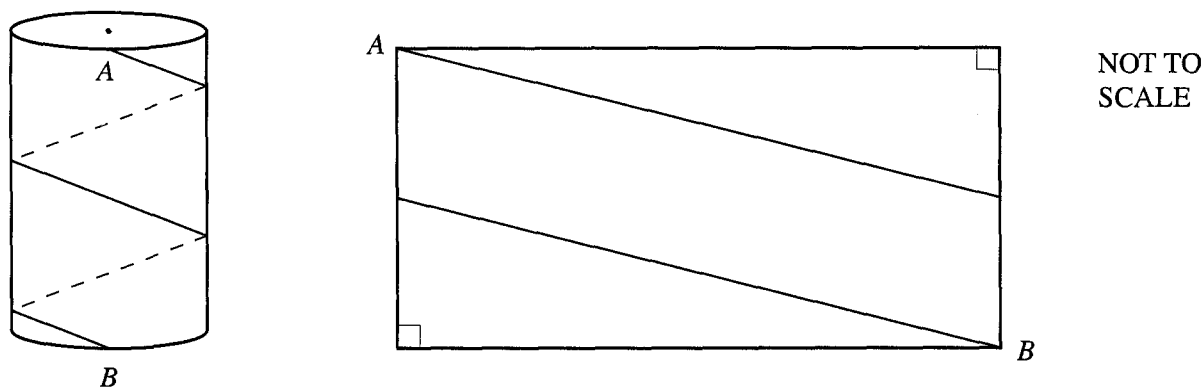
Another string, starting at A, is wound evenly **twice** around the cylinder, finishing again at B. Calculate the length of this string. [3]

(c) Sketch the net when a string, starting at A, is wound evenly three times around the cylinder, finishing at B. [2]

(d) A string is wound evenly n times around the cylinder, from A to B.
Find a formula, in terms of n, for the length of the string. [3]

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