UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

MATHEMATICS

0580/04
0581/04

Paper 4 (Extended)

October/November 2006

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

2 hours 30 minutes

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, paperclips, 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.
Give answers in degrees to one decimal place.
For π use either your calculator value or 3.142.

This document consists of **8** printed pages.

IB06 11_0580_04/4RP
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UNIVERSITY of CAMBRIDGE
International Examinations

[Turn over

1 Maria, Carolina and Pedro receive \$800 from their grandmother in the ratio

Maria: Carolina: Pedro = 7:5:4.

(a) Calculate how much money each receives. [3]

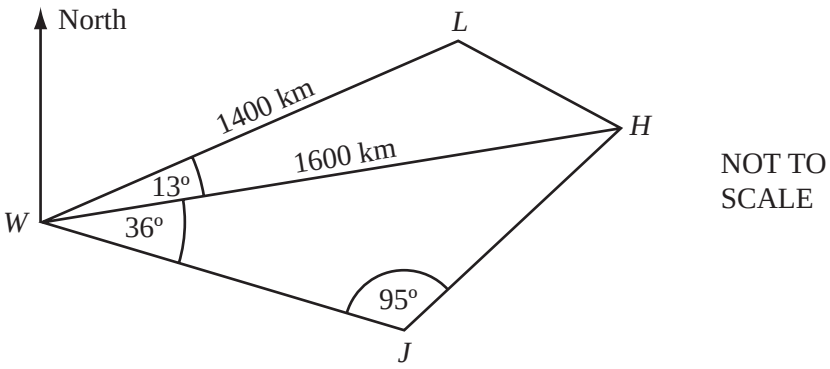
(b) Maria spends $\frac{2}{7}$ of her money and then invests the rest for two years at 5% per year simple interest.
How much money does Maria have at the end of the two years? [3]

(c) Carolina spends all of her money on a hi-fi set and two years later sells it at a loss of 20%.
How much money does Carolina have at the end of the two years? [2]

(d) Pedro spends some of his money and at the end of the two years he has \$100.
Write down and simplify the ratio of the amounts of money Maria, Carolina and Pedro have at the end of the two years. [2]

(e) Pedro invests his \$100 for two years at a rate of 5% per year **compound interest**.
Calculate how much money he has at the end of these two years. [2]

2



The diagram shows the positions of four cities in Africa, Windhoek (*W*), Johannesburg (*J*), Harari (*H*) and Lusaka (*L*).
WL = 1400 km and *WH* = 1600 km.
Angle *LWH* = 13°, angle *HWJ* = 36° and angle *WJH* = 95°.

(a) Calculate the distance *LH*. [4]

(b) Calculate the distance *WJ*. [4]

(c) Calculate the area of quadrilateral *WJHL*. [3]

(d) The bearing of Lusaka from Windhoek is 060°.
Calculate the bearing of

(i) Harari from Windhoek, [1]

(ii) Windhoek from Johannesburg. [1]

(e) On a map the distance between Windhoek and Harari is 8 cm.
Calculate the scale of the map in the form 1:*n*. [2]

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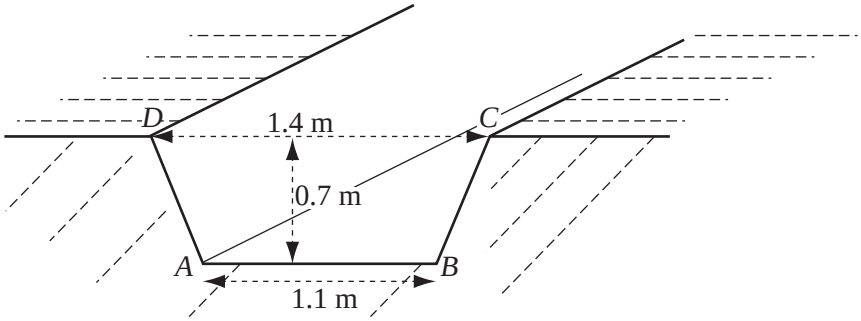
3 Workmen dig a trench in level ground.

NOT TO SCALE



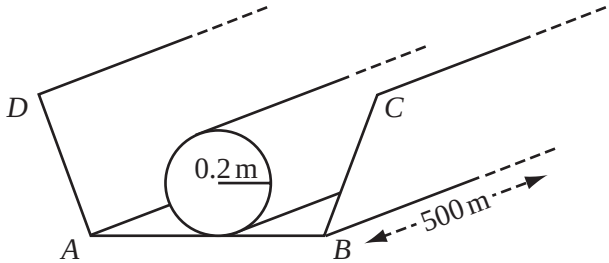
(a) The cross-section of the trench is a trapezium *ABCD* with parallel sides of length 1.1 m and 1.4 m and a vertical height of 0.7 m.
Calculate the area of the trapezium. [2]

(b) The trench is 500 m long.
Calculate the volume of soil removed. [2]

(c) One cubic metre of soil has a mass of 4.8 tonnes.
Calculate the mass of soil removed, giving your answer in tonnes and in standard form. [2]

(d) Change your answer to **part (c)** into grams. [1]

NOT TO SCALE



(e) The workmen put a cylindrical pipe, radius 0.2 m and length 500 m, along the bottom of the trench, as shown in the diagram.
Calculate the volume of the cylindrical pipe. [2]

(f) The trench is then refilled with soil.
Calculate the volume of soil put back into the trench as a percentage of the original amount of soil removed. [3]

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

$$f(x) = 3x - \frac{1}{x^2} + 3, \quad x \neq 0.$$

(a) The table shows some values of f(x).

x	−3	−2.5	−2	−1.5	−1	−0.5	−0.4	−0.3	0.3	0.4	0.5	1	1.5	2	2.5	3
f(x)	p	−4.7	−3.3	−1.9	−1	−2.5	−4.5	−9.0	−7.2	−2.1	0.5	q	7.1	8.8	10.3	r

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

(b) Draw axes using a scale of 1 cm to represent 0.5 units for $-3 \leqslant x \leqslant 3$ and 1 cm to represent 2 units for $-10 \leqslant y \leqslant 12$. [1]

(c) On your grid, draw the graph of $y = f(x)$ for $-3 \leqslant x \leqslant -0.3$ and $0.3 \leqslant x \leqslant 3$. [5]

(d) Use your graph to solve the equations

(i) $3x - \frac{1}{x^2} + 3 = 0$, [1]

(ii) $3x - \frac{1}{x^2} + 7 = 0$. [3]

(e) $g(x) = 3x + 3$.
On the same grid, draw the graph of $y = g(x)$ for $-3 \leqslant x \leqslant 3$. [2]

(f) **(i)** Describe briefly what happens to the graphs of $y = f(x)$ and $y = g(x)$ for large positive or negative values of x. [1]

(ii) Estimate the gradient of $y = f(x)$ when $x = 100$. [1]

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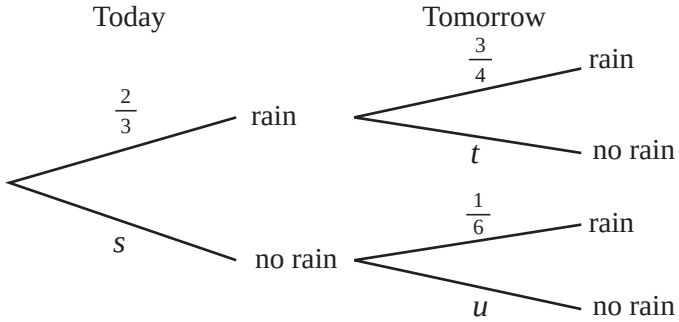
5 Give your answers to this question as fractions.

(a) The probability that it rains today is $\frac{2}{3}$.

If it rains today, the probability that it will rain tomorrow is $\frac{3}{4}$.

If it does not rain today, the probability that it will rain tomorrow is $\frac{1}{6}$.

The tree diagram below shows this information.



(i) Write down, as fractions, the values of s, t and u. [3]
(ii) Calculate the probability that it rains on both days. [2]
(iii) Calculate the probability that it will not rain tomorrow. [2]

(b) Each time Christina throws a ball at a target, the probability that she hits the target is $\frac{1}{3}$.

She throws the ball three times.
Find the probability that she hits the target

(i) three times, [2]
(ii) at least once. [2]

(c) Each time Eduardo throws a ball at the target, the probability that he hits the target is $\frac{1}{4}$.

He throws the ball until he hits the target.
Find the probability that he **first** hits the target with his

(i) 4th throw, [2]
(ii) nth throw. [1]

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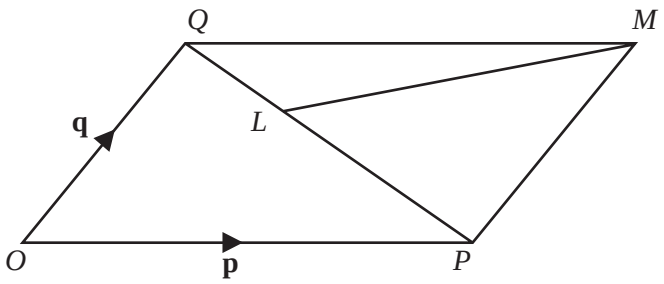
6 **(a)**

NOT TO SCALE



$OPMQ$ is a parallelogram and O is the origin.
$\overrightarrow{OP} = \mathbf{p}$ and $\overrightarrow{OQ} = \mathbf{q}$.
L is on PQ so that $PL : LQ = 2:1$.

Find the following vectors in terms of **p** and **q**. Write your answers in their simplest form.

(i) $\overrightarrow{PQ}$, [1]
(ii) $\overrightarrow{PL}$, [1]
(iii) $\overrightarrow{ML}$, [2]
(iv) the position vector of L. [2]

(b) R is the point (1,2). It is translated onto the point S by the vector $\begin{pmatrix} 3 \\ -4 \end{pmatrix}$.

(i) Write down the co-ordinates of S. [1]
(ii) Write down the vector which translates S onto R. [1]

(c) The matrix $\begin{pmatrix} 0 & 1 \\ -1 & 0 \end{pmatrix}$ represents a **single** transformation.

(i) Describe fully this transformation. [3]
(ii) Find the co-ordinates of the image of the point (5, 3) after this transformation. [1]

(d) Find the matrix which represents a reflection in the line $y = x$. [2]

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7 **(a)** The quiz scores of a class of n students are shown in the table.

Quiz score	6	7	8	9
Frequency (number of students)	9	3	a	5

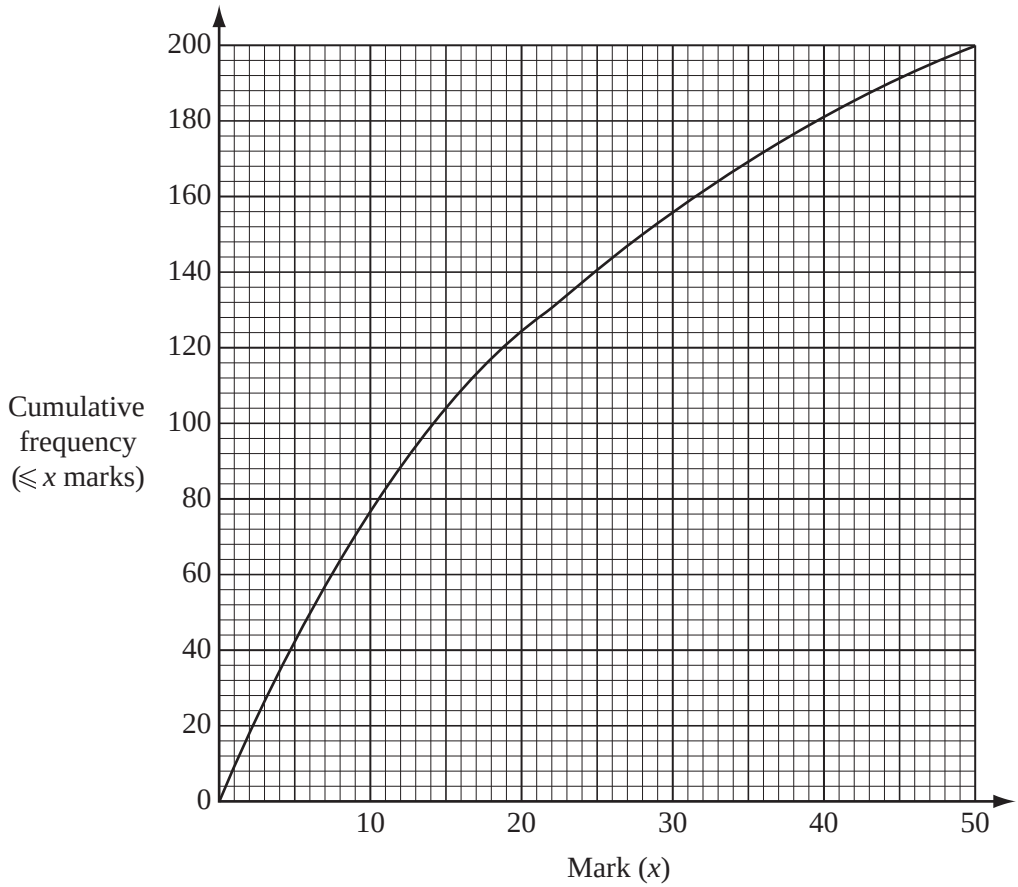
The mean score is 7.2. Find

(i) a, [3]

(ii) n, [1]

(iii) the median score. [1]

(b) 200 students take a mathematics test.
The cumulative frequency diagram shows the results.



Write down

(i) the median mark, [1]

(ii) the lower quartile, [1]

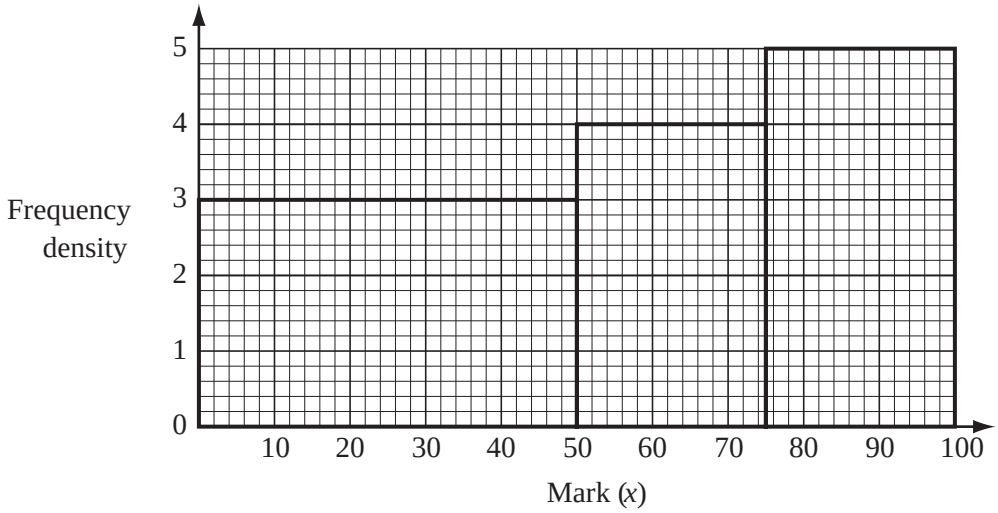
(iii) the upper quartile, [1]

(iv) the inter-quartile range, [1]

(v) the lowest possible mark scored by the top 40 students, [1]

(vi) the number of students scoring more than 25 marks. [1]

(c) Another group of students takes an English test.
The results are shown in the histogram.



100 students score marks in the range $50 < x \leqslant 75$.

(i) How many students score marks in the range $0 < x \leqslant 50$? [1]

(ii) How many students score marks in the range $75 < x \leqslant 100$? [1]

(iii) Calculate an estimate of the mean mark of this group of students. [4]

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8 **(a)** The surface area, A, of a cylinder, radius r and height h, is given by the formula

$$A = 2\pi rh + 2\pi r^2.$$

(i) Calculate the surface area of a cylinder of radius 5 cm and height 9 cm. [2]

(ii) Make h the subject of the formula. [2]

(iii) A cylinder has a radius of 6 cm and a surface area of 377 cm^2.
Calculate the height of this cylinder. [2]

(iv) A cylinder has a surface area of 1200 cm^2 and its radius and height are equal.
Calculate the radius. [3]

(b) **(i)** On Monday a shop receives \$60.30 by selling bottles of water at 45 cents each.
How many bottles are sold? [1]

(ii) On Tuesday the shop receives x **cents** by selling bottles of water at 45 cents each.
In terms of x, how many bottles are sold? [1]

(iii) On Wednesday the shop receives $(x - 75)$ **cents** by selling bottles of water at 48 cents each.
In terms of x, how many bottles are sold? [1]

(iv) The number of bottles sold on Tuesday was 7 more than the number of bottles sold on Wednesday.
Write down an equation in x and solve your equation. [4]

Question 9 is on page 8

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

Tiago does some work during the school holidays.
In one week he spends x hours cleaning cars and y hours repairing cycles.
The time he spends repairing cycles is at least equal to the time he spends cleaning cars.
This can be written as $y \geqslant x$.

He spends no more than 12 hours working.
He spends at least 4 hours cleaning cars.

(a) Write down two more inequalities in x and/or y to show this information. [3]

(b) Draw x and y axes from 0 to 12, using a scale of 1 cm to represent 1 unit on each axis. [1]

(c) Draw three lines to show the three inequalities. Shade the **unwanted** regions. [5]

(d) Tiago receives \$3 each hour for cleaning cars and \$1.50 each hour for repairing cycles.

(i) What is the least amount he could receive? [2]

(ii) What is the largest amount he could receive? [2]

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