UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

MATHEMATICS

0580/04
0581/04

Paper 4 (Extended)

May/June 2005

2 hours 30 minutes

Additional Materials: Answer Booklet/Paper
Electronic calculator
Geometrical instruments
Graph paper (3 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.
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.

IB05 06_0580_04/6RP

UNIVERSITY *of* CAMBRIDGE
International Examinations

1 Hassan sells fruit and vegetables at the market.

(a) The mass of fruit and vegetables he sells is in the ratio

fruit : vegetables = 5 : 7.

Hassan sells 1.33 **tonnes** of vegetables.
How many **kilograms** of fruit does he sell? [3]

(b) The amount of money Hassan receives from selling fruit and vegetables is in the ratio

fruit : vegetables = 9 : 8.

Hassan receives a **total** of $765 from selling fruit and vegetables.
Calculate how much Hassan receives from selling fruit. [2]

(c) Calculate the average price of Hassan's fruit, in dollars per kilogram. [2]

(d) **(i)** Hassan sells oranges for $0.35 per kilogram.
He reduces this price by 40%.
Calculate the new price per kilogram. [2]

(ii) The price of $0.35 per kilogram of oranges is an increase of 25% on the previous day's price.
Calculate the previous day's price. [2]

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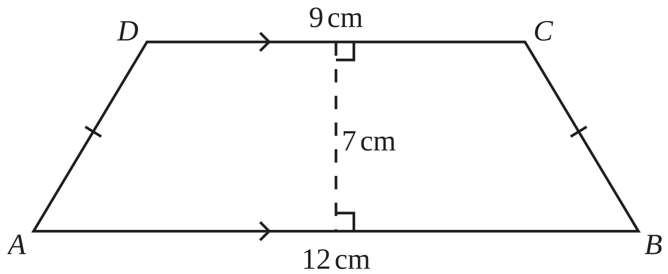
2 **Answer the whole of this question on a new page**.



NOT TO SCALE

The diagram shows a trapezium *ABCD*.
AB = 12 cm, *DC* = 9 cm and the perpendicular distance between these parallel sides is 7 cm.
AD = *BC*.

(a) Approximately halfway down your page, draw a line *AB* of length 12 cm. [1]

(b) Using a straight edge and compasses only, construct the perpendicular bisector of *AB*. [2]

(c) Complete an **accurate** drawing of the trapezium *ABCD*. [2]

(d) **Measure** angle *ABC*, giving your answer correct to the nearest degree. [1]

(e) Use trigonometry to calculate angle *ABC*.
Show all your working and give your answer correct to 1 decimal place. [2]

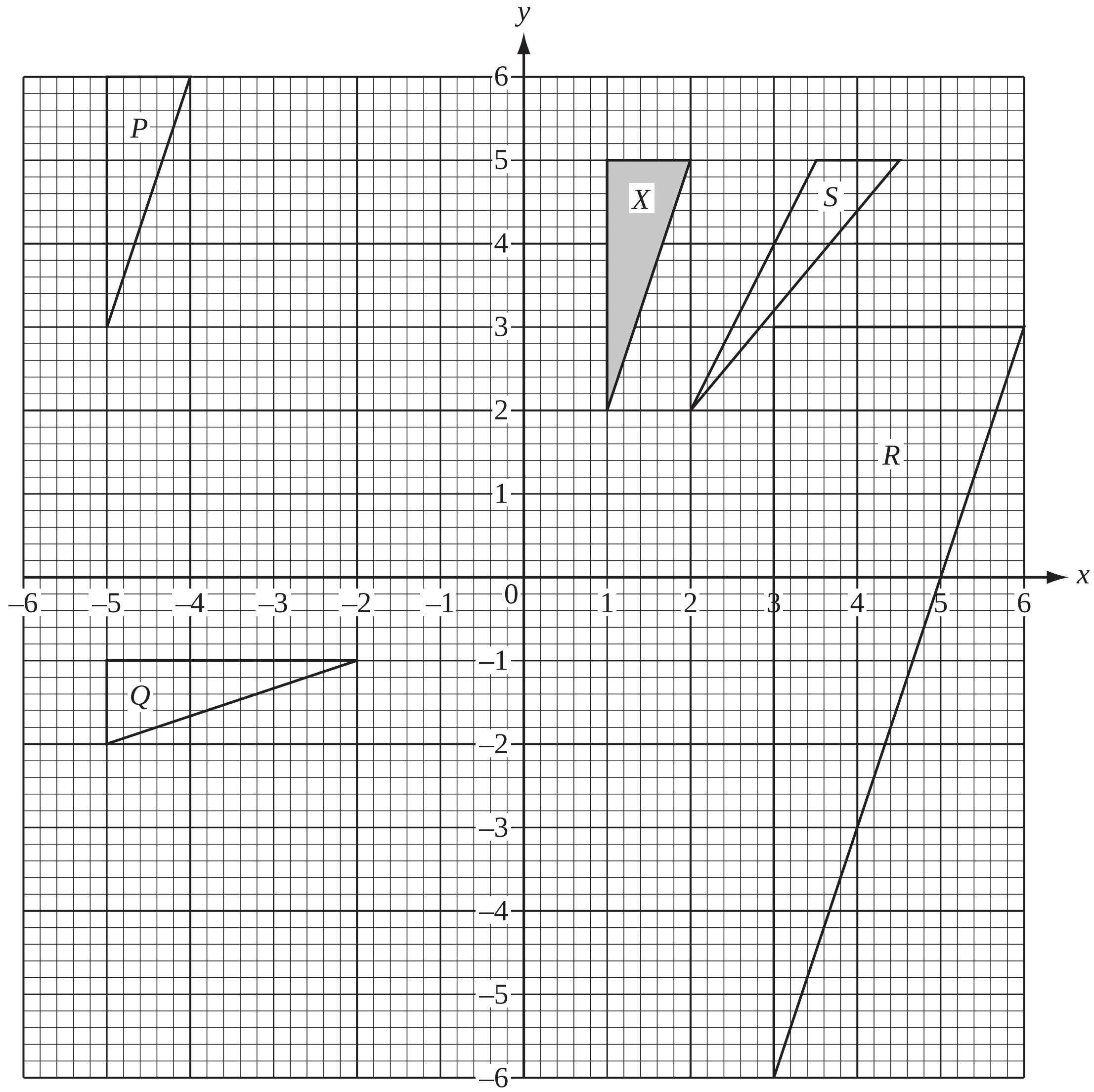
(f) On your diagram,

(i) draw the locus of points inside the trapezium which are 5 cm from *D*, [1]

(ii) using a straight edge and compasses only, construct the locus of points equidistant from *DA* and from *DC*, [2]

(iii) shade the region inside the trapezium containing points which are less than 5 cm from *D* **and** nearer to *DA* than to *DC*. [1]

3



(a) Describe fully the single transformation which maps

(i) triangle X onto triangle P, [2]

(ii) triangle X onto triangle Q, [2]

(iii) triangle X onto triangle R, [3]

(iv) triangle X onto triangle S. [3]

(b) Find the 2 by 2 matrix which represents the transformation that maps

(i) triangle X onto triangle Q, [2]

(ii) triangle X onto triangle S. [2]

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

The table gives values of $f(x) = 2^x$, for $-2 \leqslant x \leqslant 4$.

x	-2	-1	0	1	2	3	4
f(x)	p	0.5	q	2	4	r	16

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

(b) Using a scale of 2 cm to 1 unit on the x-axis and 1 cm to 1 unit on the y-axis, draw the graph of $y = f(x)$ for $-2 \leqslant x \leqslant 4$. [5]

(c) Use your graph to solve the equation $2^x = 7$. [1]

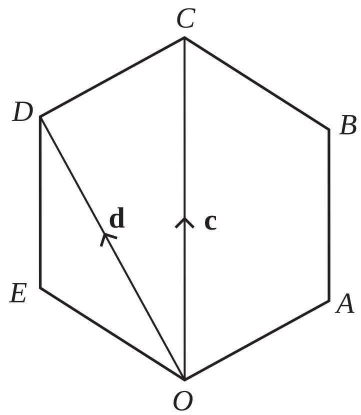
(d) What value does f(x) approach as x decreases? [1]

(e) By drawing a tangent, estimate the gradient of the graph of $y = f(x)$ when $x = 1.5$. [3]

(f) On the same grid draw the graph of $y = 2x + 1$ for $0 \leqslant x \leqslant 4$. [2]

(g) Use your graph to find the non-integer solution of $2^x = 2x + 1$. [2]

5



NOT TO SCALE

OABCDE is a regular hexagon.
With O as origin the position vector of C is **c** and the position vector of D is **d**.

(a) Find, in terms of **c** and **d**,

(i) $\overrightarrow{DC}$, [1]

(ii) $\overrightarrow{OE}$, [2]

(iii) the position vector of B. [2]

(b) The sides of the hexagon are each of length 8 cm.

Calculate

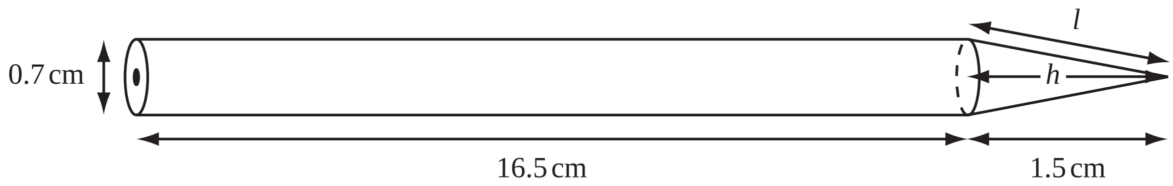
(i) the size of angle ABC, [1]

(ii) the area of triangle ABC, [2]

(iii) the length of the straight line AC, [3]

(iv) the area of the hexagon. [3]

6

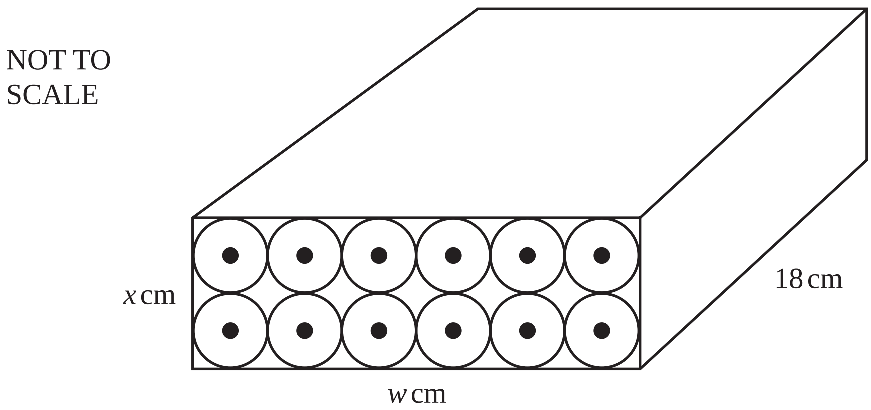


The diagram shows a pencil of length 18 cm.
It is made from a cylinder and a cone.
The cylinder has **diameter** 0.7 cm and length 16.5 cm.
The cone has **diameter** 0.7 cm and length 1.5 cm.

(a) Calculate the volume of the pencil.

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

(b)



Twelve of these pencils just fit into a rectangular box of length 18 cm, width w cm and height x cm.
The pencils are in 2 rows of 6 as shown in the diagram.

(i) Write down the values of w and x. [2]

(ii) Calculate the volume of the box. [2]

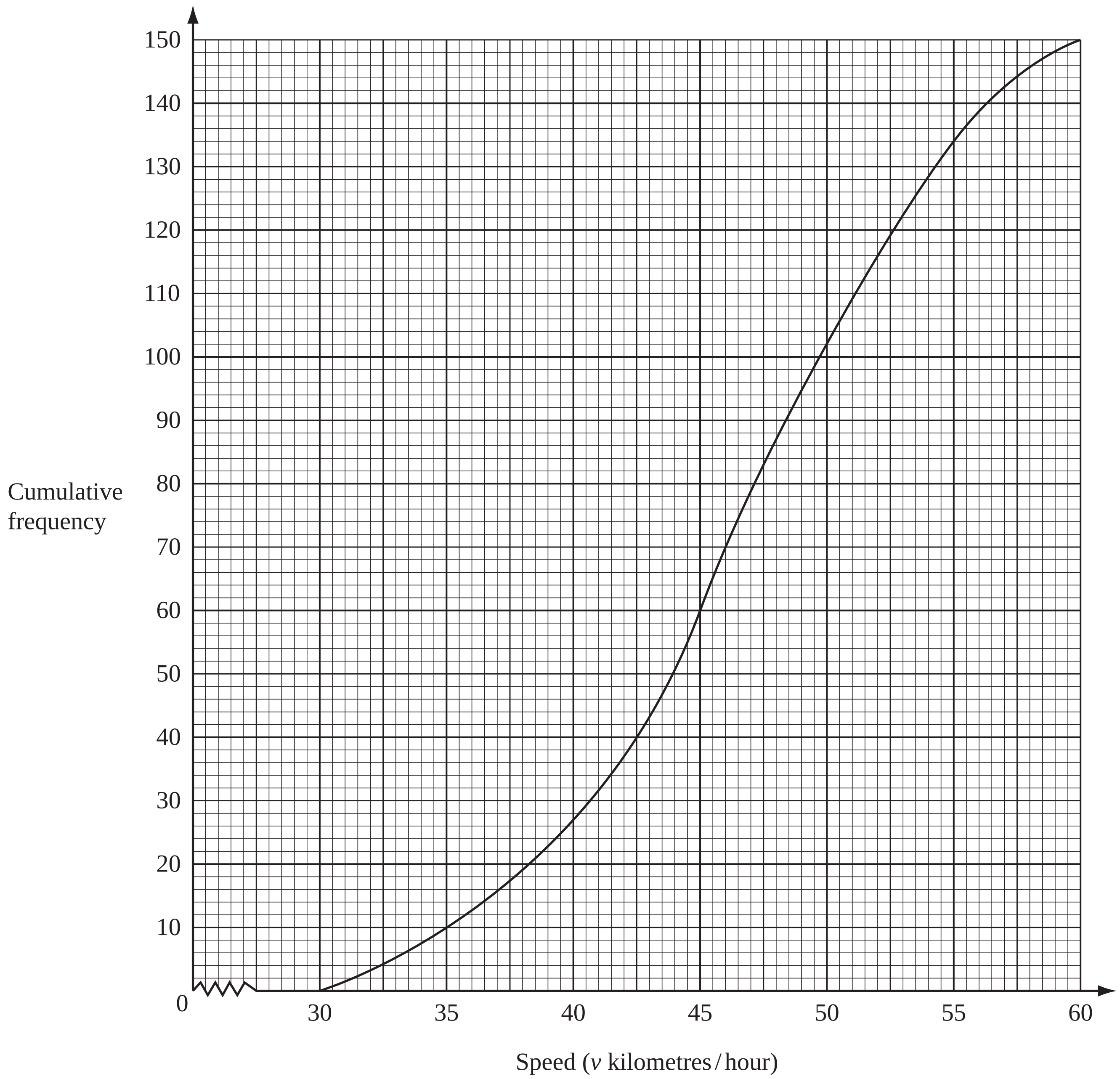
(iii) Calculate the percentage of the volume of the box occupied by the pencils. [2]

(c) Showing all your working, calculate

(i) the slant height, l, of the cone, [2]

(ii) the **total** surface area of **one** pencil, giving your answer correct to 3 significant figures.
[The curved surface area, A, of a cone of radius r and **slant** height l is given by $A = \pi r l$.] [6]

7 The speeds (v kilometres/hour) of 150 cars passing a 50 km/h speed limit sign are recorded.
A cumulative frequency curve to show the results is drawn below.



(a) Use the graph to find

(i) the median speed, [1]

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

(iii) the number of cars travelling with speeds of more than 50 km/h. [2]

(b) A frequency table showing the speeds of the cars is

Speed (v km/h)	$30 < v \leqslant 35$	$35 < v \leqslant 40$	$40 < v \leqslant 45$	$45 < v \leqslant 50$	$50 < v \leqslant 55$	$55 < v \leqslant 60$
Frequency	10	17	33	42	n	16

(i) Find the value of n. [1]

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

(c) **Answer this part of this question on a sheet of graph paper.**

Another frequency table for the same speeds is

Speed (v km/h)	$30 < v \leqslant 40$	$40 < v \leqslant 55$	$55 < v \leqslant 60$
Frequency	27	107	16

Draw an accurate histogram to show this information.
Use 2 cm to represent 5 units on the speed axis and 1 cm to represent 1 unit on the frequency density axis (so that 1 cm^2 represents 2.5 cars). [5]

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8 $\mathrm{f}(x) = x^2 - 4x + 3$ and $\mathrm{g}(x) = 2x - 1$.

(a) Solve $\mathrm{f}(x) = 0$. [2]

(b) Find $\mathrm{g}^{-1}(x)$. [2]

(c) Solve $\mathrm{f}(x) = \mathrm{g}(x)$, giving your answers correct to 2 decimal places. [5]

(d) Find the value of $\mathrm{gf}(-2)$. [2]

(e) Find $\mathrm{fg}(x)$. Simplify your answer. [3]

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

A taxi company has "SUPER" taxis and "MINI" taxis.
One morning a group of 45 people needs taxis.
For this group the taxi company uses x "SUPER" taxis and y "MINI" taxis.
A "SUPER" taxi can carry 5 passengers and a "MINI" taxi can carry 3 passengers.
So $5x + 3y \geqslant 45$.

(a) The taxi company has 12 taxis.
Write down **another** inequality in x and y to show this information. [1]

(b) The taxi company always uses at least 4 "MINI" taxis.
Write down an inequality in y to show this information. [1]

(c) Draw x and y axes from 0 to 15 using 1 cm to represent 1 unit on each axis. [1]

(d) Draw three lines on your graph to show the inequality $5x + 3y \geqslant 45$ **and** the inequalities from **parts (a) and (b)**.
Shade the **unwanted** regions. [6]

(e) The cost to the taxi company of using a "SUPER" taxi is \$20 and the cost of using a "MINI" taxi is \$10.
The taxi company wants to find the cheapest way of providing "SUPER" and "MINI" taxis for this group of people.
Find the **two** ways in which this can be done. [3]

(f) The taxi company decides to use 11 taxis for this group.

(i) The taxi company charges \$30 for the use of each "SUPER" taxi and \$16 for the use of each "MINI" taxi.
Find the two possible **total** charges. [3]

(ii) Find the largest possible **profit** the company can make, using 11 taxis. [1]