International General Certificate of Secondary Education

UNIVERSITY OF CAMBRIDGE LOCAL EXAMINATIONS SYNDICATE

MATHEMATICS 0580/4, 0581/4

PAPER 4

OCTOBER/NOVEMBER SESSION 2002 2 hours 30 minutes

Additional materials:
- Answer paper
- Electronic calculator
- Geometrical instruments
- Graph paper (1 sheet)
- Mathematical tables (optional)
- Tracing paper (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 7 printed pages and 1 blank page.

SJF2283/CG S14616/1

1 **(a)** At an athletics meeting, Ben's time for the 10 000 metres race was 33 minutes exactly and he finished at 15 17.

(i) At what time did the race start? [1]

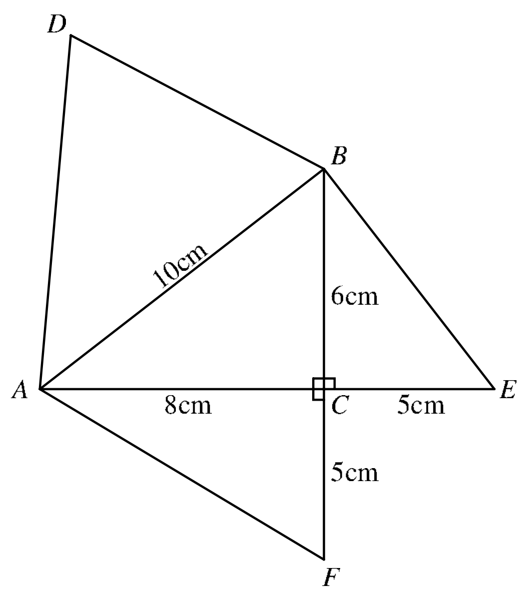
(ii) What was Ben's average speed for the race? Give your answer in kilometres per hour. [2]

(iii) The winner finished 51.2 seconds ahead of Ben.
How long did the winner take to run the 10 000 metres? [1]

(b) The winning distance in the javelin competition was 80 metres.
Otto's throw was 95% of the winning distance.
Calculate the distance of Otto's throw. [2]

(c) Pamela won the long jump competition with a jump of 6.16 metres.
This was 10% further than Mona's jump.
How far did Mona jump? [2]

2



NOT TO SCALE

The diagram shows a sketch of the net of a solid tetrahedron (triangular prism).
The right-angled triangle ABC is its base.
$AC = 8$ cm, $BC = 6$ cm and $AB = 10$ cm. $FC = CE = 5$ cm.

(a) **(i)** Show that $BE = \sqrt{61}$ cm. [1]

(ii) Write down the length of DB. [1]

(iii) Explain why $DA = \sqrt{89}$ cm. [2]

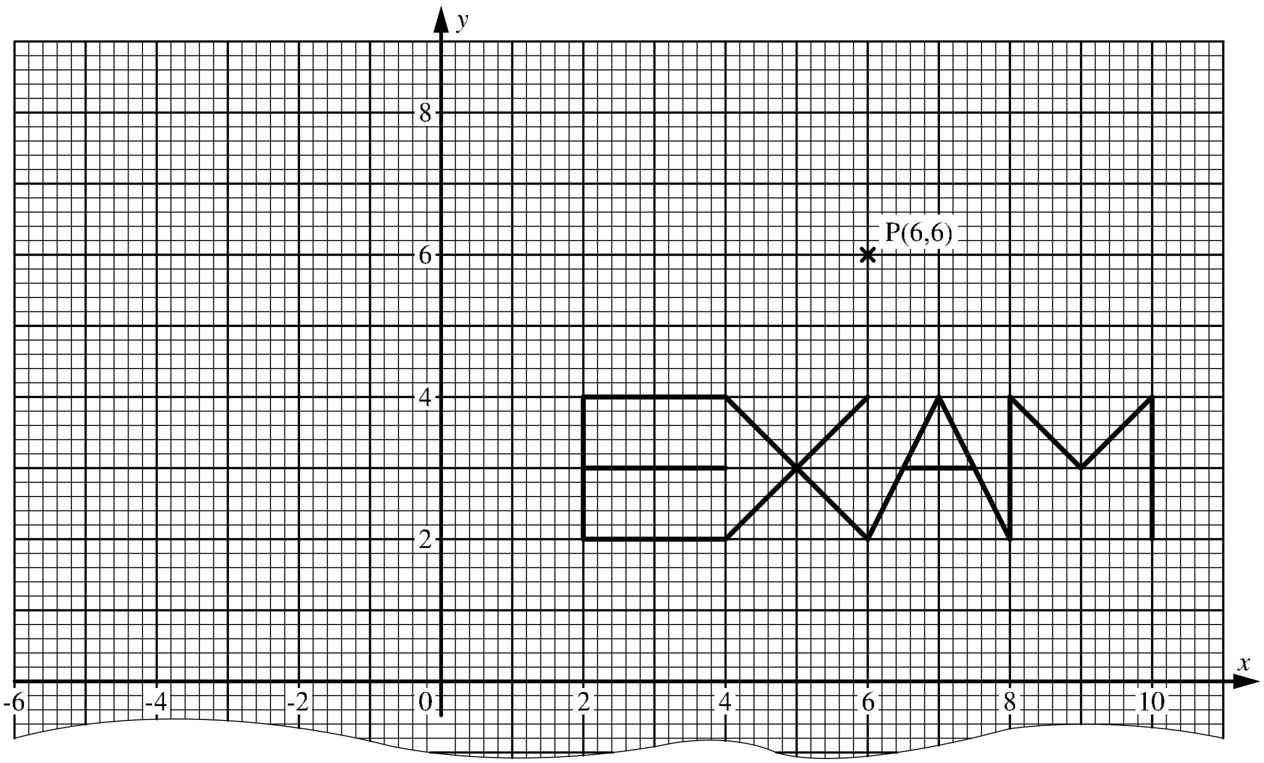
(b) **Calculate** the size of angle DBA. [4]

(c) Calculate the area of triangle DBA. [3]

(d) Find the total surface area of the solid. [3]

(e) Calculate the volume of the solid.
[The volume of a tetrahedron is $\frac{1}{3}$ (area of the base) × perpendicular height.] [3]

3



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

(a) Using a scale of 1 cm to represent 1 unit on each axis, draw an x-axis for $-6 \leqslant x \leqslant 10$ and a y-axis for $-8 \leqslant y \leqslant 8$.
Copy the word EXAM onto your grid so that it is **exactly** as it is in the diagram above.
Mark the point P (6,6). [2]

(b) Draw accurately the following transformations.

(i) Reflect the letter **E** in the line $x = 0$. [2]

(ii) Enlarge the letter **X** by scale factor 3 about centre P (6,6). [2]

(iii) Rotate the letter **A** 90° anticlockwise about the origin. [2]

(iv) Stretch the letter **M** vertically with scale factor 2 and x-axis invariant. [2]

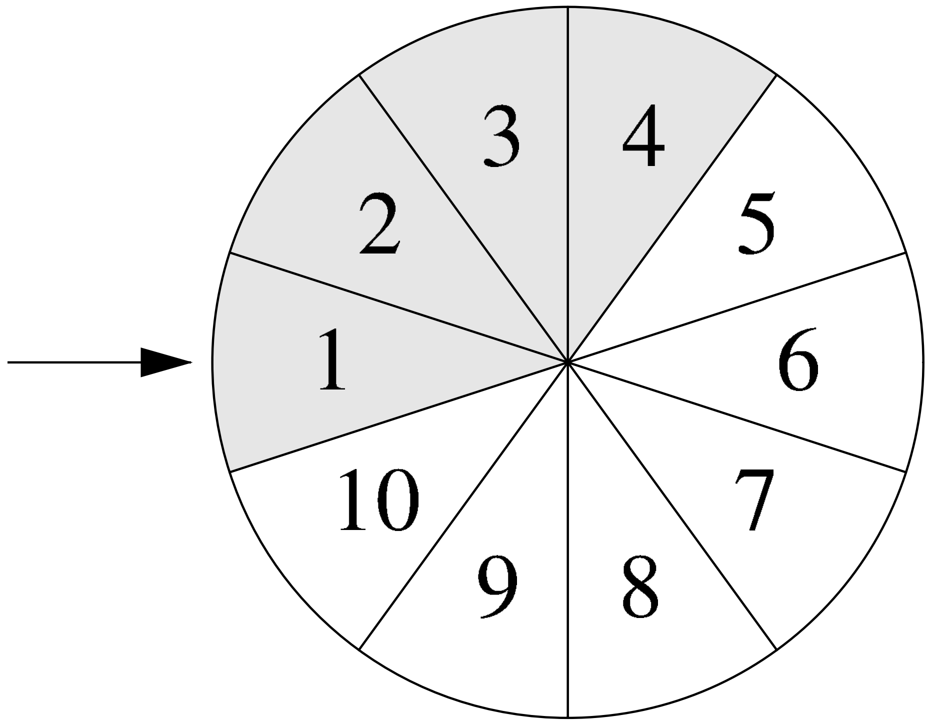
(c) **(i)** Mark and label the point Q so that $\overrightarrow{PQ} = \begin{pmatrix} -3 \\ 2 \end{pmatrix}$. [1]

(ii) Calculate $|\overrightarrow{PQ}|$ correct to two decimal places. [2]

(iii) Mark and label the point S so that $\overrightarrow{PS} \begin{pmatrix} -4 \\ -1 \end{pmatrix}$. [1]

(iv) Mark and label the point R so that $PQRS$ is a parallelogram. [1]

4



A wheel is divided into 10 sectors numbered 1 to 10 as shown in the diagram.
The sectors 1, 2, 3 and 4 are shaded.
The wheel is spun and when it stops the fixed arrow points to one of the sectors.
(Each sector is equally likely.)

(a) The wheel is spun once so that one sector is selected. Find the probability that

(i) the number in the sector is even, [1]

(ii) the sector is shaded, [1]

(iii) the number is even **or** the sector is shaded, [1]

(iv) the number is odd **and** the sector is shaded. [1]

(b) The wheel is spun twice so that each time a sector is selected. Find the probability that

(i) both sectors are shaded, [2]

(ii) one sector is shaded and one is not, [2]

(iii) the sum of the numbers in the two sectors is greater than 20, [2]

(iv) the sum of the numbers in the two sectors is less than 4, [2]

(v) the product of the numbers in the two sectors is a square number. [3]

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

(a) The table gives values of $f(x) = \frac{24}{x^2} + x^2$ for $0.8 \leqslant x \leqslant 6$.

x	0.8	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6
$f(x)$	38.1	25	12.9	10	10.1	11.7	l	m	n	26	31	36.7

Calculate, correct to 1 decimal place, the values of l, m and n. [3]

(b) Using a scale of 2 cm to represent 1 unit on the x-axis and 2 cm to represent 5 units on the y-axis, draw an x-axis for $0 \leqslant x \leqslant 6$ and a y-axis for $0 \leqslant y \leqslant 40$.

Draw the graph of $y = f(x)$ for $0.8 \leqslant x \leqslant 6$. [6]

(c) Draw the tangent to your graph at $x = 1.5$ and use it to calculate an estimate of the gradient of the curve at this point. [4]

(d) **(i)** Draw a straight line joining the points (0, 20) and (6, 32). [1]

(ii) Write down the equation of this line in the form $y = mx + c$. [2]

(iii) Use your graph to write down the x-values of the points of intersection of this line and the curve $y = f(x)$. [2]

(iv) Draw the tangent to the curve which has the same gradient as your line in **part d(i)**. [1]

(v) Write down the equation for the tangent in **part d(iv)**. [2]

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6 **(a)** On 1st January 2000, Ashraf was x years old.
Bukki was 5 years older than Ashraf and Claude was twice as old as Ashraf.

(i) Write down in terms of x, the ages of Bukki and Claude on 1st January 2000. [2]

(ii) Write down in terms of x, the ages of Ashraf, Bukki and Claude on 1st January 2002. [1]

(iii) The product of Claude's age and Ashraf's age on 1st January **2002** is the same as the square of Bukki's age on 1st January **2000**.
Write down an equation in x and show that it simplifies to $x^2 - 4x - 21 = 0$. [4]

(iv) Solve the equation $x^2 - 4x - 21 = 0$. [2]

(v) How old was Claude on 1st January 2002? [1]

(b) Claude's height, h metres, is one of the solutions of $h^2 + 8h - 17 = 0$.

(i) Solve the equation $h^2 + 8h - 17 = 0$.

Show all your working and give your answers correct to 2 decimal places. [4]

(ii) Write down Claude's height, to the nearest centimetre. [1]

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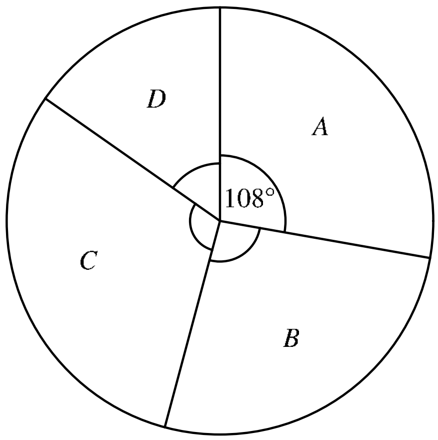
7 **(a)** A group of students sat an examination. Each student got one of the grades *A*, *B*, *C* or *D*.
The pie chart shows these results.



NOT TO SCALE

36 students got grade A, shown by an angle of 108°.

(i) Calculate the total number of students who sat the examination. [2]

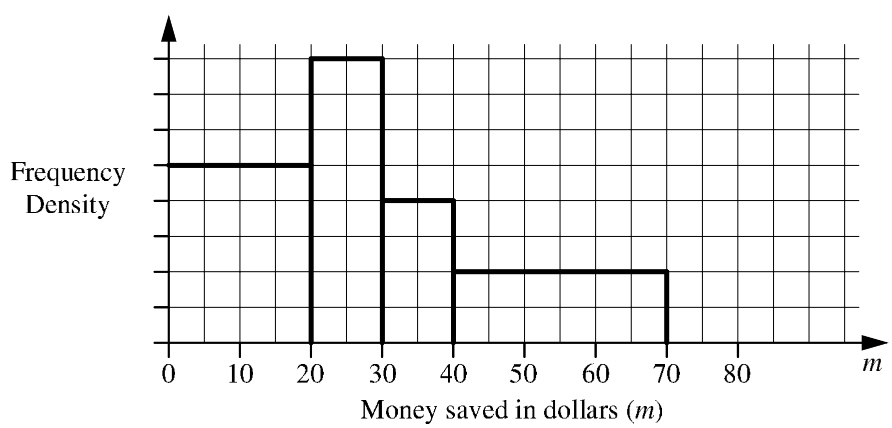
(ii) How many students did **not** get grade *A*? [1]

(iii) The ratio of the number of students getting grades *B*, *C* or *D* is 4 : 5 : 3.
Find the number of students getting each grade. [3]

(iv) Work out the angles in the pie chart for grades *B*, *C* and *D*. [3]

(v) Find the ratio, **in its lowest terms**,
the number of students with grade *A* : the number of students with grade *B*. [1]

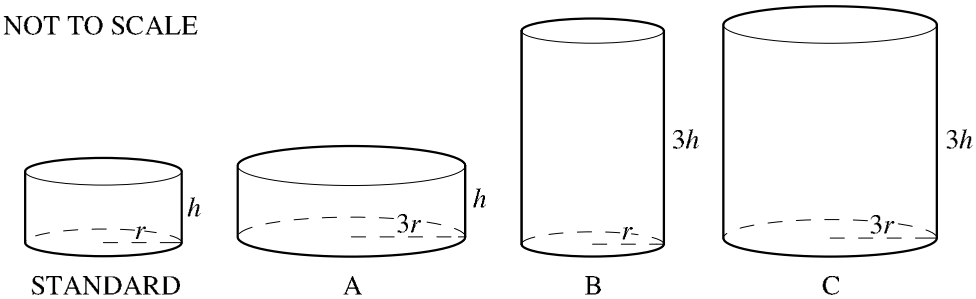
(b) A group of children were asked how much money they had saved. The histogram and table show the results.



Money saved ($\$m$)	$0 < m \leqslant 20$	$20 < m \leqslant 30$	$30 < m \leqslant 40$	$40 < m \leqslant 70$
Frequency	25	p	q	r

Use the histogram to calculate the values of p, q and r. [4]

8 NOT TO SCALE



Sarah investigates cylindrical plant pots.
The standard pot has base radius r cm and height h cm.
Pot A has radius $3r$ and height h. Pot B has radius r and height $3h$. Pot C has radius $3r$ and height $3h$.

(a) **(i)** Write down the volumes of pots A, B and C in terms of π , r and h. [3]

(ii) Find in its lowest terms the ratio of the volumes of $A : B : C$. [2]

(iii) Which one of the pots A, B or C is mathematically similar to the standard pot? Explain your answer. [2]

(iv) The surface area of the standard pot is $S\,\text{cm}^2$. Write down in terms of S the surface area of the similar pot. [2]

(b) Sarah buys a cylindrical plant pot with radius 15 cm and height 20 cm. She wants to paint its outside surface (base and curved surface area).

(i) Calculate the area she wants to paint. [2]

(ii) Sarah buys a tin of paint which will cover 30 m^2.
How many plant pots of this size could be painted on their outside surfaces **completely** using this tin of paint? [4]

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9 **(a)** Write down the 10th term and the nth term of the following sequences.

(i) 1, 2, 3, 4, 5 …, …, [1]

(ii) 7, 8, 9, 10, 11 …, …, [1]

(iii) 8, 10, 12, 14, 16 …, … . [3]

(b) Consider the sequence

1(8 – 7), 2(10 – 8), 3(12 – 9), 4(14 – 10), ……….., ………… .

(i) Write down the next term and the 10th term of this sequence in the form $a(b – c)$ where a, b and c are integers. [3]

(ii) Write down the nth term in the form $a(b – c)$ and then simplify your answer. [2]

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