

CAMBRIDGE INTERNATIONAL EXAMINATIONS

**Joint Examination for the School Certificate
and General Certificate of Education Ordinary Level**

MATHEMATICS (SYLLABUS D)

4024/2

PAPER 2

OCTOBER/NOVEMBER SESSION 2002

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 separate answer paper/answer booklet.

Write your answers and working on the separate answer paper provided.

Show all your working on the same page as the rest of the answer.

Omission of essential working will result in loss of marks.

Section A

Answer **all** questions.

Section B

Answer any **four** questions.

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 100.

You are expected to use an electronic calculator to evaluate explicit numerical expressions. You may use mathematical tables as well if necessary.

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.

Section A [52 marks]

Answer all the questions in this section.

1

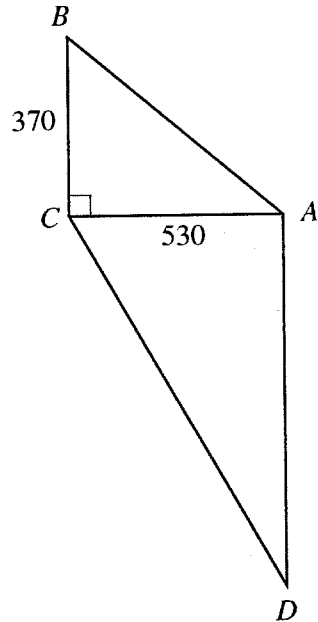


Diagram I

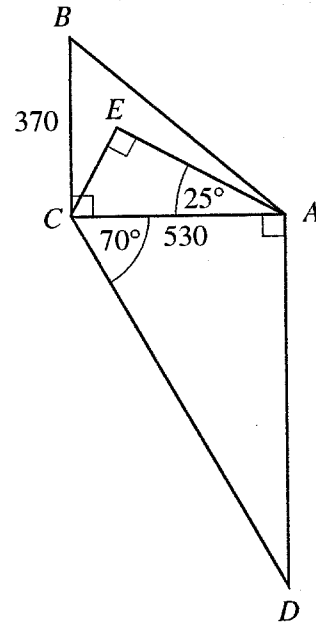


Diagram II

Diagram I shows a path, AC , in a park $ABCD$.It is given that $AC = 530$ m, $BC = 370$ m and that AC is perpendicular to BC .

- (a) Calculate angle ABC . [2]
- (b) Diagram II shows two other paths, AE and CE , in the park.
Given that angle $CAE = 25^\circ$ and angle $AEC = 90^\circ$, calculate the length of AE . [2]
- (c) Given also that angle $ACD = 70^\circ$ and angle $CAD = 90^\circ$, calculate
- (i) the length of CD , [2]
- (ii) the area of the park $ABCD$. [3]

2 (a) Solve the equation $(x - 5)^2 = 81$. [2]

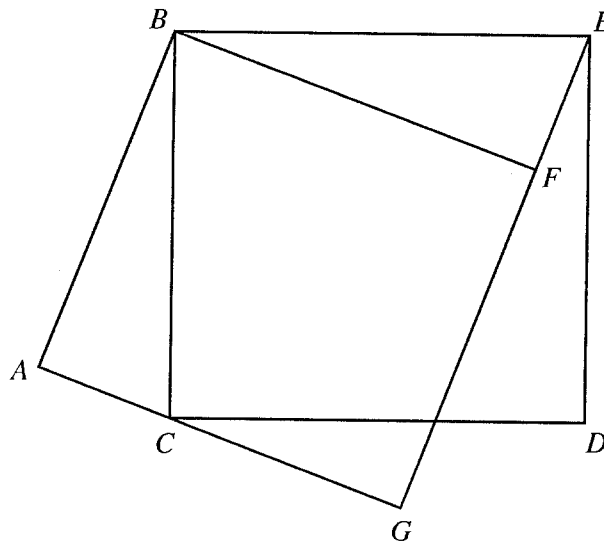
(b) Express as a single fraction in its simplest form

$$\frac{a}{2a-1} - \frac{2}{a+1}. \quad [3]$$

(c) Given that $A = h(4m + h)$,
express m in terms of h and A . [3]

- 3 (a) The points A and B are $(-2, 1)$ and $(6, -5)$ respectively.
Calculate
- the gradient of the line AB ,
 - the equation of the line through A and B .
- (b) The points C and D are $(4, 5)$ and (p, q) respectively.
- Write down, in terms of p and q , the coordinates of the midpoint of CD .
 - Given that the midpoint of CD is $(7, 1)$, find the coordinates of D .

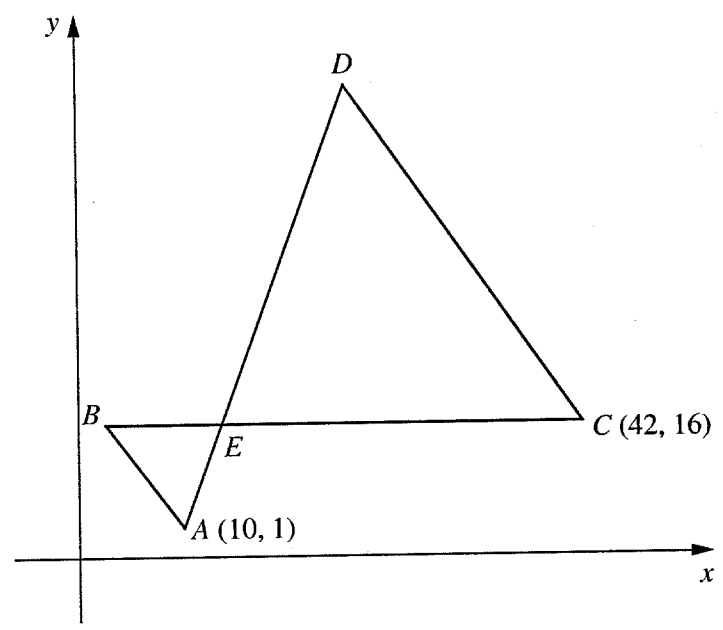
4



In the diagram, $ABFG$ is a rectangle and $BCDE$ is a square.

ACG and GFE are straight lines.

- Show that $\text{angle } ABC = \text{angle } FBE$. [2]
- Show that triangle ABC is congruent to triangle FBE . [3]
- Hence show that $ABFG$ is a square. [1]



In the diagram, A is the point (10, 1) and $\vec{AB} = \begin{pmatrix} -8 \\ 15 \end{pmatrix}$.

- (a) Find
 - (i) $|\vec{AB}|$, [2]
 - (ii) the coordinates of B. [1]

The point C is (42, 16) and $\vec{CD} = 3\vec{AB}$.

- (b) Find
 - (i) the coordinates of D, [2]
 - (ii) the vector \vec{AD} . [1]

The point E is (k, 16).

- (c) (i) Find, in terms of k, the vector \vec{AE} . [1]
- (ii) Given that AED is a straight line, find k. [2]

- (d) Find $\frac{\text{Area of triangle } ABE}{\text{Area of triangle } CDE}$. [2]
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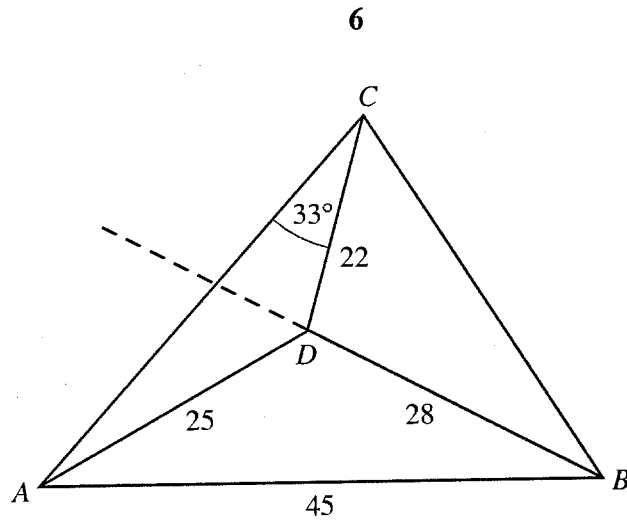
- 6 (a) (i) In 2000 the cost of a packet of nails was \$4.20.
In 2001 the price had increased to \$4.50.
Calculate the percentage increase in the cost of a packet of nails.
- (ii) A new cereal packet contains 20% more than the old packet.
The new packet contains 264 grams of cereal.
Calculate the mass of cereal in one of the old packets. [3]
- (iii) A builder bought a large number of bags of cement.
As a result he was given a discount of 7%.
The discount was \$910.
Calculate how much the builder paid for the cement. [3]
- (b) On 1 May 1998 William invested \$900 for 4 years at 6% per annum simple interest.
- (i) Calculate the interest he received on his investment. [2]
- (ii) He invested another \$900 for 3 years at 6% per annum simple interest on 1 May 1999,
then \$900 for 2 years at 6% per annum simple interest on 1 May 2000,
and a final \$900 for 1 year at 6% per annum simple interest on 1 May 2001.
William withdrew all of his money on 1 May 2002.
Calculate the total sum that he withdrew. [2]

Section B [48 marks]

Answer **four** questions in this section.

Each question in this section carries 12 marks.

- 7 A trader bought some paraffin for \$500.
He paid \$ x for each litre of paraffin.
- (a) Find, in terms of x , an expression for the number of litres he bought. [1]
- (b) Due to a leak, he lost 3 litres of paraffin.
He sold the remainder of the paraffin for \$1 per litre more than he paid for it.
Write down an expression, in terms of x , for the sum of money he received. [2]
- (c) He made a profit of \$20.
- (i) Write down an equation in x to represent this information, and show that it reduces to
$$3x^2 + 23x - 500 = 0.$$
 [3]
- (ii) Solve the equation $3x^2 + 23x - 500 = 0$, giving both answers correct to one decimal place. [4]
- (d) Find, correct to the nearest whole number, how many litres of paraffin he sold. [2]



The diagram shows four points, A , B , C and D , on a piece of horizontal land. It is given that $AB = 45$ metres, $AD = 25$ metres and $BD = 28$ metres.

- (a) Calculate angle ADB . [4]
 - (b) Given also that $CD = 22$ metres and that angle $ACD = 33^\circ$, calculate angle ADC . [3]
 - (c) The line BD is produced beyond D .
Calculate the shortest distance from C to this extended line. [2]
 - (d) D is the foot of a vertical mast, DT .
The angle of elevation of the top of the mast, T , from A is 40° .
Calculate the angle of elevation of T from B . [3]
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9 [The value of π is 3.142 correct to three decimal places.]

[The area of the curved surface of a cone of radius r and slant height l is πrl .

The volume of a cone is $\frac{1}{3} \times \text{base area} \times \text{height}$.]

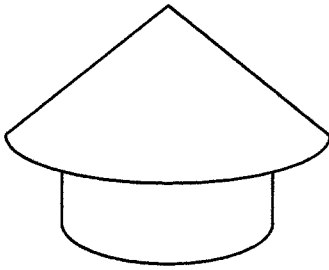


Diagram I

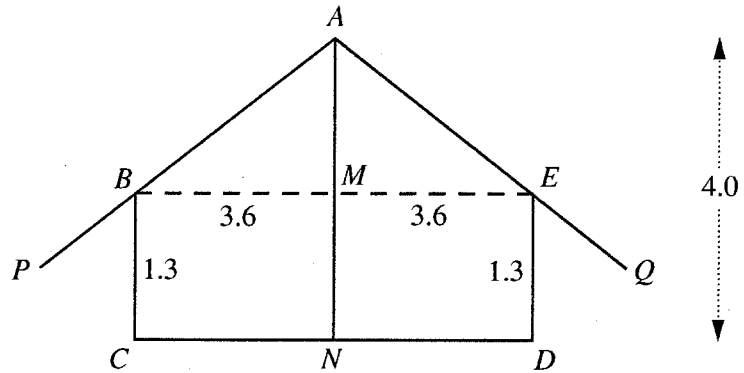


Diagram II

Diagram I shows a traditional hut which consists of a circular cylinder with an overhanging roof. The roof is the curved surface of a cone and is supported by a central vertical pole.

Diagram II shows a vertical cross-section of the hut.

BE and CD are horizontal.

$AN = 4.0$ m, $BM = ME = 3.6$ m and $BC = DE = 1.3$ m.

- (a) Show that $AB = 4.5$ m. [1]
- (b) Calculate
- (i) the volume of the inside of the hut, [3]
- (ii) the **total** surface area of the inside of the hut (including the floor). [4]
- (c) The sun is directly overhead.

The shadow of the overhanging section of the roof on the ground is a circular ring around the hut.

$AP = AQ = 5.5$ m.

Calculate

- (i) PQ , [2]
- (ii) the area of the circular ring of shadow **outside** the hut. (Ignore the thickness of the walls.) [2]

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

A man stood at the top of a tower.

He threw a ball vertically upwards.

The height, h metres, of the ball **above the top of the tower** at a time t seconds after it was thrown is given by the formula

$$h = 22t - 4.9t^2.$$

The table below shows some values of t and the corresponding values of h , correct to 1 decimal place.

t	0	1	2	2.5	3	4	5	6
h	0.0	17.1	24.4	24.4	21.9	9.6	-12.5	p

- (a) Explain the significance of the value $h = -12.5$ when $t = 5$. [1]
- (b) Find the value of p . [1]
- (c) Using a scale of 2 cm to 1 second, draw a horizontal t -axis for $0 \leq t \leq 6$.
Using a scale of 2 cm to 10 metres, draw a vertical h -axis for $-50 \leq h \leq 30$.
On your axes, plot the points given in the table and join them with a smooth curve. [3]
- (d) Use your graph to find
- (i) the greatest height of the ball above the top of the tower, [1]
- (ii) the length of time for which the ball was more than 20 metres above the top of the tower. [2]
- (e) (i) By drawing a tangent, find the gradient of the graph at $(4, 9.6)$. [2]
- (ii) Explain what your answer to (e)(i) tells you about the motion of the ball at $t = 4$. [1]
- (f) The ball hit the ground 5.4 seconds after it was thrown.
Use your graph to find the height of the tower. [1]

- 11 (a) A bag contains five balls, numbered 1, 2, 3, 4 and 5.
Another bag contains six balls, numbered 1, 2, 3, 4, 5 and 6.

One ball is drawn at random from each bag.

Find the probability that

- (i) one ball is numbered 1 and the other 6, [1]
 (ii) both balls have an odd number, [1]
 (iii) both balls have the same number, [2]
 (iv) the sum of the numbers on the balls is 9. [2]

- (b) Answer the whole of this part of the question on a sheet of graph paper.

At a school, 300 pupils took an English test.

The table below is the cumulative frequency table for their scores.

Score (s)	≤ 10	≤ 20	≤ 30	≤ 40	≤ 50	≤ 60
Cumulative frequency	15	33	67	142	257	300

- (i) Using a scale of 2 cm to represent 10 marks, draw a horizontal s -axis for $0 \leq s \leq 60$.
Using a scale of 2 cm to represent 50 pupils, draw a vertical axis for values from 0 to 300.
On your axes, draw a smooth cumulative frequency curve to illustrate this information. [2]
- (ii) Use your graph to find the lower quartile score. [1]
- (iii) Find the interquartile range of the scores. [1]
- (iv) Given that 70% of the pupils passed the test, use your graph to find the pass mark. [2]
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