UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education Ordinary Level

MATHEMATICS (SYLLABUS D) **4024/22**

Paper 2 **October/November 2010**

2 hours 30 minutes

Additional Materials: Answer Booklet/Paper
Electronic calculator
Geometrical instruments
Graph paper (1 sheet)
Mathematical tables (optional)

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READ THESE INSTRUCTIONS FIRST

If you have been given an Answer Booklet, follow the instructions on the front cover of the Booklet.
Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use a pencil for any diagrams or graphs.
Do not use staples, paper clips, highlighters, glue or correction fluid.

Section A
Answer **all** questions.

Section B
Answer any **four** questions.

Show all your working on the same page as the rest of the answer.
Omission of essential working will result in loss of marks.
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.
For π, use either your calculator value or 3.142, unless the question requires the answer in terms of π.

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.
The total of the marks for this paper is 100.

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[Turn over

Section A [52 marks]

Answer **all** questions in this section.

1 **(a)** Simplify

(i) $\frac{x+y}{8x+8y}$, [1]

(ii) $x(3x-2)-(3x^2-5)$. [2]

(b) Solve the equation $3t-4=7+2(t+3)$. [2]

(c) Factorise $5px-7qx+10py-14qy$. [2]

(d) **(i)** When $x=-2$, which of the two expressions, $3x+4$ and $2-x$, has the greater value? You must show your working. [2]

(ii) Solve the inequality $3x+4<2-x$. [2]

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2 **(a)** The rate of exchange between pounds (£) and dollars ($) is £1 = $1.87.
The rate of exchange between pounds (£) and euros (€) is £1 = €1.21.

(i) Catherine changes £500 into dollars.

Calculate how many dollars she receives. [1]

(ii) Esther changes €726 into pounds.

Calculate how many pounds she receives. [1]

(iii) Rose changes $850 into euros.

Calculate how many euros she receives. [2]

(b) Matthew changes $770 into rupees.
He receives 40 000 rupees.

How many rupees did he receive for each dollar? [2]

(c) **(i)** Lily bought a car for $13 500.
She paid for it in 36 equal monthly payments.

Calculate the amount she paid each month. [1]

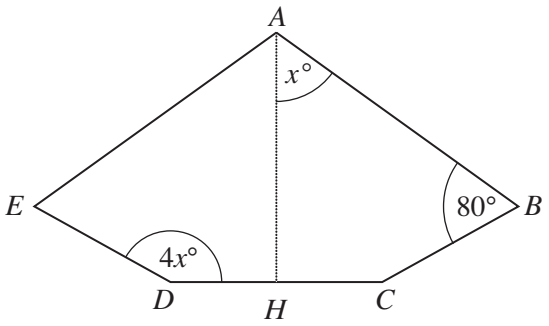
(ii) George bought a car for $27 000.
He borrowed the $27 000 at 15% per year simple interest for 3 years.
He repaid the **total** amount in 36 equal monthly payments.

Calculate the amount he paid each month. [3]

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3 **(a)** Calculate the interior angle of a regular 10-sided polygon. [2]

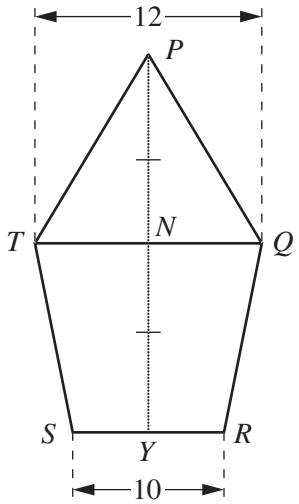
(b)



AH is the line of symmetry of the pentagon $ABCDE$.
$H\hat{A}B = x°$, $A\hat{B}C = 80°$ and $E\hat{D}H = 4x°$.

Find x. [3]

(c)

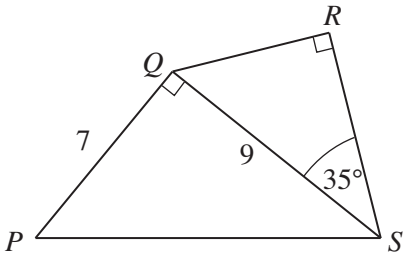


PY is the line of symmetry of the pentagon $PQRST$.
PY and TQ intersect at N.
$PN = NY$.
$TQ = 12\,\text{cm}$ and $SR = 10\,\text{cm}$.

(i) Given that $PY = 2h$ centimetres, find an expression, in terms of h, for the area of the trapezium $QRST$. [2]

(ii) Given that the area of $PQRST$ is $221\,\text{cm}^2$, calculate h. [2]

4 (a)



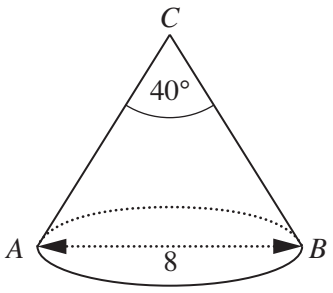
In the quadrilateral $PQRS$, $PQ = 7$ cm and $QS = 9$ cm.
$P\hat{Q}S = Q\hat{R}S = 90°$ and $Q\hat{S}R = 35°$.

Calculate

(i) $S\hat{P}Q$, [2]

(ii) RS. [2]

(b) [The area of the curved surface of a cone of radius r and slant height l is πrl]



The diagram shows a cone ABC.
The diameter $AB = 8$ cm and $A\hat{C}B = 40°$.

Calculate the curved surface area of this cone. [3]

5 The table shows the distribution of the masses of 90 apples.

Mass (m grams)	$60 < m \leqslant 80$	$80 < m \leqslant 90$	$90 < m \leqslant 95$	$95 < m \leqslant 100$	$100 < m \leqslant 110$	$110 < m \leqslant 130$
Frequency	10	16	20	21	22	1

(a) In which interval does the median lie? [1]

(b) Calculate an estimate of the mean. [3]

(c) A histogram is drawn to represent this information.

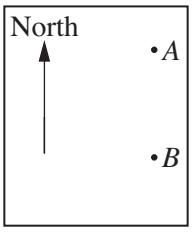
(i) Calculate the frequency density of the interval $90 < m \leqslant 95$. [1]

(ii) The rectangle representing the apples with masses in the interval $80 < m \leqslant 90$ has width 2 cm and height 4 cm.

Find the width and height of the rectangle representing the apples with masses in the interval $90 < m \leqslant 95$. [2]

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6 Answer this question on a new page.



A and B are two coastguard stations with A due north of B.
On your new blank page, mark A in a position near the top right hand corner, as shown in the diagram.

(a) The distance between A and B is 140 km.

Using a scale of 1 cm to 10 km,

(i) mark the position of B and draw the line AB, [1]

(ii) construct the locus of the points west of AB that are

(a) equidistant from A and B, [1]

(b) 90 km from B. [1]

(b) A ship, S, lies to the west of AB and is

I nearer to A than B,

II within 90 km of B.

On your diagram, shade the region in which the ship is situated. [1]

(c) It is also known that the bearing of the ship from A is 204°.

(i) On your diagram, mark the two extreme positions, S_1 and S_2, of the ship. [2]

(ii) Measure the angle S_1BS_2. [1]

(iii) The bearing of the ship from B is x°.

Find the least possible value of x. [1]

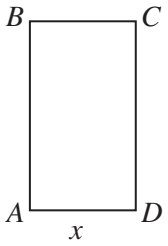
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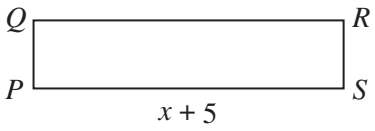
Section B [48 marks]

Answer **four** questions in this section.

Each question in this section carries 12 marks.

7





ABCD and *PQRS* are rectangles.
Each rectangle has an area of $13\,\text{cm}^2$.
$AD = x$ centimetres and $PS = (x + 5)$ centimetres.

(a) Find, in terms of x, an expression for

(i) AB, [1]

(ii) PQ. [1]

(b) Given that AB is 3 cm greater than PQ, form an equation in x and show that it simplifies to

$$3x^2 + 15x - 65 = 0.$$ [3]

(c) Solve the equation $3x^2 + 15x - 65 = 0$, giving each answer correct to 2 decimal places. [4]

(d) **(i)** Show that the perimeter of *ABCD* is 14.9 cm, correct to 3 significant figures. [1]

(ii) Find the difference between the perimeters of the two rectangles. [2]

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

The variables x and y are connected by the equation

$$y = \frac{x^3}{10} - \frac{x}{2}.$$

The table below shows some corresponding values of x and y.

x	0	1	2	3	4	4.5
y	0	–0.4	–0.2	1.2	4.4	p

(a) Calculate p. [1]

(b) Using a scale of 2 cm to 1 unit on each axis, draw a horizontal x-axis for $0 \leqslant x \leqslant 5$ and a vertical y-axis for $-1 \leqslant y \leqslant 7$.

On your axes, plot the points given in the table and join them with a smooth curve. [3]

(c) Use your graph to solve the equation $\frac{x^3}{10} - \frac{x}{2} = 0.3$ for values of x in the range $0 \leqslant x \leqslant 5$. [1]

(d) (i) Draw the chord joining the two points (0, 0) and (3, 1.2) and calculate its gradient. [1]

(ii) Draw a tangent at the point where the gradient of the curve is equal to the gradient of the chord. [1]

(e) (i) On the same axes, draw the graph of the straight line $y = -x + 6$. [2]

(ii) Write down the x coordinate of the point where the line crosses the curve. [1]

(iii) This value of x is a solution of the equation $x^3 + Ax + B = 0$.

Find A and B. [2]

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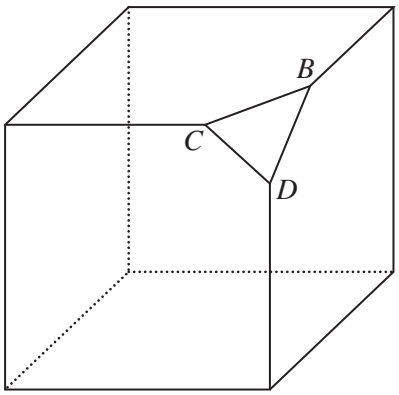


Diagram I

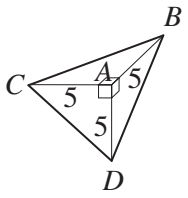


Diagram II

Diagram I shows a cube with a triangular pyramid removed from one vertex.
This triangular pyramid $ABCD$ is shown in Diagram II.
$AB = AC = AD = 5$ cm.

(a) State the height of this pyramid when the base is triangle ABD. [1]

(b) **[The volume of a pyramid = $\frac{1}{3}$ × area of base × height]**

Calculate

(i) the volume of the pyramid, [2]

(ii) the area of triangle BCD, [3]

(iii) the height of the pyramid when the base is triangle BCD. [3]

(c) An identical triangular pyramid is removed from each of the other 7 vertices of the cube to form the new solid shown in Diagram III.

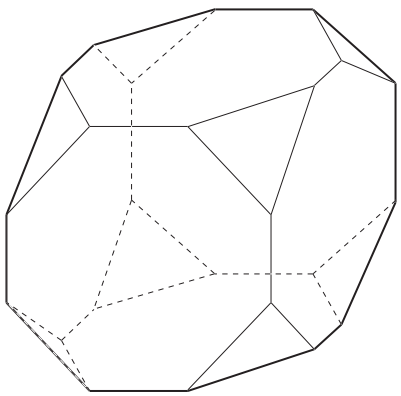


Diagram III

The original cube had 6 faces, 8 vertices and 12 edges.
For the new solid, write down the number of

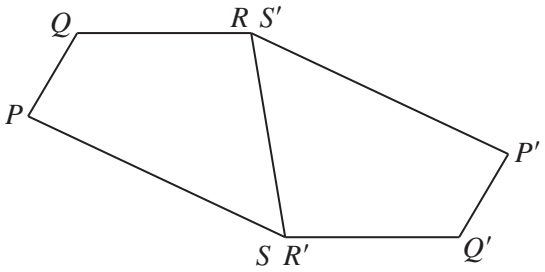
(i) faces, [1]

(ii) vertices, [1]

(iii) edges. [1]

10 **(a)** $PQRS$ and $P'Q'R'S'$ are congruent quadrilaterals.
R is the same point as S'.
S is the same point as R'.

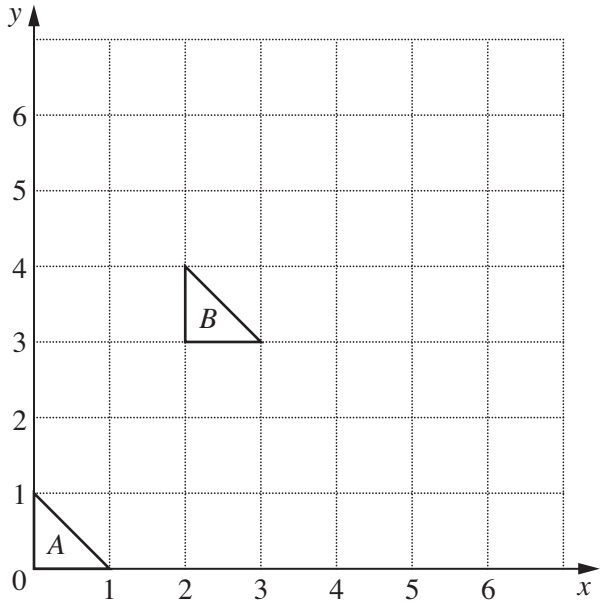
A single transformation maps P onto P',
Q onto Q', R onto R' and S onto S'.



(i) Describe fully this transformation. [3]

(ii) Write down two facts connecting PQ and $Q'P'$. [1]

(b)



The diagram shows triangle A and triangle B.

(i) A translation, T, maps triangle A onto triangle B.

State the column vector representing this translation. [1]

(ii) The transformation, S, that maps triangle A onto triangle C is represented by the matrix $\begin{pmatrix} 2 & 0 \\ 0 & 1 \end{pmatrix}$.

Find the vertices of triangle C. [2]

(iii) Given that TS(A) = D, find the vertices of triangle D. [1]

(iv) Triangle E has vertices (0,0), (2,0) and (0,3).

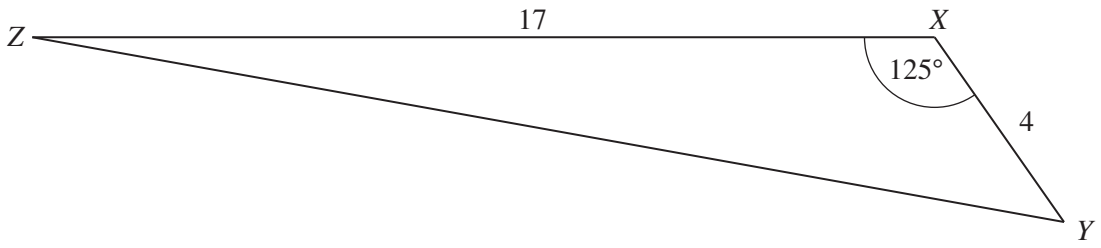
(a) It is given that (0,0) $\longrightarrow$ (0,0), (1,0) $\longrightarrow$ (2,0) and (0,1) $\longrightarrow$ (0,3).

Find the matrix that represents this transformation. [2]

(b) Describe fully the **single** transformation that maps triangle A onto triangle E. [2]

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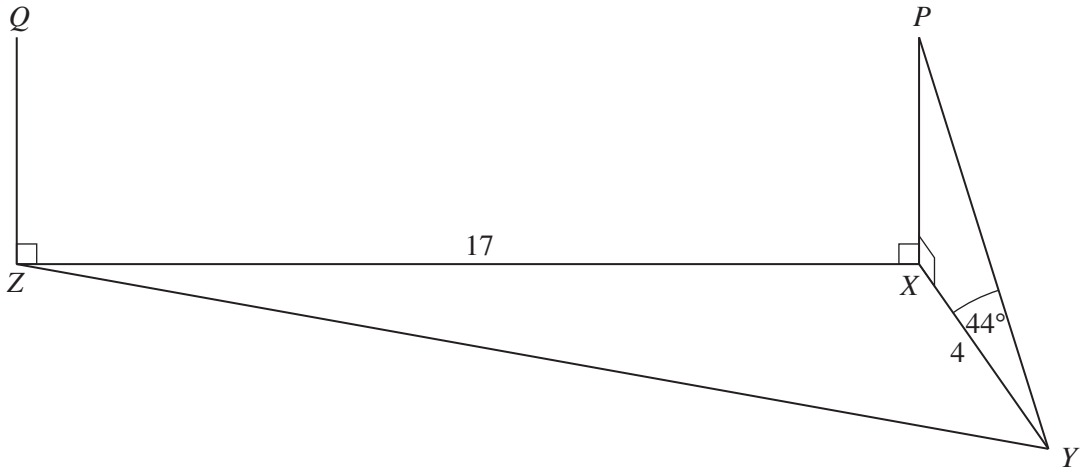
11



The points X, Y and Z are on horizontal ground.
$XY = 4\,\text{km}$, $XZ = 17\,\text{km}$ and $Y\hat{X}Z = 125°$.

(a) Calculate YZ. [4]

(b)



The points P and Q are the same height vertically above X and Z respectively.

(i) When an aircraft was at P, its angle of elevation from Y was 44°.

Calculate PX.
Give your answer in metres, correct to the nearest 100 metres. [3]

(ii) The aircraft took 2 minutes 54 seconds to fly from P to Q.

(a) The aircraft reached its destination 39 minutes 6 seconds after flying over Q.
The flight ended at 15 03.

At what time did the aircraft fly over P? [2]

(b) Calculate the average speed of the aircraft as it flew from P to Q.
Give your answer in kilometres per hour. [3]

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