



UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS  
General Certificate of Education Ordinary Level

CANDIDATE  
NAME

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CENTRE  
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## MATHEMATICS (SYLLABUS D)

4024/11

## Paper 1

October/November 2011

**2 hours**

Candidates answer on the Question Paper.

Additional Materials: Geometrical instruments

## READ THESE INSTRUCTIONS FIRST

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.

DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.

If working is needed for any question it must be shown in the space below that question.

Omission of essential working will result in loss of marks.

**ELECTRONIC CALCULATORS MUST NOT BE USED IN THIS PAPER.**

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 80.

**For Examiner's Use**

This document consists of **20** printed pages.

**ELECTRONIC CALCULATORS MUST NOT BE USED IN THIS PAPER.**

- 1 (a) Evaluate  $3 + 5(3 - 1.4)$ .

Answer ..... [1]

- (b) Evaluate  $0.2 \times 0.07$ .

Answer ..... [1]

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- 2 (a) Evaluate  $3\frac{2}{3} - 2\frac{4}{5}$ .

Answer ..... [1]

- (b) Express  $\frac{48}{84}$  in its lowest terms.

Answer ..... [1]

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- 3 (a) Write the following numbers in order of size, starting with the smallest.

0.67       $\frac{7}{9}$        $\frac{2}{3}$       66 %

Answer ..... , ..... , ..... , ..... [1]  
smallest

- (b) During one month, the volume of perfume in a bottle decreased from 5 ml to 4 ml.

Calculate the percentage decrease.

Answer ..... % [1]

- 4 (a) Add 55 minutes to 2.4 hours, giving your answer in hours and minutes.

Answer ..... hours ..... minutes [1]

- (b) The mass of a bag of sugar is given as 1.5 kg, correct to the nearest tenth of a kilogram.

Write down the upper bound of this mass, giving your answer in grams.

Answer ..... g [1]

- 5 Given that  $f(x) = \frac{2x+3}{5x}$ , find  $f^{-1}(x)$ .

Answer  $f^{-1}(x) = \dots\dots\dots$  [2]

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- 6 By making suitable approximations, estimate the value of  $\frac{304.3 \times \sqrt{15.98}}{0.1975}$ .

Answer  $\dots\dots\dots$  [2]

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- 7 Find the values of  $x$  and  $y$ , where

$$2 \begin{pmatrix} x \\ 7 \end{pmatrix} = 3 \begin{pmatrix} -2 \\ y \end{pmatrix} - \begin{pmatrix} 4 \\ -2 \end{pmatrix}.$$

*Answer*  $x = \dots\dots\dots$

$y = \dots\dots\dots$  [2]

- 8 A large tank contained  $2.3 \times 10^6$  litres of oil.  
During a 4 week period,  $1.2 \times 10^5$  litres were used.

- (a) Calculate how many litres of oil remain in the tank after the 4 weeks.  
Give your answer in standard form.

*Answer*  $\dots\dots\dots$  [1]

- (b) Giving your answer in standard form, calculate the average number of litres used each week.

*Answer*  $\dots\dots\dots$  [1]

- 9 It is given that  $13 < 7 - 2x < 18$  has the solution  $a < x < b$ .

Find the values of  $a$  and  $b$ .

Answer  $a = \dots\dots\dots$

$b = \dots\dots\dots$  [2]

- 
- 10 Factorise completely  $2xy - 3x - 10y + 15$ .

Answer  $\dots\dots\dots$  [2]

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11

|               |           |         |        |
|---------------|-----------|---------|--------|
| parallelogram | rectangle | rhombus | square |
|---------------|-----------|---------|--------|

Which of these quadrilaterals have

- (a) exactly 2 lines of symmetry,

Answer ..... [1]

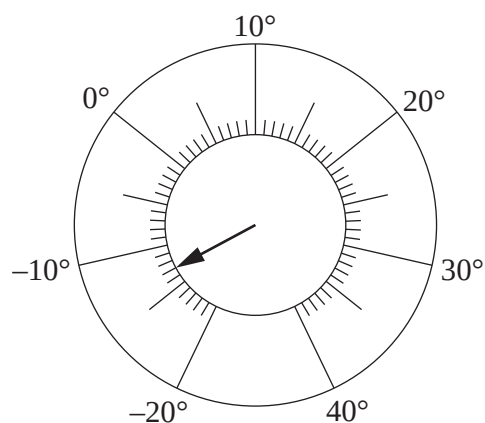
- (b) rotational symmetry of order 2,

Answer ..... [1]

- (c) diagonals that are equal?

Answer ..... [1]

- 12 The diagram shows a thermometer, with a circular dial, that records temperatures in  $^{\circ}\text{C}$ .



- (a) Write down the temperature indicated by the pointer.

Answer .....  $^{\circ}\text{C}$  [1]

- (b) When the temperature increases from  $-20^{\circ}\text{C}$  to  $40^{\circ}\text{C}$ , the pointer turns through an angle of  $300^{\circ}$ .

Calculate the angle through which the pointer turns when there is a  $7^{\circ}\text{C}$  rise in temperature.

Answer ..... [1]

- (c) On one particular day, the temperature at 1 a.m. was  $4^{\circ}\text{C}$ .  
By 6 a.m. it had fallen by  $9^{\circ}\text{C}$ .

Calculate the temperature at 6 a.m.

Answer .....  $^{\circ}\text{C}$  [1]

13 A map has a scale of 2 cm to 5 km.

(a) Express this scale in the form  $1 : n$ .

Answer  $1 : \dots\dots\dots$  [1]

(b) The actual distance between two places is 35 km.

Calculate the distance on the map between these two places.

Answer  $\dots\dots\dots$  cm [1]

(c) On the map, the area of a lake is  $8 \text{ cm}^2$ .

Calculate the actual area of the lake.

Answer  $\dots\dots\dots$   $\text{km}^2$  [1]

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- 14 The table shows the results when a 6-sided die was thrown 50 times.

|           |   |   |   |   |    |    |
|-----------|---|---|---|---|----|----|
| Score     | 1 | 2 | 3 | 4 | 5  | 6  |
| Frequency | 7 | 7 | 6 | 9 | 11 | 10 |

- (a) Write down the modal score.

Answer ..... [1]

- (b) Calculate the mean score.

Answer ..... [2]

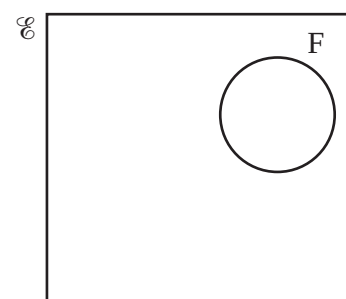
- 15  $\mathcal{U} = \{ x : x \text{ is an integer and } x > 5 \}$

$P = \{ x : x \text{ is a prime number} \}$

$F = \{ x : x \text{ is a multiple of 4} \}$

$S = \{ x : x \text{ is a multiple of 6} \}$

The Venn diagram shows the Universal set and the set F.



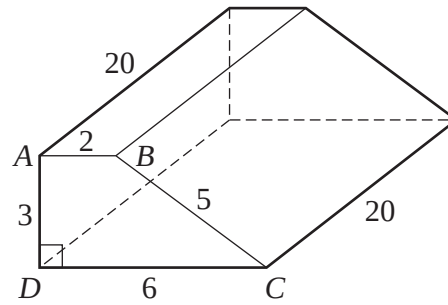
- (a) Draw and label the two sets P and S to complete the Venn diagram. [2]

- (b) Write down a possible element  $y$  such that  $y$  is an even number and  $y \in (F \cup S)'$ .

Answer  $y =$  ..... [1]

- 16 The diagram shows a solid prism of length 20 cm.  
The cross-section,  $ABCD$ , is a trapezium.

$AB = 2$  cm,  $BC = 5$  cm,  $CD = 6$  cm,  
 $DA = 3$  cm and angle  $ADC = 90^\circ$ .



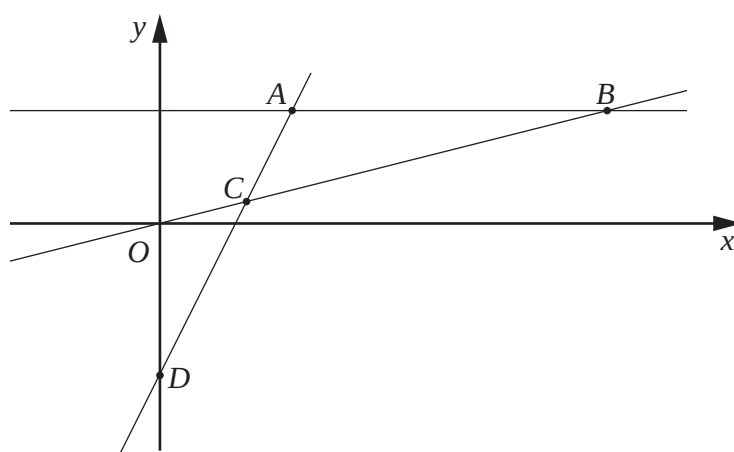
- (a) Calculate the area of trapezium  $ABCD$ .

Answer .....  $\text{cm}^2$  [1]

- (b) Calculate the **total** surface area of the prism.

Answer .....  $\text{cm}^2$  [2]

17



In the diagram,  $B$  is the point  $(8, 2)$ .

The equation of the line  $AB$  is  $y = 2$  and the equation of the line  $AC$  is  $2x - y = 3$ .  
 $BC$  produced passes through the origin.

- (a)  $AC$  produced intersects the  $y$ -axis at  $D$ .

Find the coordinates of  $D$ .

Answer (..... , ..... ) [1]

- (b) The region **inside** triangle  $ABC$  is defined by three inequalities.  
 One of these is  $y < 2$ .

Find the other two inequalities.

Answer .....

..... [2]

18 (a) Simplify  $(3a^4)^2$ .

Answer ..... [1]

(b) Evaluate  $\left(\frac{1}{4}\right)^{-2}$ .

Answer ..... [1]

(c) Given that  $x^3 = 27^0$ , find  $x$ .

Answer  $x =$  ..... [1]

(d) Evaluate  $\frac{12^{\frac{1}{2}}}{3^{\frac{3}{2}}}$ .

Answer ..... [1]

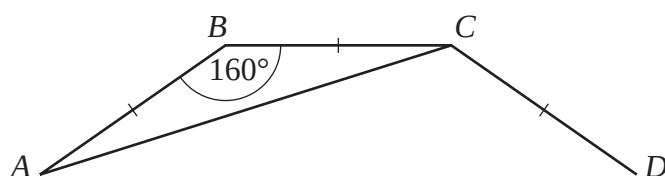
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19 A regular polygon has interior angles of  $160^\circ$ .

(a) Calculate the number of sides of the polygon.

Answer ..... [2]

(b)



The diagram shows three sides,  $AB$ ,  $BC$  and  $CD$ , of this polygon.

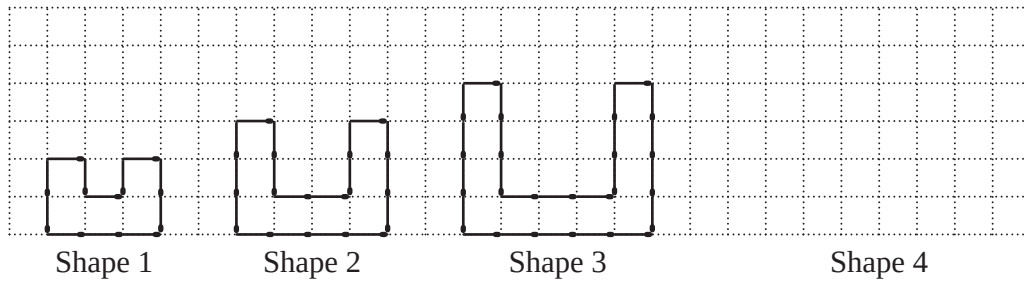
(i) Calculate  $\hat{BAC}$ .

Answer ..... [1]

(ii) Calculate  $\hat{ACD}$ .

Answer ..... [1]

20 A series of shapes, made of matchsticks, is shown below.



(a) Draw Shape 4. [1]

(b) The table shows the numbers of matchsticks used to make Shapes 1 and 2.

| Shape                 | 1  | 2  | 3 | 4 |
|-----------------------|----|----|---|---|
| Number of matchsticks | 12 | 18 |   |   |

Complete the table for Shapes 3 and 4. [1]

(c) Find an expression, in terms of  $n$ , for the number of matchsticks used to make Shape  $n$ .

Answer ..... [1]

(d) Explain why there is not a shape that is made of 100 matchsticks.

Answer .....  
 .....  
 ..... [1]

- 21 The time taken to fill a tank with water varies inversely as the area of cross-section of the pipe. The time taken is 40 minutes when the area is  $3 \text{ cm}^2$ .

(a) Find the number of minutes taken to fill the tank when the area is  $5 \text{ cm}^2$ .

Answer ..... [2]

(b) It is given that the area is  $A$  square centimetres.

Find the expression, in terms of  $A$ , for the number of minutes taken to fill the tank.

Answer ..... [1]

(c) Water flowed into the empty tank through a pipe of area  $4 \text{ cm}^2$ .  
It flowed for 9 minutes.

Find, in its simplest form, the fraction of the tank that now contained water.

Answer ..... [1]

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22  $\mathbf{A} = \begin{pmatrix} 5 & 2 \\ -1 & 1 \end{pmatrix}$

(a) Find the determinant of  $\mathbf{A}$ .

Answer ..... [1]

(b) Write down  $\mathbf{A}^{-1}$ .

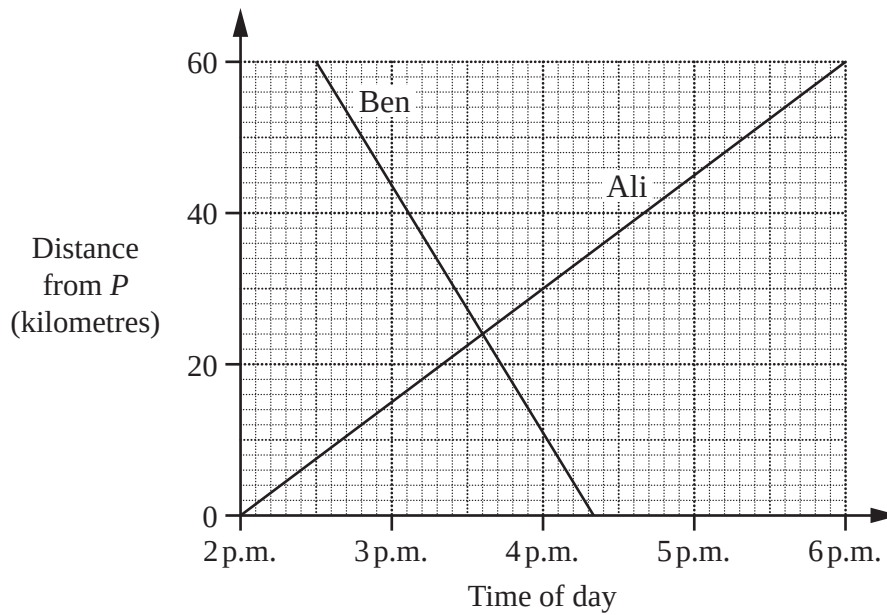
Answer ..... [1]

(c) Find the matrix  $\mathbf{X}$ , where  $\mathbf{AX} = \begin{pmatrix} 11 \\ -5 \end{pmatrix}$ .

Answer ..... [2]

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23



Ali and Ben each made a journey between two towns, P and Q, that are 60 km apart. These two journeys are shown on the travel graph.

- (a) Calculate Ali's speed.

Answer ..... km/h [1]

- (b) Find the number of minutes after 3 p.m. that Ali and Ben passed each other.

Answer ..... [1]

- (c) Find how far Ben had travelled when he met Ali.

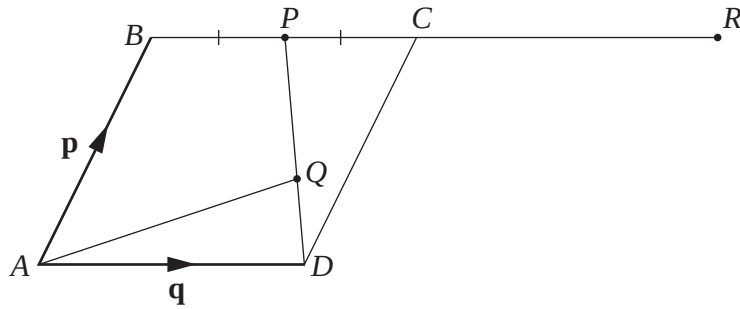
Answer ..... km [1]

- (d) Chris left P at 3 p.m. and travelled to Q at a speed of 30 km/h.

On the diagram, draw the graph that represents Chris's journey.

[1]

24



In the diagram,  $ABCD$  is a parallelogram.

$P$  is the midpoint of  $BC$ .

$DQ : QP = 1 : 2$ .

$\vec{AB} = \mathbf{p}$  and  $\vec{AD} = \mathbf{q}$ .

(a) Express  $\vec{DP}$  in terms of  $\mathbf{p}$  and  $\mathbf{q}$ .

Answer ..... [1]

(b) Express  $\vec{DQ}$  in terms of  $\mathbf{p}$  and  $\mathbf{q}$ .

Answer ..... [1]

(c) Express  $\vec{AQ}$  in terms of  $\mathbf{p}$  and  $\mathbf{q}$ , giving your answer in its simplest form.

Answer ..... [1]

(d)  $R$  is the point on  $BC$  produced such that  $\vec{BR} = k\vec{BP}$ .

(i) Express  $\vec{AR}$  in terms of  $\mathbf{p}$  and  $\mathbf{q}$  and  $k$ .

Answer ..... [1]

(ii) Given that  $A$ ,  $Q$  and  $R$  lie on a straight line, find the value of  $k$ .

Answer  $k =$  ..... [1]

25 The diagram below shows quadrilateral  $ABCD$ .

(a) Measure  $\hat{ABC}$ .

Answer  $\hat{ABC} = \dots\dots\dots$  [1]

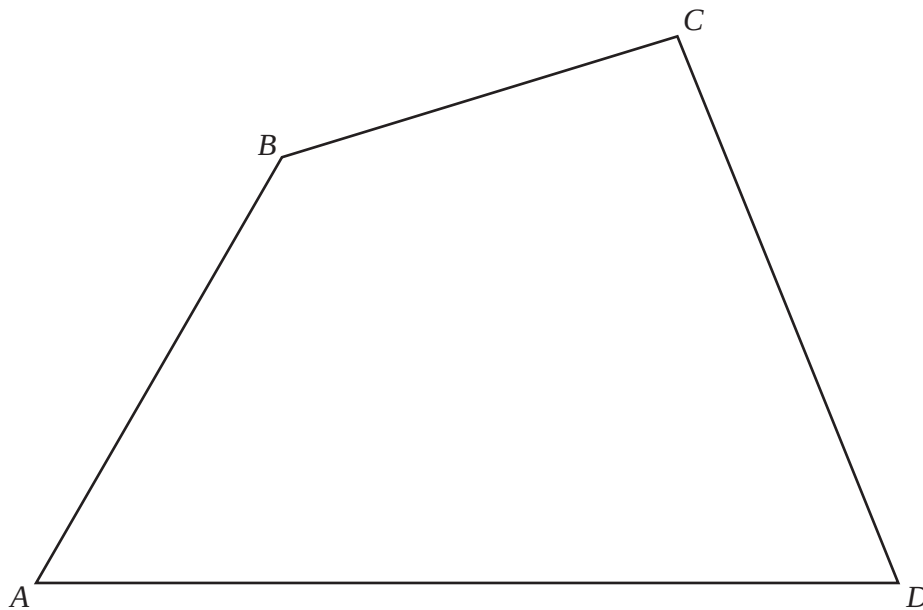
(b) On the diagram, construct the locus of points, **inside** the quadrilateral, that are

**I** 4 cm from  $AD$ ,

**II** equidistant from  $A$  and  $D$ . [2]

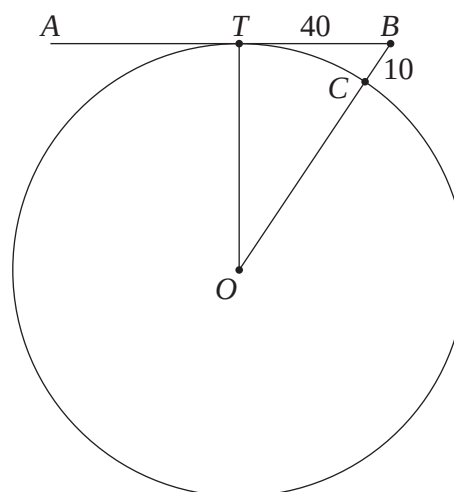
(c) On the diagram, shade the region **inside** the quadrilateral, containing the points that are more than 4 cm from  $AD$  and nearer to  $D$  than to  $A$ . [1]

(d) The point  $P$  is 4 cm from  $AD$  and as near as possible to  $C$ . Mark, and label, the position of  $P$  on the diagram. [1]



- 26 In the diagram,  $AB$  touches the circle, centre  $O$ , at  $T$ .

$OB$  intersects the circle at  $C$ .



- (a) State, with a reason, the value of  $\hat{BTO}$ .

Answer  $\hat{BTO} = \dots\dots\dots$  because  $\dots\dots\dots$

$\dots\dots\dots$  [1]

- (b) Given that  $TB = 40$  cm,  $CB = 10$  cm, and the radius of the circle is  $x$  centimetres, form an equation in  $x$ , and hence find the radius of the circle.

Answer  $\dots\dots\dots$  cm [4]