



UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS  
General Certificate of Education Ordinary Level

CANDIDATE  
NAME

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**MATHEMATICS (SYLLABUS D)**

**4024/12**

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.

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



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

1 (a) Evaluate  $2\frac{3}{4} - 1\frac{7}{9}$ .

Answer ..... [1]

(b) Evaluate  $0.7 - 0.1 \times 3$ .

Answer ..... [1]

---

2 (a) Ali and Ben share \$30 such that Ali's share : Ben's share = 3 : 2.

Calculate Ali's share.

Answer \$ ..... [1]

(b) Write the following times in order of size, starting with the smallest.

6 500 seconds      110 minutes       $1\frac{3}{4}$  hours

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

---

3 Exactly 9 litres of liquid filled 60 identical bottles.

(a) How many litres filled 40 of these bottles?

*Answer* ..... [1]

(b) How many of these bottles are filled using 750 ml of liquid?

*Answer* ..... [1]

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4 It is given that  $f(x) = \frac{3+x}{2}$ .

(a) Find  $f(-3)$ .

*Answer* ..... [1]

(b) Find  $f^{-1}(x)$ .

*Answer*  $f^{-1}(x) =$  ..... [1]

---

- 5 (a) Express the number 0.000 042 in standard form.

Answer ..... [1]

- (b) Calculate  $(7 \times 10^{-3}) \times (3 \times 10^9)$ , giving your answer in standard form.

Answer ..... [1]

---

- 6 (a) Solve the inequality  $2(4 - x) < x - 10$ .

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

- (b) Find the smallest integer  $n$  such that  $3n > -17$ .

Answer  $n =$  ..... [1]

---

- 7 (a) Evaluate  $4^0 - 4^{-2}$ .

Answer ..... [1]

- (b) Simplify  $(2x^2)^3$ .

Answer ..... [1]

---

- 8 The first four terms of a sequence are 55, 53, 49, 41.  
The  $n$ th term of this sequence is  $57 - 2^n$ .

(a) Calculate the fifth term.

*Answer* ..... [1]

(b) **Write down** the  $n$ th term of the sequence 56, 55, 52, 45 ... .

*Answer* ..... [1]

---

- 9 Each interior angle of a regular polygon is  $p$  times each exterior angle.

Find an expression, in terms of  $p$ , for

(a) an exterior angle,

*Answer* ..... [1]

(b) the number of sides of the polygon.

*Answer* ..... [1]

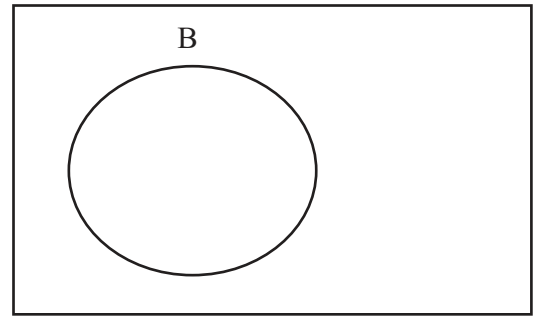
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- 10 The Venn diagram shows the Universal set and the set B.  
A and C are two sets such that

$$A \cup B = B, \quad A \cap B \neq B, \quad A \cap C = \emptyset \quad \text{and} \quad B \cap C \neq \emptyset.$$

Draw the sets A and C in the Venn diagram.

⊆



[2]

- 11 By writing each number correct to two significant figures, estimate, correct to one significant figure, the value of

$$\sqrt{110.94 - 0.2034 \times 368.62} .$$

Answer ..... [2]

- 12 The length of a rectangle is 8 cm.  
It is increased by 150%.

Calculate the new length.

Answer ..... cm [2]

- 13**  $y$  is inversely proportional to  $x$ .  
The table shows some values of  $x$  and  $y$ .

$x$	3	4	$q$	$n$
$y$	20	$p$	5	$m$

- (a) Find  $p$ .

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

- (b) Find  $q$ .

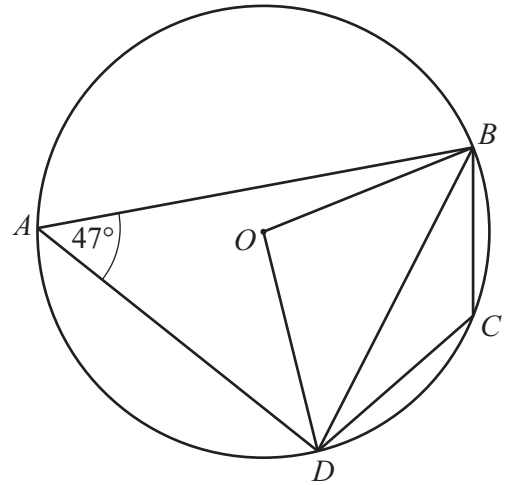
*Answer*  $q = \dots\dots\dots$  [1]

- (c) Express  $m$  in terms of  $n$ .

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

- 14 In the diagram, the points  $A, B, C$  and  $D$  lie on the circle, centre  $O$ .

$$\hat{BAD} = 47^\circ.$$



Find

(a)  $\hat{BOD}$ ,

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

(b)  $\hat{BCD}$ ,

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

(c)  $\hat{OBD}$ .

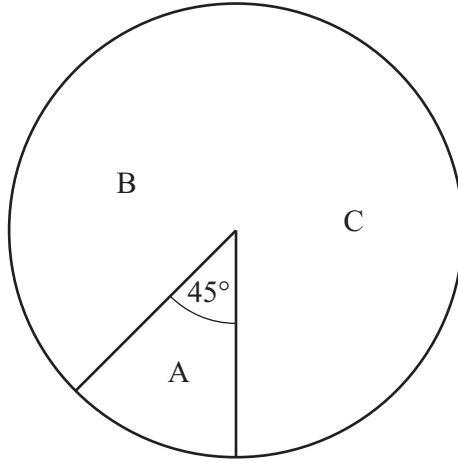
Answer  $\hat{OBD} = \dots\dots\dots [1]$



15 In a survey, some people were asked which of three songs, labelled A, B and C, they liked best. The diagram shows part of a pie chart illustrating the results. The angle of the sector that represents the people who liked C best is  $168^\circ$ .

(a) Complete the pie chart.

[1]



(b) Expressing your answer in its lowest terms, find the fraction of people in the survey who liked C best.

Answer ..... [1]

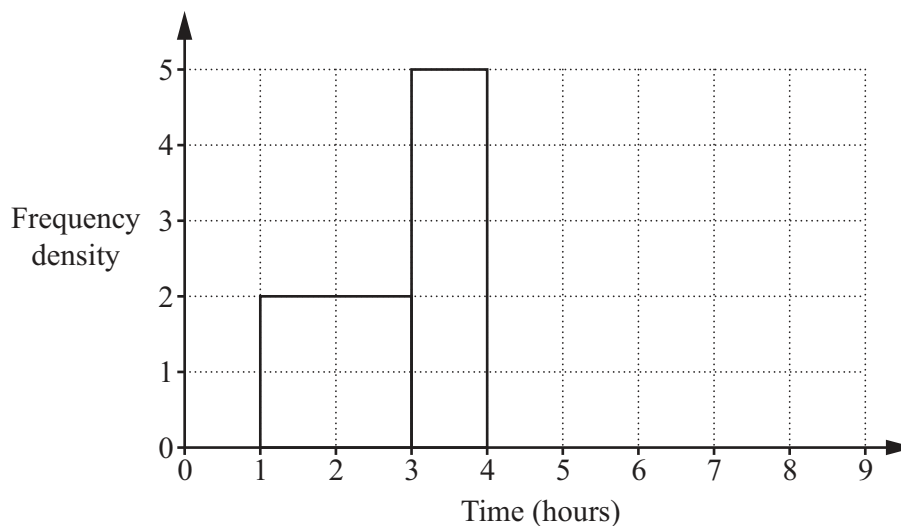
(c) Given that 30 people liked A best, calculate the number of people in the survey.

Answer ..... [1]

- 16 The distribution of the lengths of time taken by an engineer to repair some washing machines is given in the table.

Time ( $t$ hours)	$1 < t \leq 3$	$3 < t \leq 4$	$4 < t \leq 5$	$5 < t \leq 8$
Frequency	$k$	5	4	3

The histogram represents some of this information.



- (a) Find  $k$ .

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

- (b) Complete the histogram.

[2]

- 17 The length of a side of a square is given as 57 mm, correct to the nearest millimetre.

- (a) Write down the upper bound for the length of a side.

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

- (b) Giving your answer in **centimetres**, calculate the upper bound for the perimeter of the square.

*Answer*  $\dots\dots\dots$  cm [2]

18 Renata went on a journey that took  $7\frac{1}{2}$  hours.

(a) The journey started at 22 48 on Monday.

At what time on Tuesday did it finish?

*Answer* ..... [1]

(b) In the first part of the journey Renata travelled 150 km in 5 hours.  
She travelled at an average speed of 20 km/h for the rest of the journey.

Calculate her average speed for the whole journey.

*Answer* ..... km/h [2]

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19 Solve the simultaneous equations.

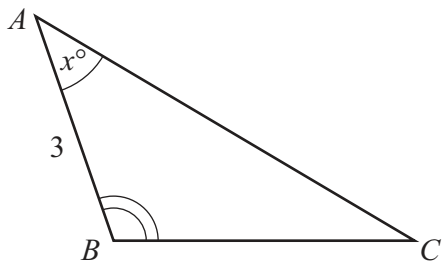
$$\begin{aligned} 2x + 3y &= 0 \\ x + 4y &= -15 \end{aligned}$$

*Answer*  $x =$  .....

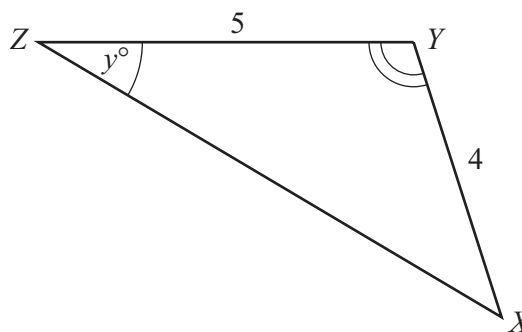
$y =$  ..... [3]

---

20



12



The triangles  $ABC$  and  $XYZ$  are similar and  $\hat{A}BC = \hat{X}YZ$ .

$\hat{B}AC = x^\circ$ ,  $\hat{Y}ZX = y^\circ$  where  $x \neq y$ .  
 $AB = 3$  cm,  $XY = 4$  cm and  $YZ = 5$  cm.

(a) Express  $\hat{A}BC$  in terms of  $x$  and  $y$ .

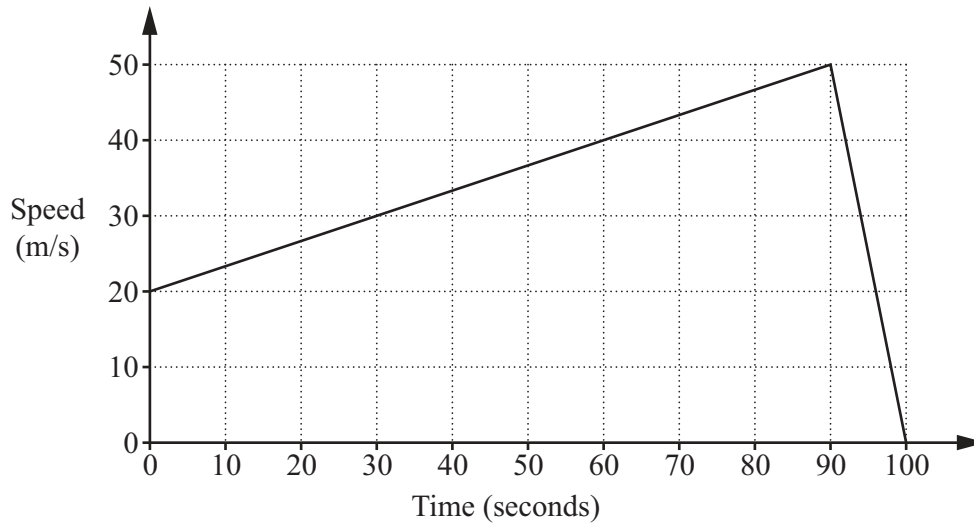
Answer  $\hat{A}BC = \dots\dots\dots$  [1]

(b) Find  $BC$ .

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

(c) Write down the value of  $\frac{\text{area of triangle } ABC}{\text{area of triangle } XYZ}$ .

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



The diagram is the speed-time graph of the last 100 seconds of a train's journey.

(a) Calculate the train's retardation during the last 10 seconds of the journey.

*Answer* ..... m/s<sup>2</sup> [1]

(b) Calculate the distance travelled in the 100 seconds.

*Answer* ..... m [2]

$$22 \quad \mathbf{A} = \begin{pmatrix} 4 & -2 \\ -1 & 1 \end{pmatrix} \quad \mathbf{B} = \begin{pmatrix} -3 & 2 \\ -1 & 4 \end{pmatrix}$$

(a) Find  $2\mathbf{A} - \mathbf{B}$ .

*Answer*  $\left( \begin{array}{cc} & \\ & \end{array} \right)$  [2]

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

*Answer*  $\left( \begin{array}{cc} & \\ & \end{array} \right)$  [2]

---

23 (a) Factorise  $9x^2 - 1$ .

*Answer* ..... [1]

(b) Solve the equation  $2y^2 + 29y - 15 = 0$ .

*Answer*  $y = \dots\dots\dots$  or  $\dots\dots\dots$  [3]

---

24 The table shows the number of goals scored by 40 football teams during one weekend.

Number of goals	0	1	2	3	4	5	6
Number of teams	16	6	6	6	4	0	2

Find

(a) the mode,

*Answer* ..... [1]

(b) the median,

*Answer* ..... [1]

(c) the mean.

*Answer* ..... [2]

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25 The diagram shows the graphs of

$$x + y = 12\frac{1}{2},$$

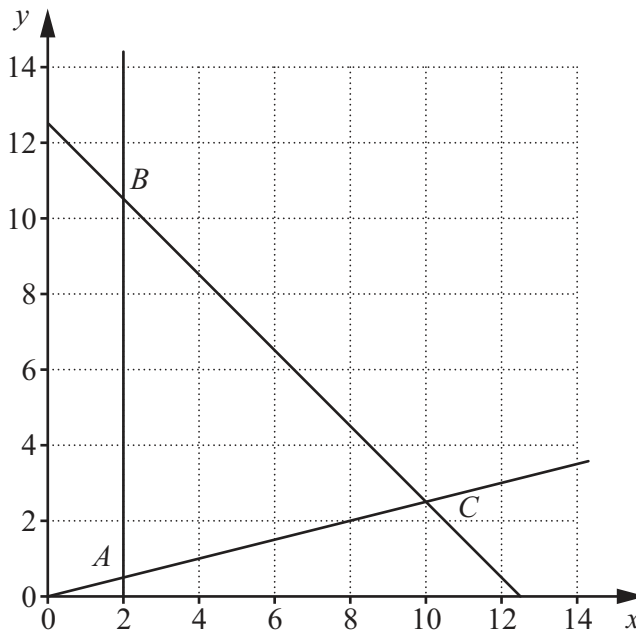
$$y = \frac{x}{4} \text{ and}$$

$$x = 2.$$

These graphs intersect to form triangle  $ABC$ .

The region **inside** triangle  $ABC$  is defined by three inequalities.

One of these is  $y > \frac{x}{4}$ .



(a) Write down the other two inequalities.

Answer .....  
 ..... [2]

(b)  $P = \{(x, y) : x \text{ and } y \text{ are integers, } (x, y) \text{ lies inside triangle } ABC\}$   
 $Q = \{(7, y) : y \text{ is an integer}\}$

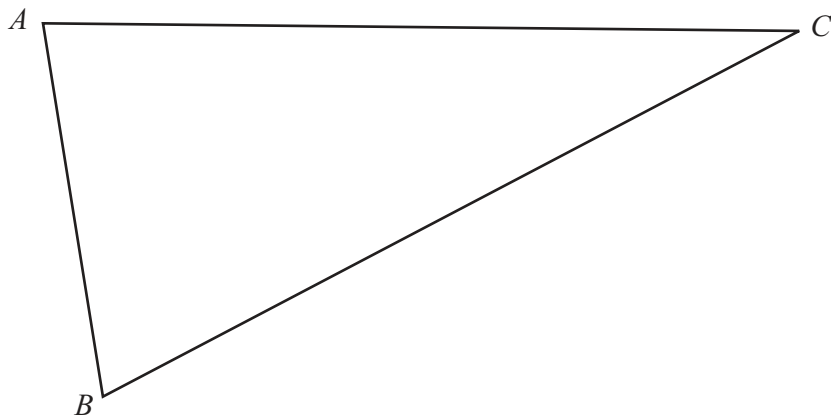
(i) Find the member of the set  $P$  that is closest to the point  $C$ .

Answer ..... [1]

(ii) Find  $n(P \cap Q)$ .

Answer ..... [1]

26 The diagram below shows triangle  $ABC$ .



- (a) The point  $D$  is on the opposite side of  $AC$  to  $B$ .  
 $AD = 6$  cm and  $CD = 8$  cm.

Construct triangle  $ADC$ .

[1]

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

(i) 2.5 cm from  $AC$ ,

[1]

(ii) equidistant from  $AB$  and  $BC$ .

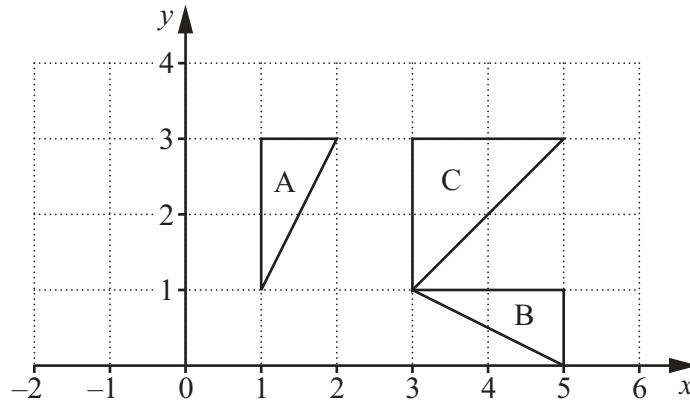
[1]

- (c) The points  $P$  and  $Q$  are 2.5 cm from  $AC$  and equidistant from  $AB$  and  $BC$ .

Mark and label  $P$  and  $Q$ .

Measure  $PQ$ .

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



The diagram shows triangles A, B and C.

(a) Triangle A is mapped onto triangle B by an **anticlockwise** rotation.

(i) Write down the angle of rotation.

Answer ..... [1]

(ii) Find the coordinates of the centre of rotation.

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

(b) Triangle A is mapped onto triangle C by a stretch.

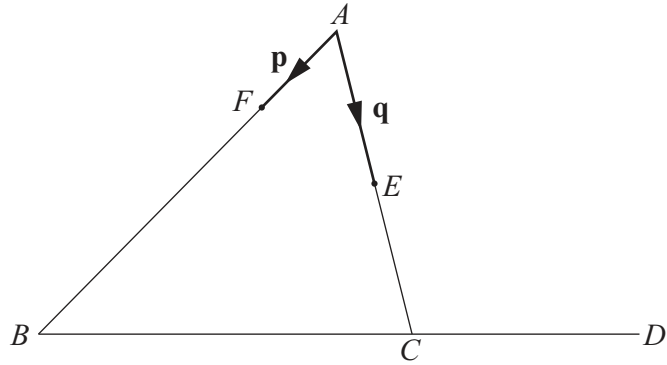
(i) Write down the scale factor.

Answer ..... [1]

(ii) Write down the equation of the invariant line.

Answer ..... [1]

**Question 28 is printed on the following page.**



In the diagram,  $F$  is the point on  $AB$  where  $AF = \frac{1}{4} AB$ .  
 $E$  is the midpoint of  $AC$ .  
 $\vec{AF} = \mathbf{p}$  and  $\vec{AE} = \mathbf{q}$ .

(a) Express, in terms of  $\mathbf{p}$  and  $\mathbf{q}$ ,

(i)  $\vec{FE}$ ,

Answer ..... [1]

(ii)  $\vec{BC}$ .

Answer ..... [1]

(b)  $D$  is the point on  $BC$  produced such that  $BD = kBC$ .

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

Answer ..... [1]

(ii) Given that  $F$ ,  $E$  and  $D$  are collinear, find the value of  $k$ .

Answer  $k =$  ..... [2]

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