UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education Ordinary Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

**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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**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*

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**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]

---

**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]

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**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 $56, 55, 52, 45 \ldots$ .

*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]

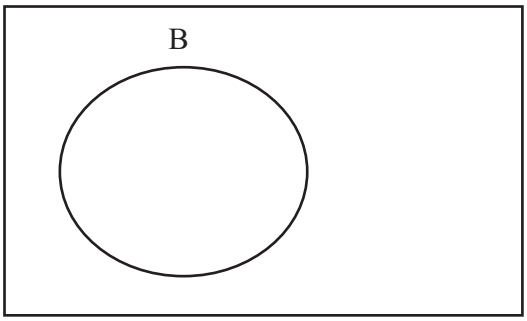
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**10** The Venn diagram shows the Universal set and the set B.
A and C are two sets such that

$$A \cup B = B, \qquad A \cap B \neq B, \qquad A \cap C = \varnothing \qquad \text{and} \qquad B \cap C \neq \varnothing.$$

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* $p =$ ..... [1]

**(b)** Find $q$.

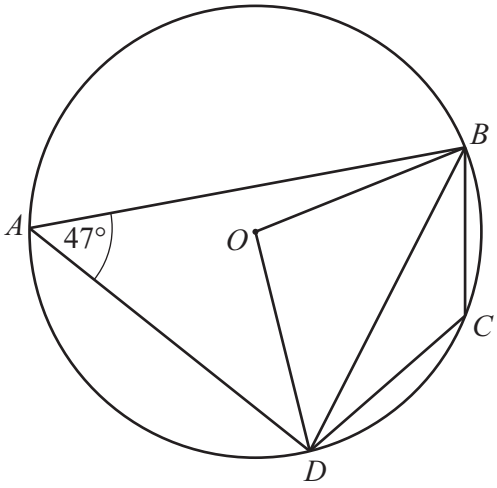
*Answer* $q =$ ..... [1]

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

*Answer* $m =$ ..... [1]

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

$B\hat{A}D = 47°$.




Find

**(a)** $B\hat{O}D$,

*Answer* $B\hat{O}D =$ ..... [1]

**(b)** $B\hat{C}D$,

*Answer* $B\hat{C}D =$ ..... [1]

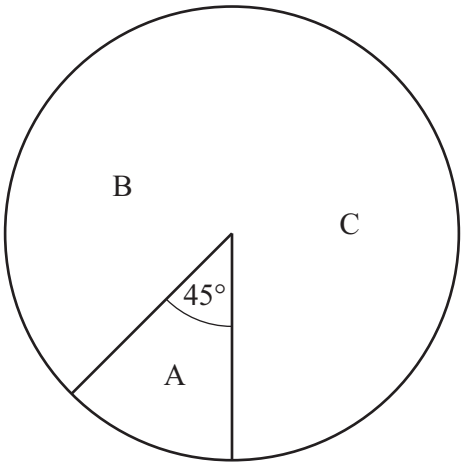
**(c)** $O\hat{B}D$.

*Answer* $O\hat{B}D =$ ..... [1]

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**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°.

**(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]

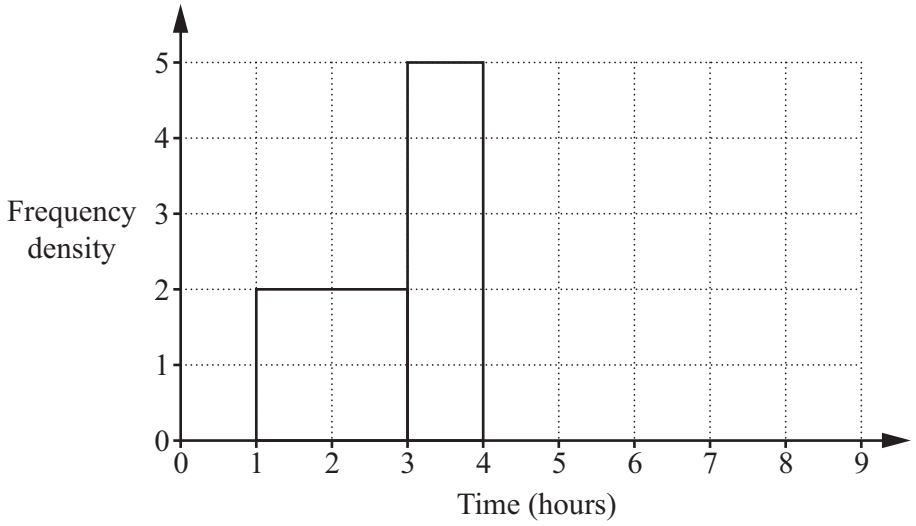
**(c)** Given that 30 people liked A best, calculate the number of people in the survey.

*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) | $1 < t \leqslant 3$ | $3 < t \leqslant 4$ | $4 < t \leqslant 5$ | $5 < t \leqslant 8$ |
|---|---|---|---|---|
| Frequency | $k$ | 5 | 4 | 3 |

The histogram represents some of this information.




**(a)** Find $k$.

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

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

*Answer* ..... cm [2]

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**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.

$$2x + 3y = 0$$
$$x + 4y = -15$$

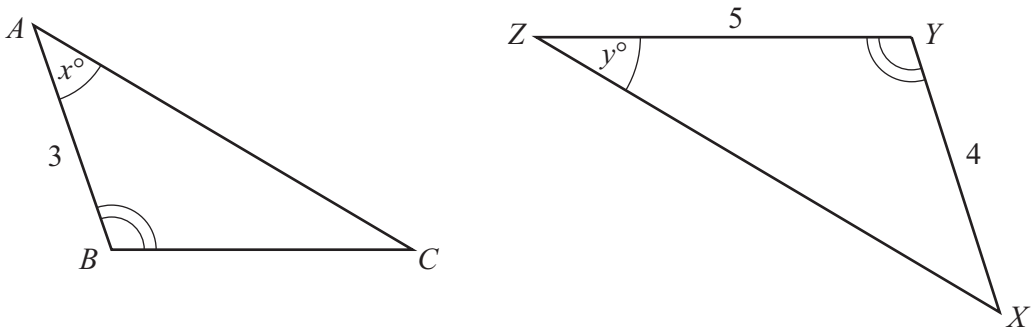
*Answer* $x =$ .....

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

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**20**




The triangles $ABC$ and $XYZ$ are similar and $A\hat{B}C = X\hat{Y}Z$.

$B\hat{A}C = x°$, $Y\hat{Z}X = y°$ where $x \neq y$.
$AB = 3\,\text{cm}$, $XY = 4\,\text{cm}$ and $YZ = 5\,\text{cm}$.

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

*Answer* $A\hat{B}C =$ ..... [1]

**(b)** Find $BC$.

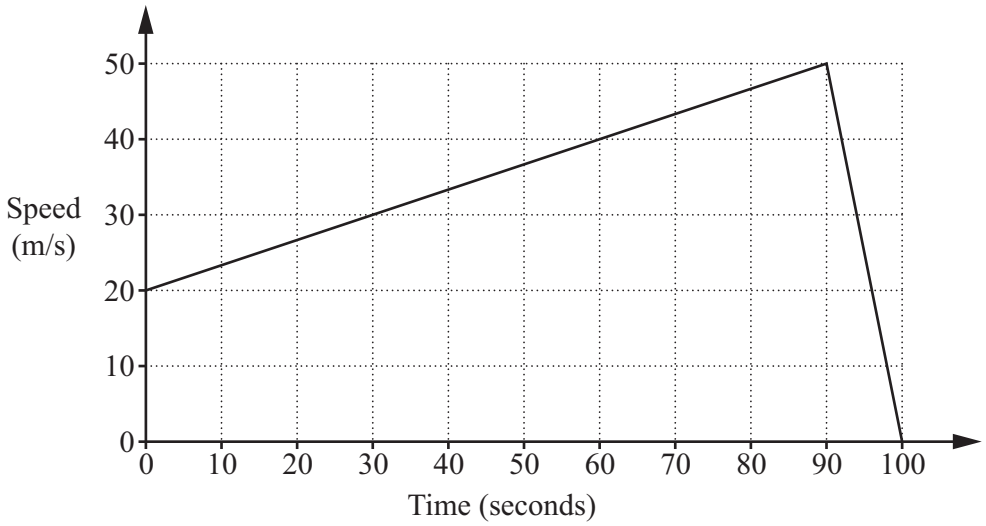
*Answer* $BC =$ ..... cm [1]

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

*Answer* ..... [1]

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**21**




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* ..... $m/s^2$ [1]

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

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

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

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

*Answer* $\begin{pmatrix} & \\ & \end{pmatrix}$ [2]

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

*Answer* $\begin{pmatrix} & \\ & \end{pmatrix}$ [2]

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

*Answer* ..... [1]

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

*Answer* $y =$ ..... or ..... [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

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

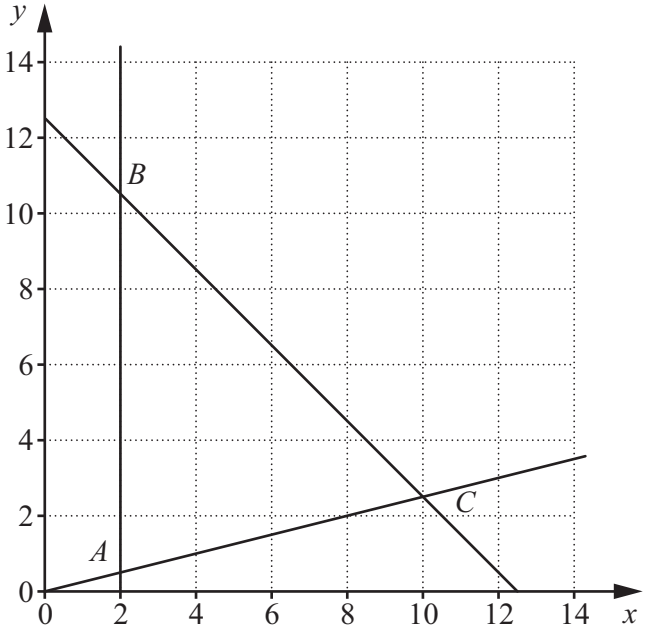
$y = \frac{x}{4}$ and

$x = 2$.

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

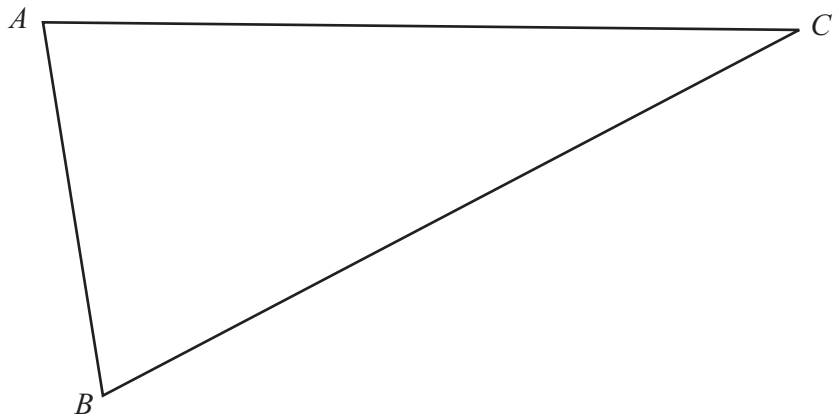
**(i)** Find the member of the set P that is closest to the point $C$.

*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 $BC$.

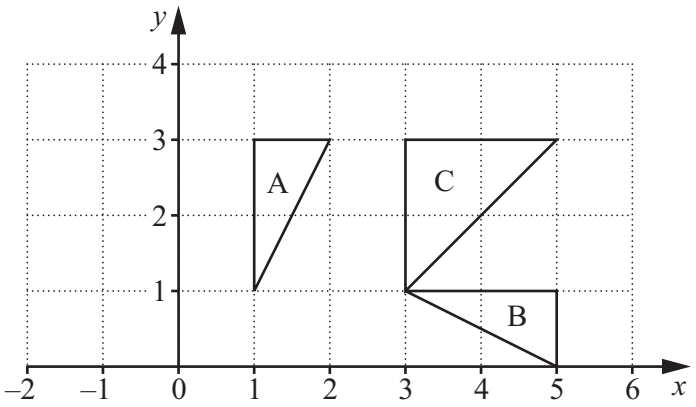
Mark and label $P$ and $Q$ .

Measure $PQ$.

*Answer* $PQ =$ ..... cm [1]

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**27**




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]

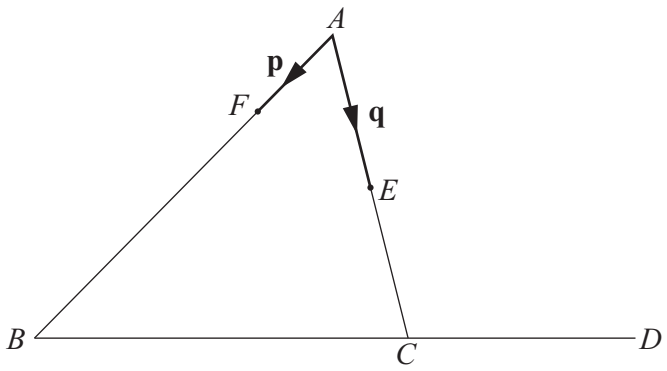
**(ii)** Write down the equation of the invariant line.

*Answer* ..... [1]

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

**28**




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

**(a)** Express, in terms of **p** and **q**,

**(i)** $\overrightarrow{FE}$ ,

*Answer* ..... [1]

**(ii)** $\overrightarrow{BC}$.

*Answer* ..... [1]

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

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

*Answer* ..... [1]

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

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

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