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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International Examinations

[Turn over

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 $f(x) = \dfrac{3 + x}{2}$.

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

Answer .... [1]

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

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

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

Answer ....

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

Answer .... [1]

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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 nth term of this sequence is $57 - 2^n$.

(a) Calculate the fifth term.

Answer .... [1]

(b) **Write down** the nth 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]

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.

$\mathscr{E}$

B
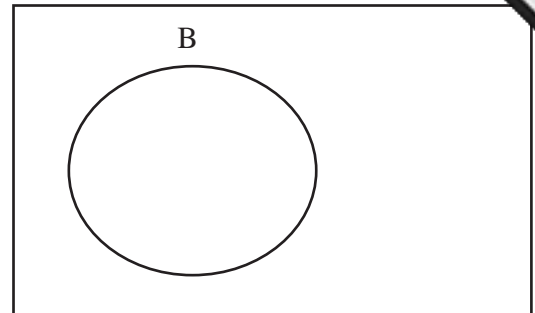
[2]

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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.

$B\hat{A}D = 47°$.
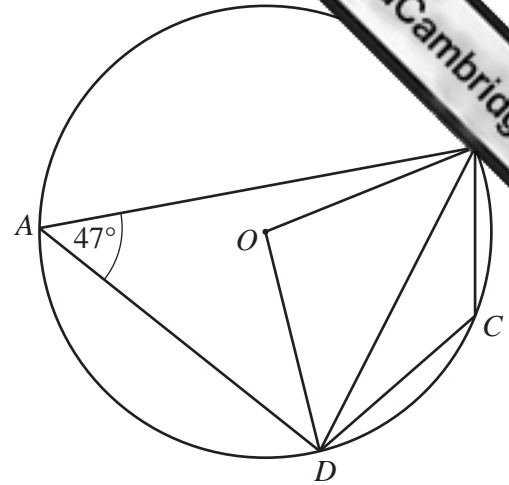
Find

(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]

15 In a survey, some people were asked which of three songs, labelled A, B and C, they liked.
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.
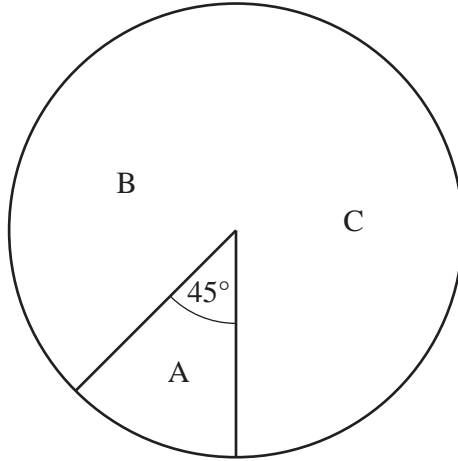
(b) Expressing your answer in its lowest terms, find the fraction of people in the survey who liked C best.

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 mach[...] 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.
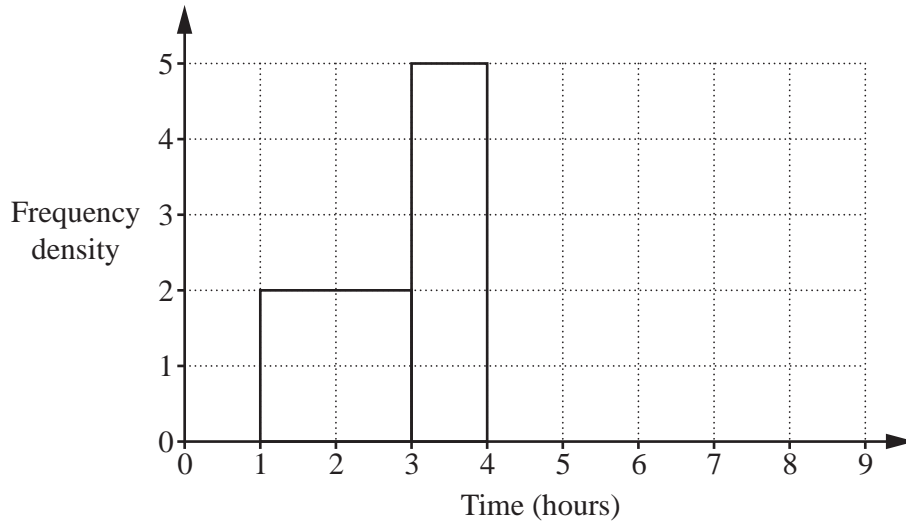
(a) Find *k*.

Answer *k* = ... [1]

(b) Complete the histogram. [2]

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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]

---

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]

20
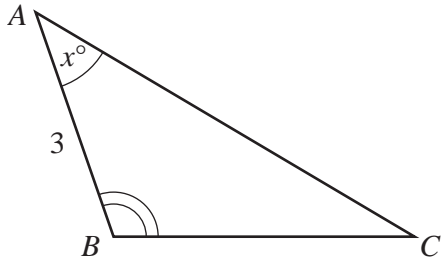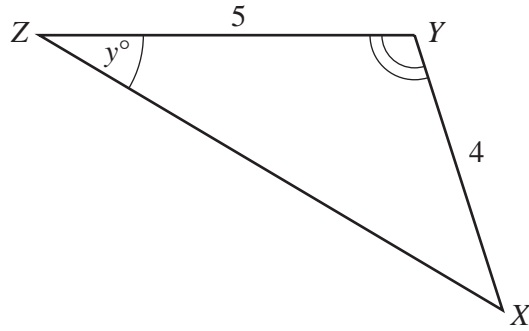
The triangles *ABC* and *XYZ* are similar and $A\hat{B}C = X\hat{Y}Z$.

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

21
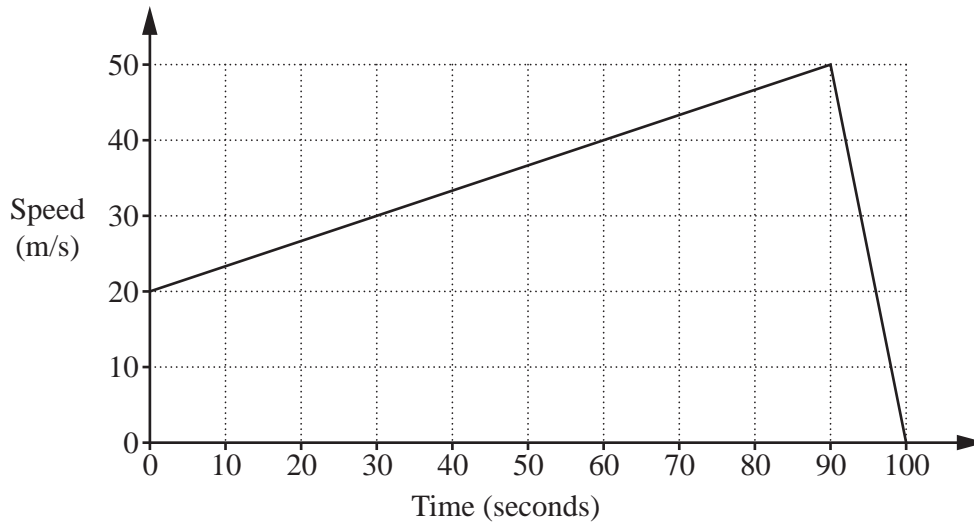
The diagram is the speed-time graph of the last 100 seconds of a train's journey.

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

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

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

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

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

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]

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 $y > \frac{x}{4}$.
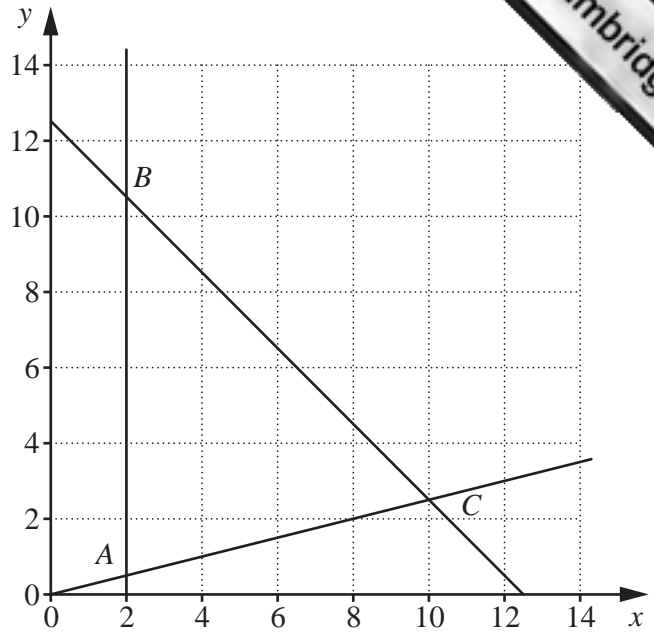
(a) Write down the other two inequalities.

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 ∩ Q) .

Answer .... [1]

26 The diagram below shows triangle *ABC*.

A ——————————————————— *C*

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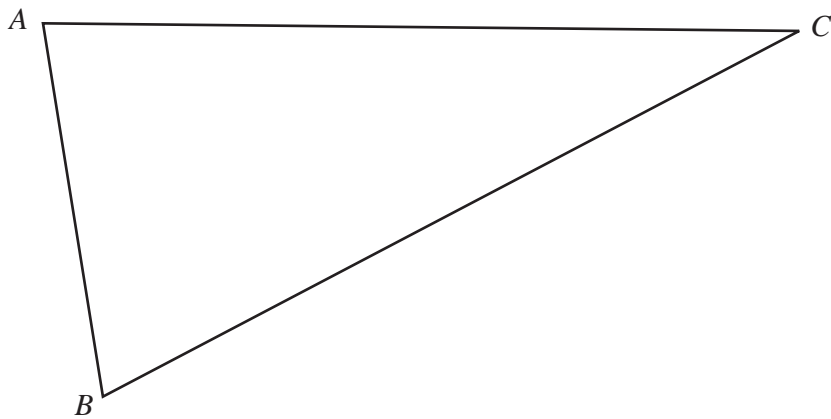
(a) The point *D* is on the opposite side of *AC* to *B*.
AD = 6 cm and CD = 8 cm.

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]
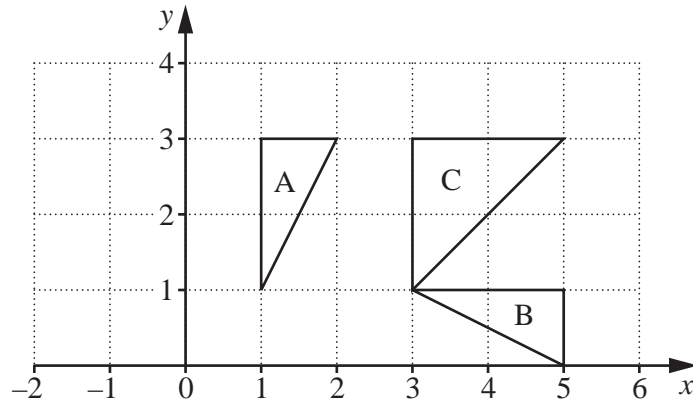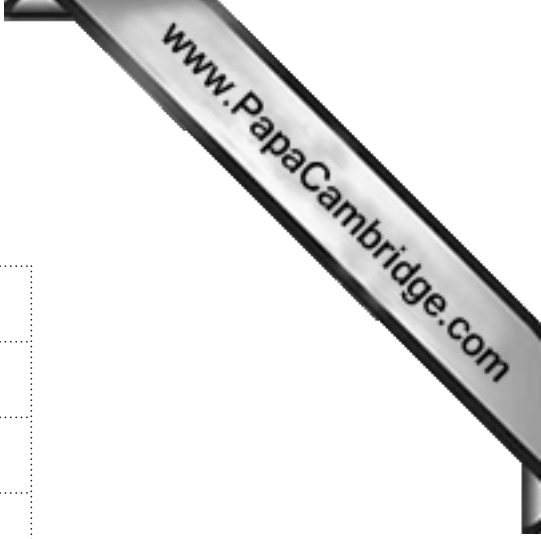
   (ii) equidistant from *AB* and *BC*. [1]

(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]

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]

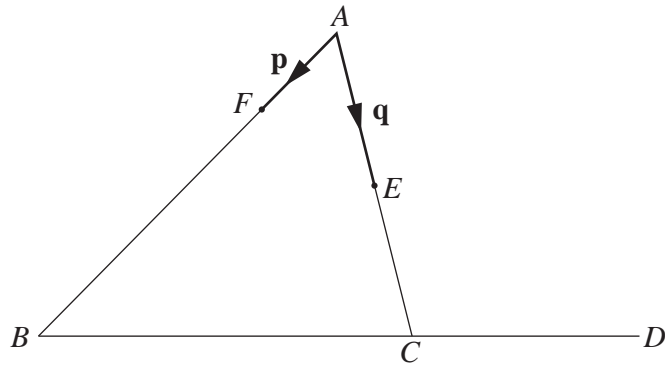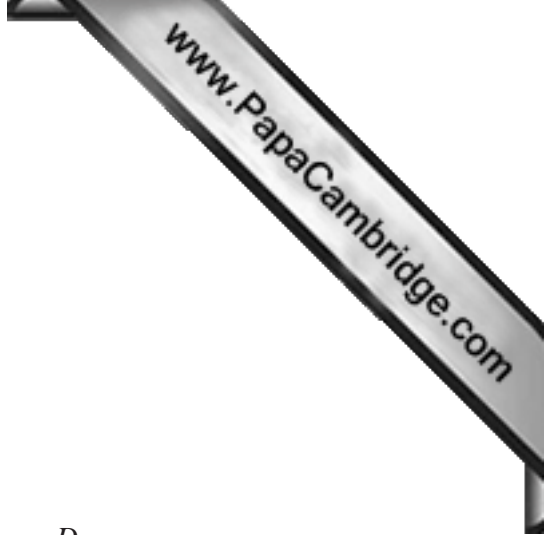**(b)** Triangle A is mapped onto triangle C by a stretch.

  (i) Write down the scale factor.

  Answer .... [1]

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

  Answer .... [1]

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 $\mathbf{p}$ and $\mathbf{q}$,

(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, $\mathbf{p}$ and $\mathbf{q}$.

Answer .... [1]

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

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