Cambridge
O Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

MATHEMATICS (SYLLABUS D) **4024/12**

Paper 1 **October/November 2014**

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, 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.

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

Cambridge
International Examinations

[Turn over

ELECTRONIC CALCULATORS MUST NOT BE USED IN THIS PAPER

1 Mavis went to a café to meet some friends.

   (a) She bought 3 drinks at $1.42 each and 1 cake for 85 cents.

   How much did she spend altogether?

   Answer $ .... [1]

   (b) She left home at 10.45 a.m. and returned at 1.20 p.m.

   How long, in hours and minutes, was she away from home?

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

2 A cookery book states that the time it takes to cook some meat is

   13 minutes for every 500 grams of meat + 20 minutes.

   (a) Calculate the number of minutes it takes to cook 1.5 kg of meat.

   Answer .... [1]

   (b) It takes *T* minutes to cook *M* grams of meat.

   Find a formula for *T*.

   Answer .... [1]

3 In an experiment, a red die and a blue die were thrown 10 times.
Each time, the score on the red die was subtracted from the score on the blue die.
The results are given below.

$$5 \quad -4 \quad -3 \quad 4 \quad 0 \quad 2 \quad -1 \quad -3 \quad 3 \quad -2$$

For these results, find

(a) the median,

Answer .... [1]

(b) the mean.

Answer .... [1]

4 $$f(x) = 2(x - 3)$$

(a) Evaluate $f\left(\frac{1}{2}\right)$.

Answer .... [1]

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

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

5 **(a)** Write the value of 1234.567, correct to 2 significant figures.

Answer .... [1]

(b) **Write down** an estimate for the value of $\sqrt{\dfrac{28}{\pi}}$.

Answer .... [1]

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6 **(a)** On the Venn diagram, shade the set $C' \cap (A \cup B)$.

[1]
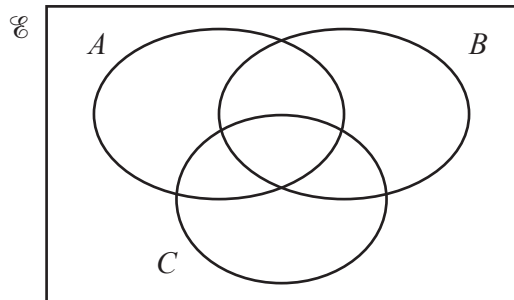
(b) $\mathscr{E} = \{ -1, 0, 1, 2, 3, 4, 5, 6 \}$

$P = \{ -1, 0, 1, 2 \}$

$Q = \{ x^2 : x \in P \}$

Find n(Q).

Answer .... [1]

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7 A car travels at 90 km/h.

How many metres does it travel in 1 second?

Answer .... [2]

8 Two bottles are geometrically similar.
The ratio of the areas of their bases is 1 : 4.

Write down the ratios of their

(a) heights,

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

(b) volumes.

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

9 The time taken to run a race is given as 54.3 seconds, correct to the nearest 0.1 of a second.

(a) Find the lower bound for the time taken.

Answer .... s [1]

(b) The distance run is given as *d* metres, correct to the nearest metre.

Write down an expression, in terms of *d*, for the maximum possible average speed, in metres per second.

Answer .... m/s [1]

10 *y* is inversely proportional to *x*.

Given that *y* = 9 when *x* = 8, find *y* when *x* = 6.

Answer *y* = ... [2]

11 The sequence of diagrams below shows small black and small white squares in an arrangement to form large squares.

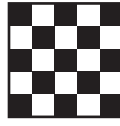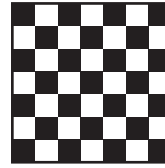Diagram 1   Diagram 2   Diagram 3

The table below shows the numbers of black and white squares in each diagram.

Diagram (n)	1	2	3	4
Black squares	5	13	25	
White squares	4	12	24	
Total number of black and white squares	9	25	49	

(a) For each diagram, how many more black squares are there than white squares?

Answer .... [1]

(b) On the table, complete the column for Diagram 4. [1]

(c) Write down an expression, in terms of n, for the total number of black and white squares in Diagram n.
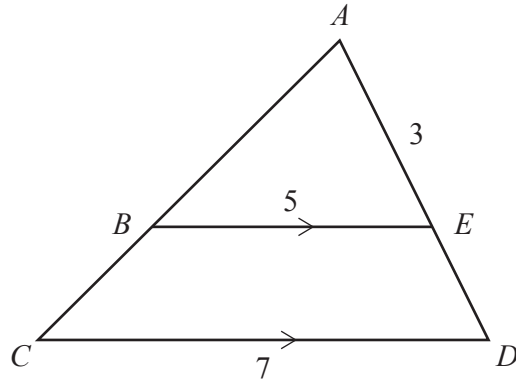
Answer .... [1]

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12 (a) Write the number 0.000 567 in standard form.

Answer .... [1]

(b) Giving your answer in standard form, evaluate $\dfrac{3 \times 10^{-5}}{5 \times 10^{6}}$.

Answer .... [2]

13

In the diagram, $BE = 5$ cm, $CD = 7$ cm and $AE = 3$ cm.

BE is parallel to CD.

(a) Express CD as a percentage of BE.

Answer .... % [1]

(b) Find ED.

Answer .... cm [2]

14
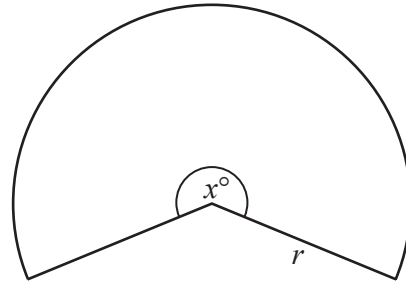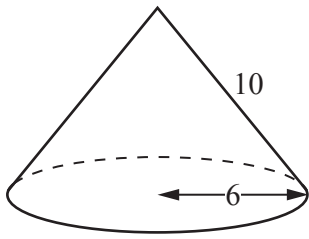
A hollow cone has a base radius 6 cm and slant height 10 cm.
The curved surface of the cone is cut, and opened out into the shape of a sector of a circle, with angle
$x°$ and radius r cm.

(a) Write down the value of r.

Answer r = ... [1]

(b) Calculate x.

Answer x = ... [2]

15 [**The volume of a sphere is** $\frac{4}{3}\pi r^3$]

20 spheres, each of radius 3 cm, have a total volume of $k\pi$ cm^3.

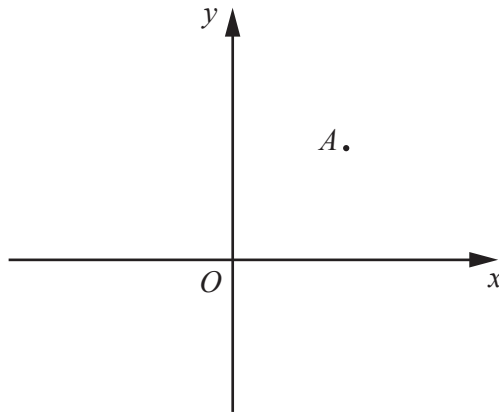**(a)** Find the value of k.

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

(b) The spheres are inside an open cylinder, with radius 6 cm.
The cylinder stands on a horizontal surface and contains enough water to cover the spheres.

Calculate the change in depth of the water when the spheres are taken out of the cylinder.

Answer   .... cm [2]

16

A is the point (5, 5) $\overrightarrow{AB} = \begin{pmatrix} 4 \\ -3 \end{pmatrix}$

(a) AB is mapped onto CD by a reflection in the y-axis.

Find $\overrightarrow{CD}$.

Answer   .... [1]

(b) AB is mapped onto AE by a rotation, centre A, through an angle of 90° clockwise.

Find $\overrightarrow{AE}$.

Answer   .... [1]

(c) Find $\left|\overrightarrow{AB}\right|$.

Answer   .... [1]

         [Turn over

17 (a) Simplify $p^2(p^3 - 3p^{-2})$.

Answer .... [2]

(b) Simplify $(27x^6)^{\frac{1}{3}}$.

Answer .... [2]

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18 (a) Factorise completely $4a - 16a^2$.

Answer .... [1]

(b) Factorise $9b^2 - c^2$.

Answer .... [1]

(c) Factorise $x^2 - 5y - xy + 5x$.

Answer .... [2]

19
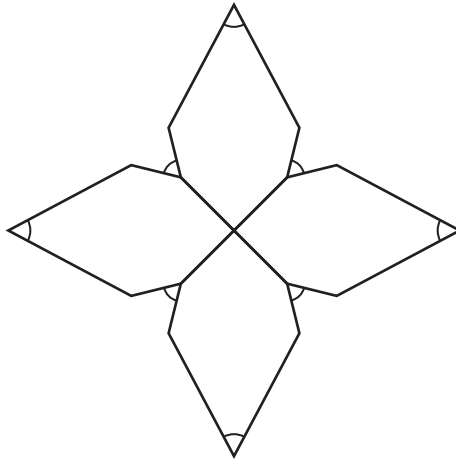
The diagram shows a figure made from four identical hexagons.

It has both line and rotational symmetry.

(a) What is the order of the rotational symmetry?

Answer .... [1]

(b) Each marked angle is 60°.

Find the other angles in one of the hexagons.

Answer .... , ... , ... , ... , ... [3]

 [Turn over

20
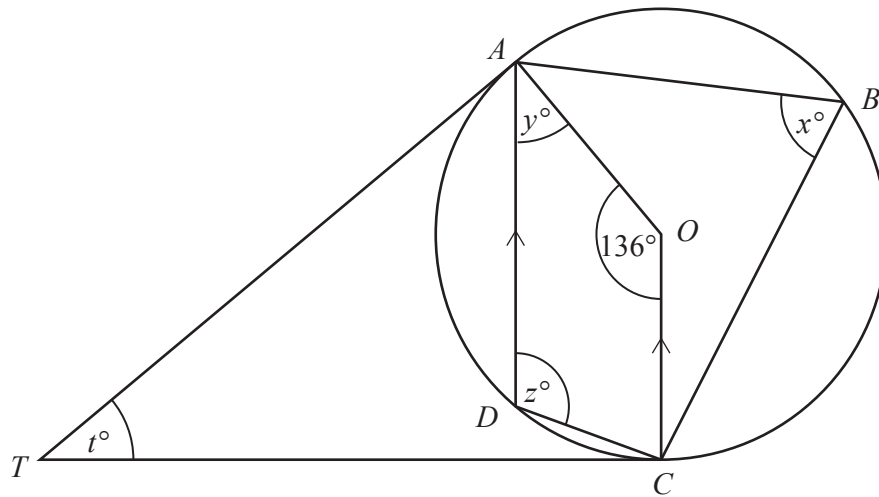
In the diagram, *A*, *B*, *C* and *D* lie on the circle, centre *O*.
CO is parallel to *DA*.
The tangents to the circle at *A* and *C* meet at *T*.

$A\hat{O}C = 136°$.

(a) Find *x*.

Answer *x* = ... [1]

(b) Find *y*.

Answer *y* = ... [1]

(c) Find *z*.

Answer *z* = ... [1]

(d) Find *t*.

Answer *t* = ... [1]

21 A bag contains 5 balls, 2 of which are blue and 3 are red.
One ball is taken, at random, from the bag.
If it is red it is put back into the bag.
If it is blue it is **not** put back into the bag.

A second ball is taken, at random, from the bag.
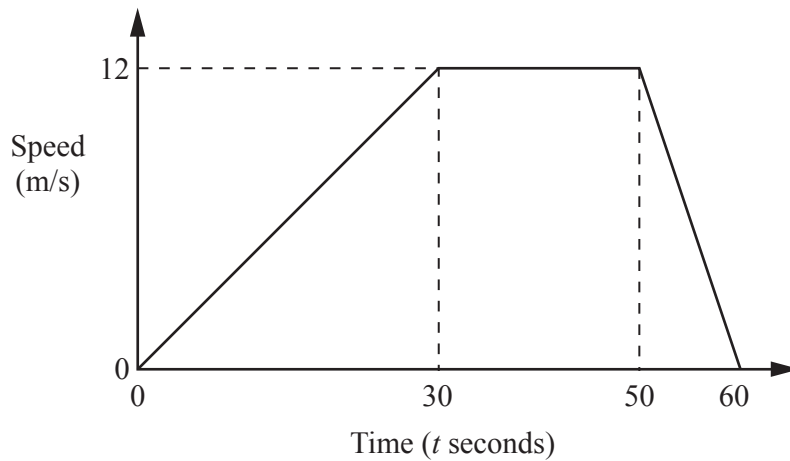Part of the tree diagram that represents these outcomes is drawn below.
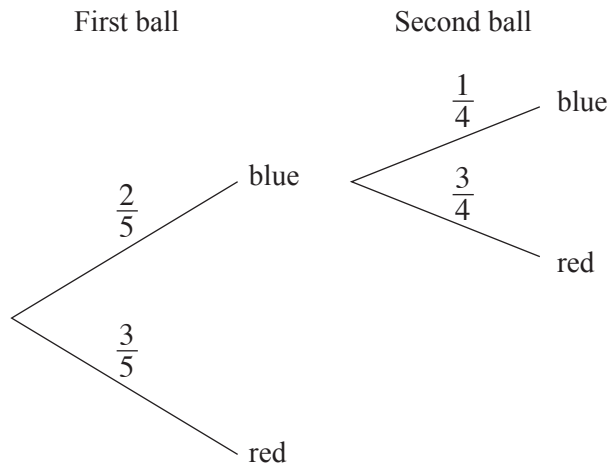
(a) Complete the tree diagram. [1]

(b) Expressing each answer as a fraction in its simplest form, find the probability that

   (i) both balls taken are blue,

Answer .... [1]

   (ii) the second ball taken is blue.

Answer .... [2]

22 The diagram shows the speed-time graph of a cyclist's journey.

(a) Find the retardation.

Answer ....m/s^2 [1]

(b) Find the speed when $t = 9$.

Answer .... m/s [1]

(c) Find the distance travelled by the cyclist from $t = 0$ to $t = 60$.

Answer .... m [2]

23
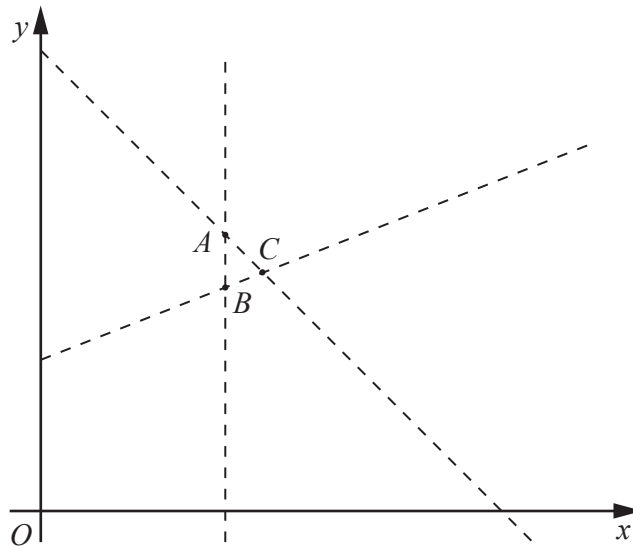
The diagram shows the three lines $x = 8$, $x + y = 21$ and $2y = 12 + x$ which intersect at the points A, B and C.

(a) Find the coordinates of B.

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

(b) The region **inside** triangle ABC is defined by three inequalities.

One of these is $x + y < 21$.

Write down the other two inequalities.

Answer ....

.... [2]

(c) Find the coordinates of the point, with integer coordinates, that is inside triangle ABC.

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

24 The diagram shows the positions, on a map, of three boats *A*, *B* and *C*.
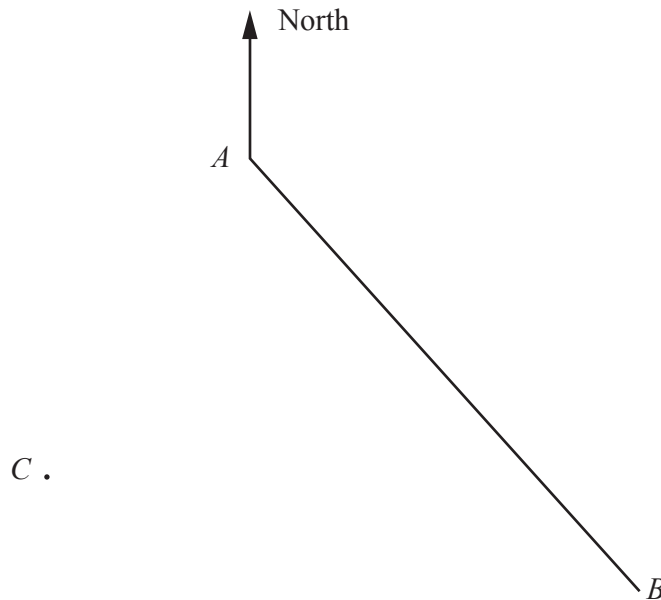The map has a scale of 1 cm to 1 km.

(a) Find the bearing of *B* from *A*.

Answer .... [1]

(b) A fourth boat, *D*, is

- closer to *B* than to *A*,

- less than 4 km from *C*.

By drawing appropriate loci find, and shade, the region in which *D* is situated. [3]

North

A

C .

B

25 *P* is $(-4, 4)$ and *Q* is $(3, -2)$.

M is the midpoint of *PQ*.

(a) Find the coordinates of *M*.

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

(b) Find the gradient of the line *PQ*.

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

(c) *Q* is the midpoint of the line *PQR*.

   (i) Find the coordinates of *R*.

Answer   (.................... , ...) **[2]**

   (ii) **Write down** the value of $\dfrac{PM}{MR}$.

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

Question 26 is printed on the following page.

26

$$A = \begin{pmatrix} 3 & 1 \\ -1 & 2 \end{pmatrix} \qquad A^{-1} = k\begin{pmatrix} 2 & -1 \\ 1 & 3 \end{pmatrix}$$

(a) Find the value of k.

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

(b) Find the matrix **X**, where $2A + X = \begin{pmatrix} 5 & -2 \\ 0 & 4 \end{pmatrix}$.

Answer [2]

(c) Find the matrix **Y**, where $YA = \begin{pmatrix} 6 & 2 \end{pmatrix}$.

Answer [2]