Cambridge O Level

**Cambridge International Examinations**
Cambridge Ordinary Level

| CANDIDATE NAME | |
|---|---|

| CENTRE NUMBER | | | | | | CANDIDATE NUMBER | | | | |
|---|---|---|---|---|---|---|---|---|---|---|

* 6 4 2 1 2 2 7 5 3 1 *

**MATHEMATICS (SYLLABUS D)** **4024/11**

Paper 1 **May/June 2016**

**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.

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**[Turn over**

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

**1** **(a)** Evaluate $12 - 6 \div 3 + 4$.

*Answer* ..... [1]

**(b)** Evaluate $0.3 \times 1.5$.

*Answer* ..... [1]

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**2** **(a)** Evaluate $\frac{2}{3} - \frac{5}{8}$.

*Answer* ..... [1]

**(b)** Evaluate $\frac{1}{3} \div \frac{7}{9}$, giving your answer as a fraction in its lowest terms.

*Answer* ..... [1]

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**3** **(a)** An aircraft leaves at 22 35 on a flight that takes 3 hours and 50 minutes.

Find the time when the aircraft arrives.

*Answer* ..... [1]

**(b)** The aircraft flies a distance of 3200 km, correct to the nearest 100 km.

Write down the lower bound for the distance.

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

---

**4** A bottle full of liquid has a total mass of 1.27 kg.
When the bottle is half-full of liquid the total mass is 900 grams.

Calculate the mass of the bottle.

*Answer* ..... grams [2]

---

**5** Stella walks to a park.

For 4 minutes she walks at a rate of 80 steps per minute.
For 1 minute she walks at a rate of 120 steps per minute.

Find the mean number of steps per minute she takes.

*Answer* ..... [2]

---

**6** **(a)** Write the number $0.034 \times 10^{-3}$ in standard form.

*Answer* ..... [1]

**(b)** Arrange the following numbers in order, starting with the smallest.

$0.034 \times 10^{-3}$ $\quad$ $33.7 \times 10^{-6}$ $\quad$ $0.42 \times 10^{-5}$

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

---

**7** By writing each number correct to 1 significant figure, estimate the value of

$$\frac{29.2 \times 8.17}{0.396}.$$

*Answer* ..... [2]

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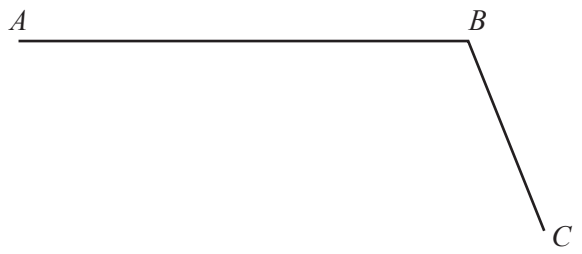
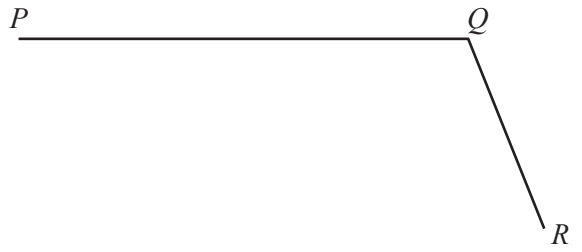
**8** **(a)** Complete the diagram to make a quadrilateral *ABCD* which has *AC* as its line of symmetry.




[1]

**(b)** Complete the diagram to make a quadrilateral *PQRS* which has rotational symmetry of order 2.




[1]

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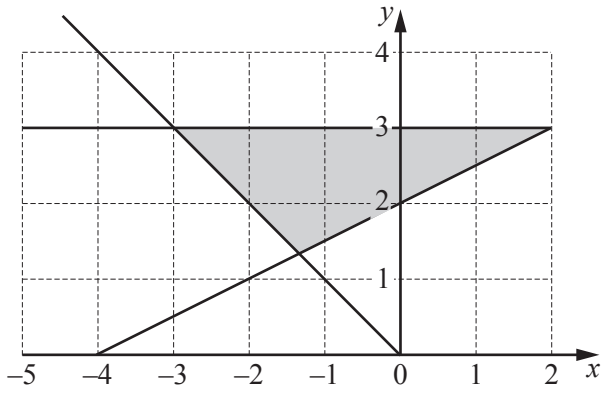
**9**




The shaded region in the diagram is defined by three inequalities.

One of these is $y \geqslant \frac{1}{2}x + 2$.

Write down the other two inequalities.

*Answer* .....

..... [2]

---

**10** Factorise completely $3xy - 20 + 5x - 12y$.

*Answer* ..... [2]

---

**11** $f(x) = 2x - 9$

**(a)** Find $f\left(-\frac{3}{4}\right)$.

*Answer* ..... [1]

**(b)** Find $f^{-1}(3)$.

*Answer* ..... [2]

---

**12** A map is drawn to a scale of 2 cm to 5 km.

**(a)** Two towers are 9 km apart.

Calculate the distance between them on the map.

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

**(b)** On the map, a town covers an area of $4\,\text{cm}^2$.

Calculate its actual area.

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

**(c)** Express the scale of the map in the form $1 : n$.

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

---

**13** Solve the simultaneous equations.

$$3x = 4y$$
$$1 + 5x = 6y$$

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

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

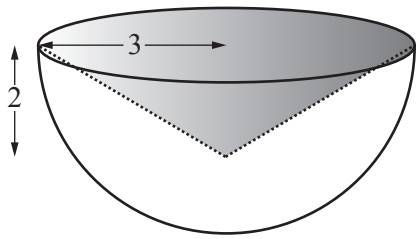
**14** **[The volume of a sphere is $\frac{4}{3}\pi r^3$] [The volume of a cone is $\frac{1}{3}\pi r^2 h$]**

A cone is removed from a solid wooden hemisphere of radius 3 cm.

The cone has radius 3 cm and height 2 cm.

The volume of wood remaining is $k\pi$ cm$^3$.

Find $k$.




*Answer* $k =$ ..... [3]

---

**15** **(a)** $y$ is directly proportional to the square of $x$.

Given that $y = 8$ when $x = 4$, find $y$ when $x = 3$.

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

**(b)** $p$ is inversely proportional to $q$.
It is known that $p = 15$ for a particular value of $q$.

Write down the value of $p$ when this value of $q$ is doubled.

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

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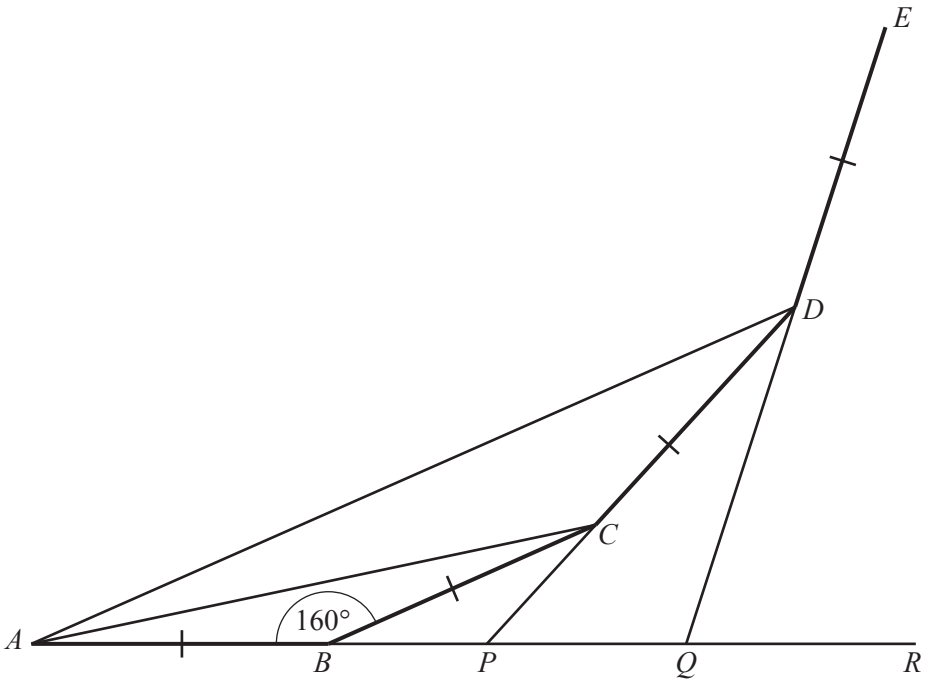
**16**




In the diagram, $AB$, $BC$, $CD$ and $DE$ are four sides of a regular polygon.
Each interior angle of the polygon is 160°.

$ABPQR$, $DCP$ and $EDQ$ are straight lines.

**(a)** Find $C\hat{A}B$.

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

**(b)** Find $C\hat{B}P$.

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

**(c)** Find $D\hat{Q}R$.

*Answer* $D\hat{Q}R$ = ..... [1]

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**17** A sequence of diagrams is made using counters.

Diagram 1 Diagram 2 Diagram 3 Diagram 4

**(a)** Complete the table.

| Diagram number | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| Number of counters | 4 | 6 | 8 | | |

[1]

**(b)** Find an expression, in terms of $n$, for the number of counters in Diagram $n$.

*Answer* ..... [1]

**(c)** In this sequence, Diagram $p$ has 200 counters.

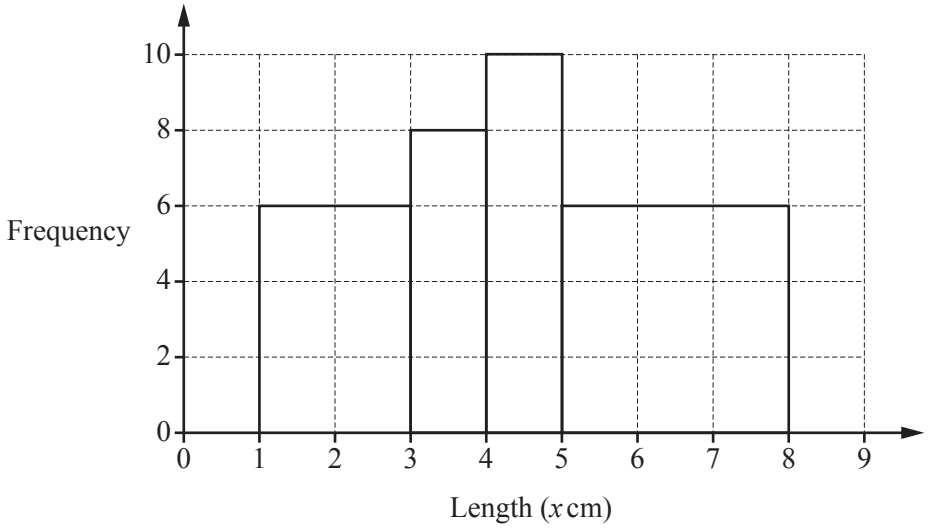
Find the value of $p$.

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

**18** Henri did a survey of the lengths of the leaves on a plant.
The results are summarised in the table.

| Length ($x$ cm) | $1 < x \leqslant 3$ | $3 < x \leqslant 4$ | $4 < x \leqslant 5$ | $5 < x \leqslant 8$ |
|---|---|---|---|---|
| Frequency | 6 | 8 | 10 | 6 |

**(a)** When asked to draw a histogram to illustrate the results, Henri drew the following diagram.

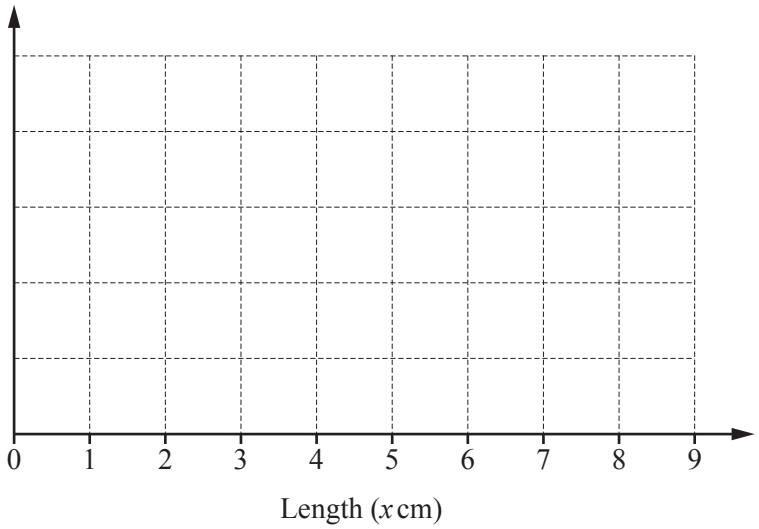



Explain why this diagram is incorrect.

.....

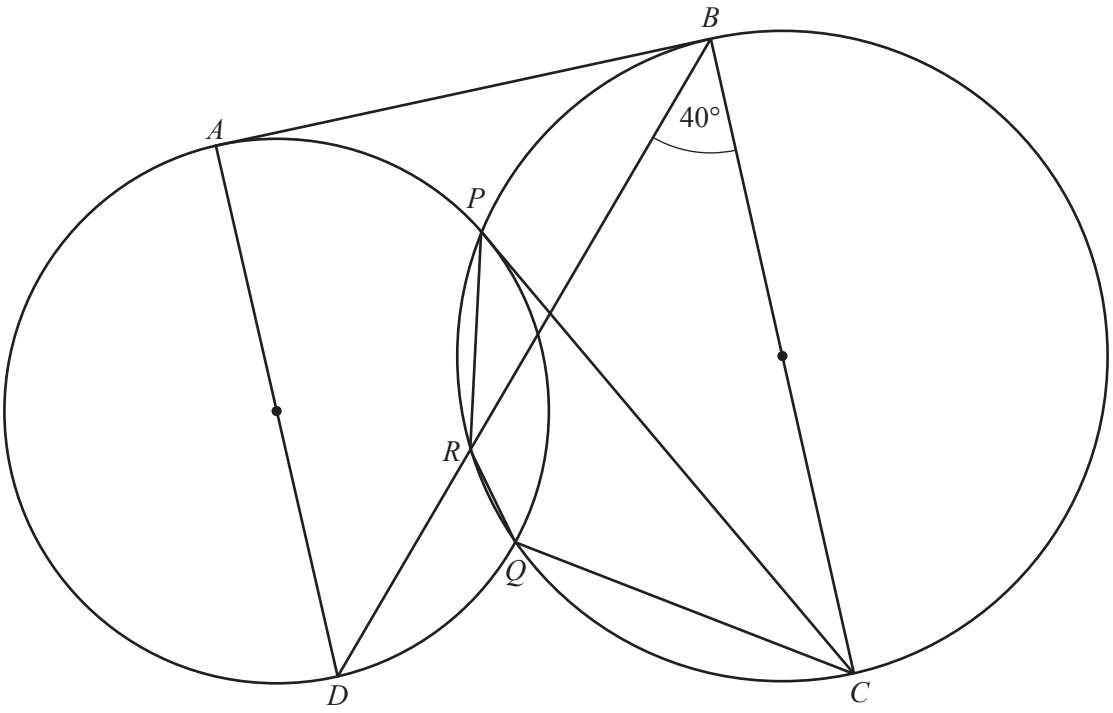
..... [1]

**(b)** On the grid below, draw a correct histogram for Henri's results.




[3]

**19**




In the diagram, the two circles intersect at $P$ and $Q$.
The line $AB$ is a tangent to the circles at $A$ and $B$.
$AD$ and $BC$ are diameters.
$BD$ intersects the larger circle at $R$.

$D\hat{B}C = 40°$.

**(a)** Find $C\hat{P}R$.

*Answer* $C\hat{P}R$ = ..... [1]

**(b)** Find $C\hat{Q}R$.

*Answer* $C\hat{Q}R$ = ..... [1]

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

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

**(d)** Find $A\hat{D}B$.

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

**20** The number of goals scored in each of 50 football matches was recorded.
The results are given in the table.

| Number of goals scored | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|---|
| Frequency | 16 | 11 | 9 | 7 | 6 | 0 | 1 |

For these results, find

**(a)** the mode,

*Answer* ..... [1]

**(b)** the median,

*Answer* ..... [1]

**(c)** the mean.

*Answer* ..... [2]

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**21** **(a)** Express 500 as the product of its prime factors.

*Answer* ..... [1]

**(b)** $M = 2 \times 3^2$ $N = 2^4 \times 3^2$

Find the values of $p$ and $q$ when

**(i)** $M \times N = 2^p \times 3^q$ ,

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

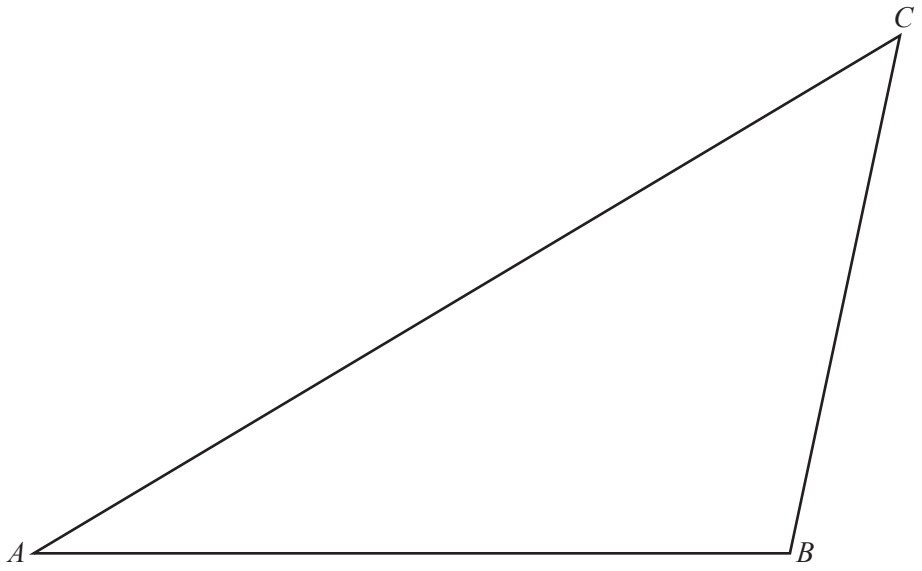
**(ii)** $M \div N = 2^p \times 3^q$ ,

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

**(iii)** $N^2 = 2^p \times 3^q$ .

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

**22** The diagram shows triangle $ABC$.




**(a)** Measure $A\hat{B}C$.

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

**(b)** On the diagram, construct the locus of points, **inside** triangle $ABC$, that are

**(i)** 4 cm from $B$, [1]

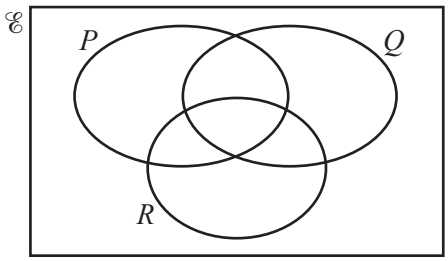
**(ii)** 2 cm from $AC$. [1]

**(c)** The point $P$ is
4 cm from $B$,
2 cm from $AC$,
**and** nearer to $A$ than to $C$.

Label the position of $P$ on the diagram and find the length of $AP$.

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

**23** **(a)** In the Venn diagram, shade the region which represents the subset $(P \cup Q)' \cap R$.




[1]

**(b)** $\mathscr{E} = \{ x : x \text{ is an integer and } 22 \leqslant x \leqslant 33 \}$
$E = \{ x : x \text{ is an even number} \}$
$T = \{ x : x \text{ is a multiple of } 3 \}$
$F = \{ x : x \text{ is a multiple of } 4 \}$

**(i)** List the members of $T \cap F$.

*Answer* ..... [1]

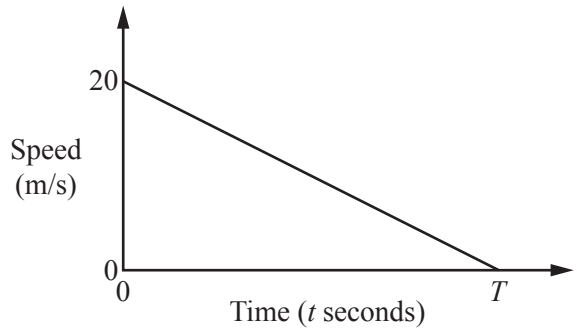
**(ii)** Find $\mathrm{n}(E \cup T)$.

*Answer* ..... [1]

**(iii)** Given that $y \in F' \cap E$, find one possible value of $y$.

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

**24** The diagram shows the speed-time graph of a train which slows down from 20 m/s to a stop in $T$ seconds.




**(a)** **(i)** Find an expression, in terms of $T$, for the retardation of the train.

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

**(ii)** Find the speed of the train when $t = \frac{3}{4}T$ .

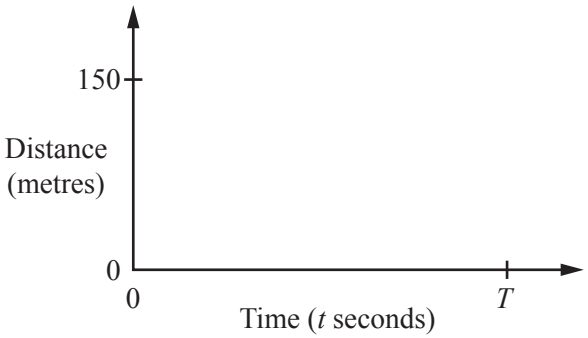
*Answer* ..... m/s [1]

**(b)** The distance travelled by the train between $t = 0$ and $t = T$ is 150 m.

**(i)** Find $T$.

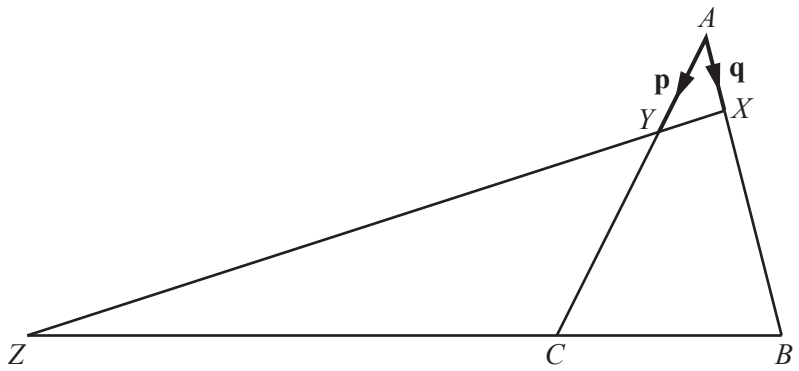
*Answer* $T$ = ..... [1]

**(ii)** On the diagram, sketch the distance–time graph of the train.




[1]

**25**




In the diagram,

$X$ is the point on $AB$ where $AX = \frac{1}{4}AB$,

$Y$ is the point on $AC$ where $AY = \frac{1}{3}AC$,

$Z$ is the point on $BC$ produced where $CZ = 2BC$.

$\overrightarrow{AY} = \mathbf{p}$ and $\overrightarrow{AX} = \mathbf{q}$.

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

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

*Answer* $\overrightarrow{XY}$ = ..... [1]

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

*Answer* $\overrightarrow{BC}$ = ..... [1]

**(iii)** $\overrightarrow{XZ}$.

*Answer* $\overrightarrow{XZ}$ = ..... [2]

**(b)** Hence find $XY : YZ$.

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

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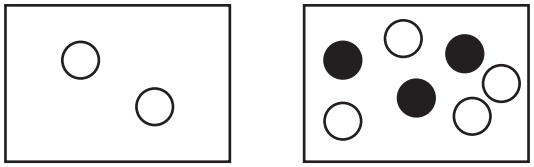
**Question 26 is printed on the next page**

**26**



Box 1 Box 2

Box 1 contains 2 white balls. Box 2 contains 4 white balls and 3 black balls.

**(a)** Ann chooses, at random, one ball from each box.

**(i)** Find the probability that these balls are both black.

*Answer* ..... [1]

**(ii)** Find the probability that these balls have different colours.

*Answer* ..... [1]

**(b)** From the original contents of **Box 2**, Belle chooses, at random, two balls without replacement.

Find the probability that these balls are both white.

*Answer* ..... [1]

**(c)** Carla chooses one of the boxes at random.
With the original box contents, she then chooses, at random, one ball from this box.

Find the probability that the ball is white.

*Answer* ..... [2]

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