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 2013**

**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.

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




UNIVERSITY of CAMBRIDGE International Examinations

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

*For Examiner's Use*

**1** **(a)** Amy buys 3 drinks at \$1.86 each and 1 drink for \$2.04.
She pays for the 4 drinks with a \$10 note.

How much change should she receive?

*Answer* \$ ..... [1]

**(b)** \$180 is shared between Ali and Ben so that Ali's share : Ben's share = 4 : 5.

Find Ali's share.

*Answer* \$ ..... [1]

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**2** **(a)** Evaluate $3\frac{1}{4} - 1\frac{4}{5}$.

*Answer* ..... [1]

**(b)** Evaluate $3.01 \times 0.02$.

*Answer* ..... [1]

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**3** $f(x) = 2x - 6$

For Examiner's Use

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

*Answer* ..... [1]

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

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

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**4** **(a)** A journey started at 07 44 and finished at 11 32.

How long, in hours and minutes, did the journey take?

*Answer* ..... hours ..... minutes [1]

**(b)** Arrange these values in order, starting with the smallest.

$\frac{4}{9}$ $\frac{2}{5}$ 44%

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

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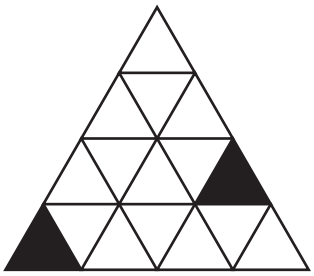
**5** **(a)** In the diagram, two small triangles are shaded.

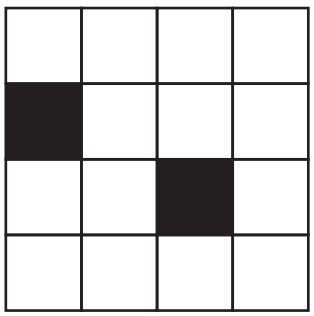
Shade one more small triangle, so that the diagram will then have one line of symmetry.



[1]

**(b)** In the diagram, two small squares are shaded.

Shade two more small squares, so that the diagram will then have rotational symmetry of order 2.



[1]

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**6** $y$ is inversely proportional to $x$.

Given that $y = 20$ when $x = 2$, find $y$ when $x = 5$.

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

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**7** **(a)** Write the number 35 000 000 in standard form.

*Answer* ..... [1]

**(b)** Giving your answer in standard form, evaluate $\frac{4.2 \times 10^{-2}}{3 \times 10^{4}}$.

*Answer* ..... [1]

---

**8** Solve the equation $\frac{3x + 1}{2} - \frac{x}{3} = 1$.

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

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**9** **By making suitable approximations,** estimate the value of $\dfrac{\sqrt{35.78} \times \sqrt[3]{1005}}{0.3012}$.
Show clearly the approximate values you use.

*Answer* ..... [2]

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**10** Find **one** value of $x$ that satisfies **both** $x > 4$ **and** $17 - 4x > 2 - x$.

*Answer* ..... [2]

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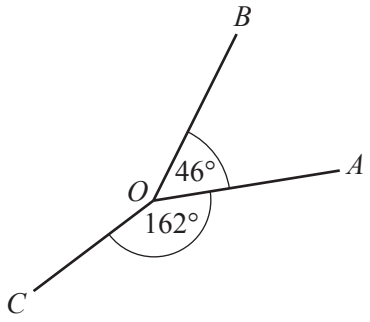
**11** In the diagram,
$A\hat{O}B = 46°$, correct to the nearest degree,
$A\hat{O}C = 162°$, correct to the nearest degree.




**(a)** Write down the lower bound for $A\hat{O}B$.

*Answer* ..... [1]

**(b)** Find the lower bound for $B\hat{O}C$.

*Answer* ..... [2]

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**12** **(a)** Evaluate $\left(\frac{5}{3}\right)^{-2}$.

*Answer* ..... [1]

**(b)** Simplify $\left(\frac{9}{t^6}\right)^{\frac{1}{2}}$.

*Answer* ..... [1]

**(c)** Simplify $\frac{2x^3y}{6xy^2}$.

*Answer* ..... [1]

---

**13** Solve the simultaneous equations.

$$4x - 3y = 14$$
$$2x + y = -3$$

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

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

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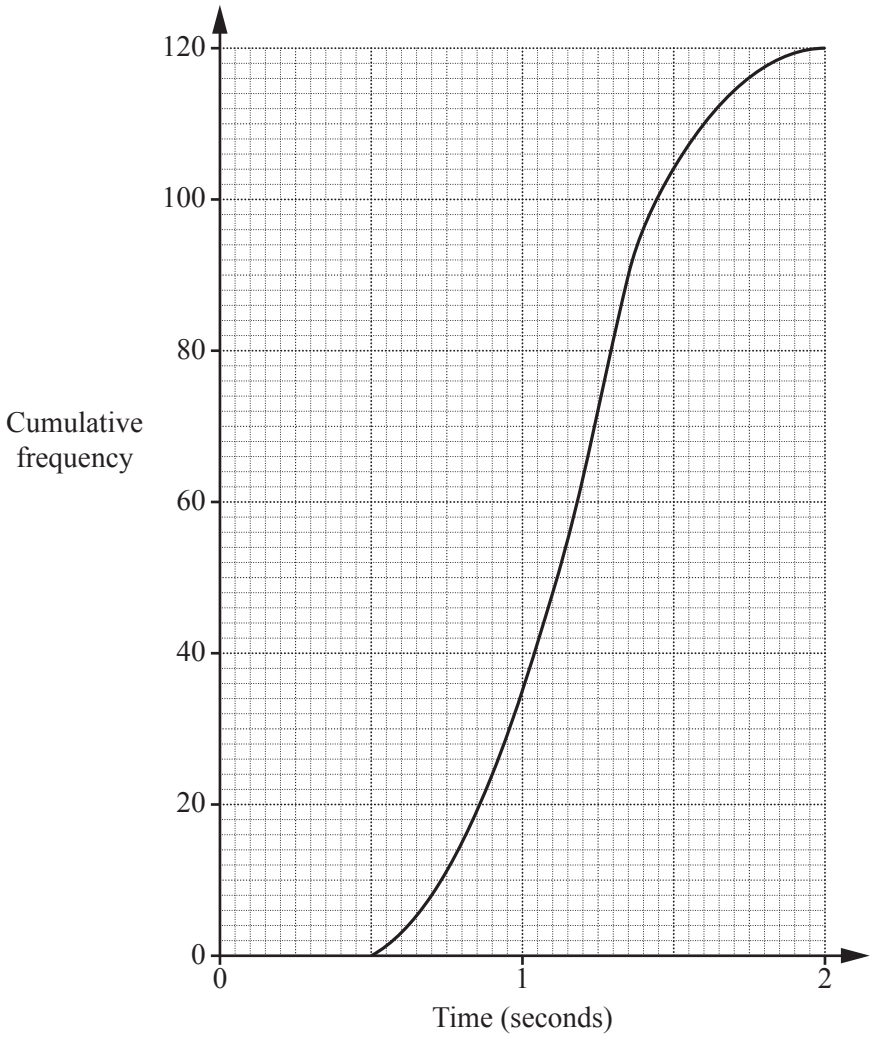
**14** The times taken by each of 120 runners to react to the starting gun were recorded. The cumulative frequency curve summarises the results.

For Examiner's Use




**(a)** Find the upper quartile.

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

**(b)** Find the 40th percentile.

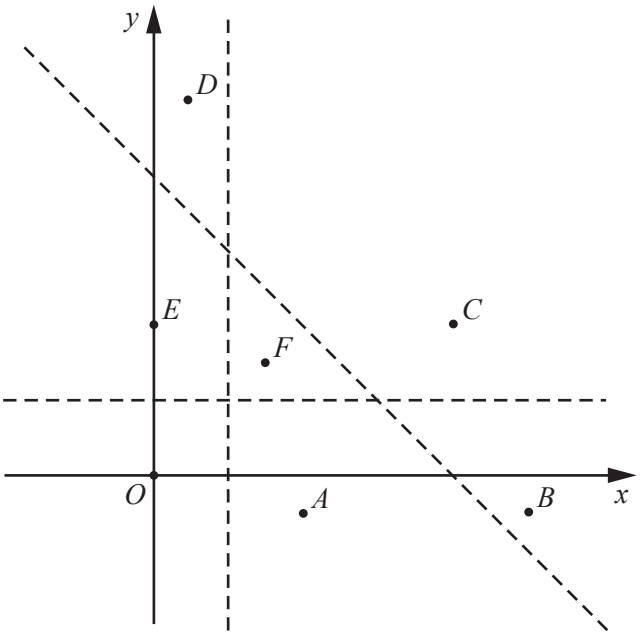
*Answer* ..... s [1]

**(c)** Find the number of students who took less than 1.5 seconds.

*Answer* ..... [1]

**15**

For Examiner's Use




The diagram shows the three lines $x = 1$, $y = 1$ and $x + y = 4$ and the seven points $O$, $A$, $B$, $C$, $D$, $E$ and $F$.

**(a)** Which of these seven points lie in the region defined by $x + y > 4$?

*Answer* ..... [1]

**(b)** Which one of these seven points lies in the region defined by

$x < 1$, $y > 1$ and $x + y < 4$?

*Answer* ..... [1]

**(c)** Given that $O$ is (0, 0) and $C$ is (4, 2), find the inequality that defines the region below the line that passes through $O$ and $C$.

*Answer* ..... [1]

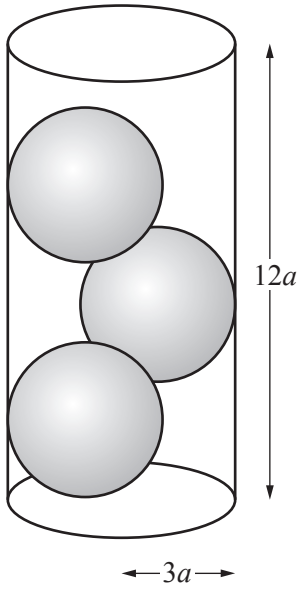
**16** **[Volume of a sphere = $\frac{4}{3}\pi r^3$]**

Three spheres, each of radius $2a$ cm are placed inside a cylinder of radius $3a$ cm and height $12a$ cm.

Water is poured into the cylinder to fill it completely.

The volume of water is $k\pi a^3$ cm$^3$.

Find the value of $k$.




*For Examiner's Use*

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

**17** **(a)** Factorise $25t^2 - 4$.

*For Examiner's Use*

*Answer* ..... [1]

**(b)** Factorise completely $6r^2H - 2r^2h$ .

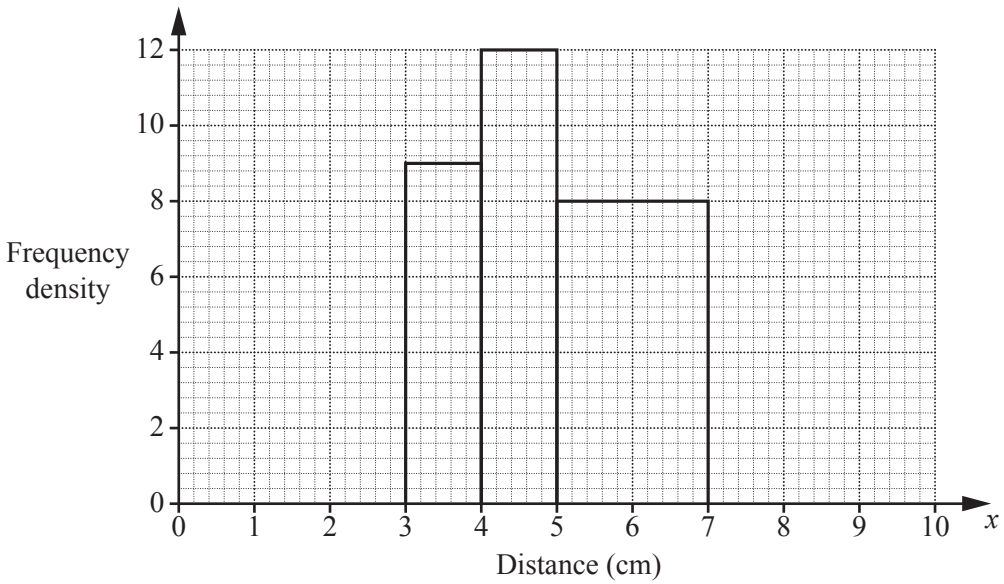
*Answer* ..... [1]

**(c)** Factorise completely $8xy + 4x - 6y - 3$.

*Answer* ..... [2]

**18** In an experiment with a group of snails, the distance moved in one minute by each snail was recorded.
Some of the results are shown in the table and illustrated in the histogram.

| Distance ($x$ centimetres) | $2 < x \leqslant 3$ | $3 < x \leqslant 4$ | $4 < x \leqslant 5$ | $5 < x \leqslant 7$ | $7 < x \leqslant 9$ |
|---|---|---|---|---|---|
| Frequency | 6 | 9 | 12 | $p$ | 4 |




**(a)** Use the histogram to find the value of $p$.

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

**(b)** Complete the histogram. [2]

**(c)** One snail is chosen at random.

Find the probability that this snail did not move more than 4 cm.

*Answer* ..... [1]

**19** $P$ is $(-1, 3)$ and $Q$ is $(5, -1)$.

*For Examiner's Use*

**(a)** Find the coordinates of the midpoint of $PQ$.

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

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

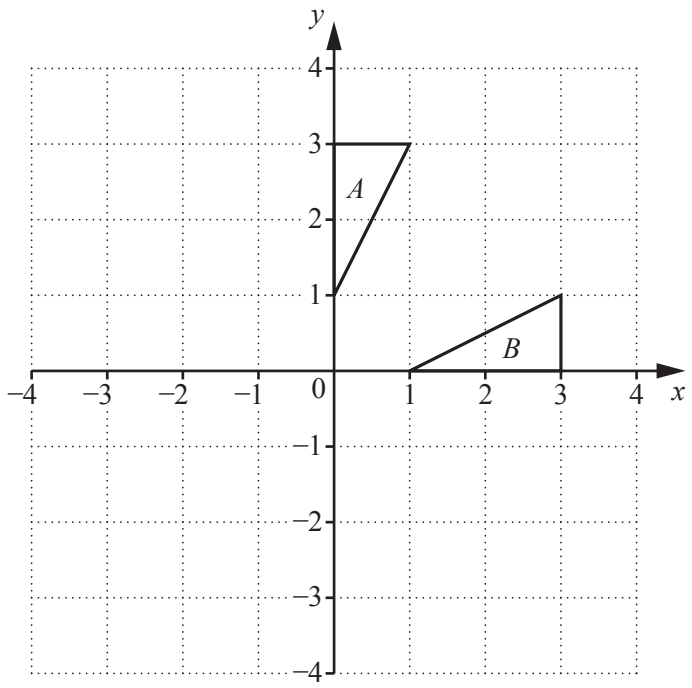
*Answer* ..... [1]

**(c)** Given that the length of $PQ = 2\sqrt{n}$ units, where $n$ is an integer, find the value of $n$.

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

**20**






The diagram shows triangles $A$ and $B$.

**(a)** Describe fully the **single** transformation that maps triangle $A$ onto triangle $B$.

*Answer* .....

..... [2]

**(b)** Triangle $A$ is mapped onto triangle $C$ by the transformation **T**.
**T** is a rotation, centre the origin, through 270° clockwise.

**(i)** On the diagram, draw triangle $C$. [1]

**(ii)** Find the matrix that represents **T**.

*Answer* $\begin{pmatrix} & \\ & \end{pmatrix}$ [1]

**21**

For Examiner's Use

| 2 | 3 | 3 | 4 | 4 | 4 |
|---|---|---|---|---|---|

The numbers 2, 3, 3, 4, 4, 4 are written on six cards.
Two cards are chosen, at random, without replacement, to form a 2-digit number.
The first card chosen shows the number of Tens.
The second card chosen shows the number of Units.

| First card | Second card |
|---|---|
| Tens | Units |

Expressing each answer in its simplest form, find the probability that the two cards show

**(a)** a number greater than 20,

*Answer* ..... [1]

**(b)** the number 33,

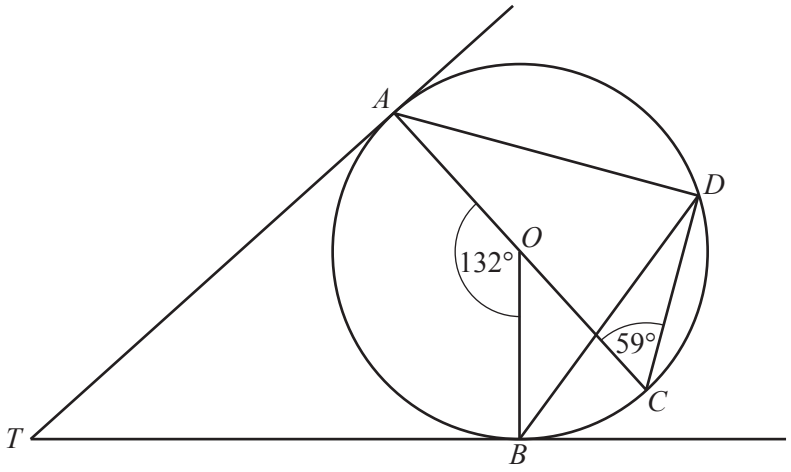
*Answer* ..... [1]

**(c)** the number 43 or the number 32.

*Answer* ..... [2]

**22**






In the diagram, the points $A$, $B$, $C$ and $D$ lie on the circle centre $O$.
$TA$ and $TB$ are tangents touching the circle at $A$ and $B$ respectively.

$A\hat{O}B = 132°$, $A\hat{C}D = 59°$ and $AOC$ is a straight line.

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

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

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

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

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

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

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

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

**23** The first four lines of a pattern of numbers are shown below.

For Examiner's Use

$$\begin{array}{lllll} \text{1st line} & 3^2 - 1^2 & = & 8 \times 1 \\ \text{2nd line} & 5^2 - 1^2 & = & 8 \times (1 + 2) \\ \text{3rd line} & 7^2 - 1^2 & = & 8 \times (1 + 2 + 3) \\ \text{4th line} & 9^2 - 1^2 & = & 8 \times (1 + 2 + 3 + 4) \end{array}$$

**(a)** Write down the 7th line of the pattern.

*Answer* ..... [1]

**(b)** Write down an expression, in terms of $n$, to complete the $n$th line of the pattern.

*Answer* ..... $= 8 \times (1 + 2 + 3 + 4 + \ldots + n)$ [1]

**(c)** **Using the *n*th line of the pattern**, show that $1 + 2 + 3 + 4 + \ldots + n = \dfrac{n(n+1)}{2}$.

[2]

**24** The diagram at the bottom of the page shows triangle $ABC$.

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

*Answer* ..... [1]

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

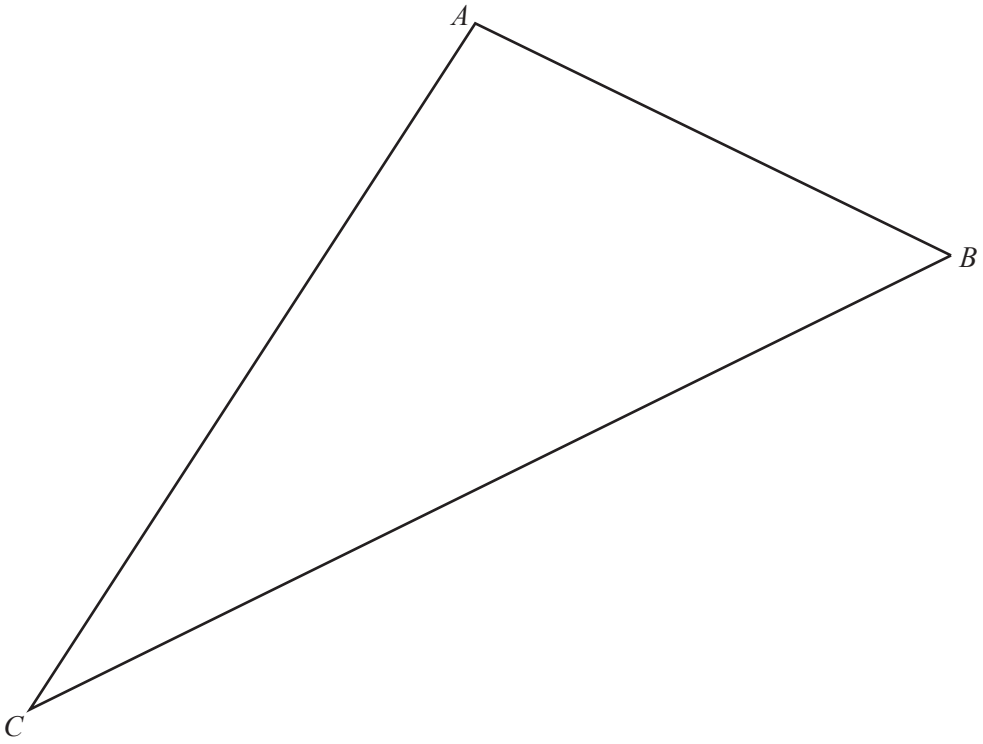
**(i)** equidistant from $A$ and $B$, [1]

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

**(c)** These two loci meet at the point $P$.

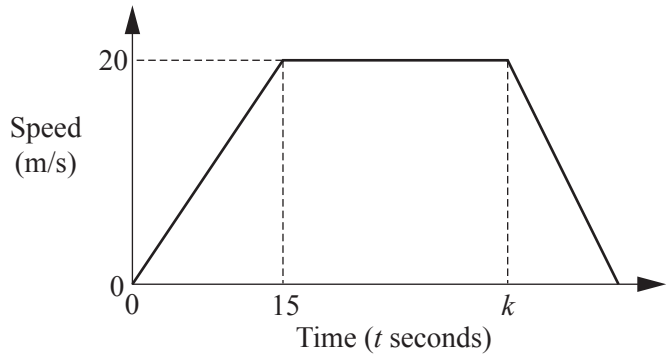
Label the point $P$ on the diagram and measure $CP$.

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



**25** The diagram is the speed-time graph of a car's journey.






**(a)** Find the speed when $t = 12$.

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

**(b)** Find the distance travelled by the car from $t = 0$ to $t = 15$.

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

**(c)** The distance travelled by the car from $t = 0$ to $t = k$ is 750 m.

Find $k$.

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

**(d)** The retardation of the car is $2\,m/s^2$.

Find the number of seconds it takes to slow down and stop.

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

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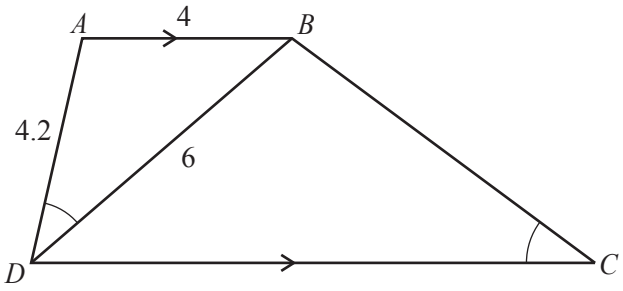
**Question 26 is printed on the following page.**

**26** In the diagram, $AB$ is parallel to $DC$ and $A\hat{D}B = B\hat{C}D$.

*For Examiner's Use*




**(a)** Explain why triangles $ABD$ and $BDC$ are similar.

[2]

**(b)** $AB = 4\,\text{cm}$, $BD = 6\,\text{cm}$ and $AD = 4.2\,\text{cm}$.

**(i)** Calculate $BC$.

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

**(ii)** Write down the value of $\dfrac{\text{area of triangle } ABD}{\text{area of triangle } BDC}$.

*Answer* ..... [1]