Cambridge
O Level

Cambridge Assessment International Education
Cambridge Ordinary Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

9351102030

MATHEMATICS (SYLLABUS D) **4024/21**

Paper 2 **May/June 2019**

2 hours 30 minutes

Candidates answer on the Question Paper.

Additional Materials: Geometrical instruments
Electronic calculator

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 an HB 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 below that question.
Essential working must be shown for full marks to be awarded.

Electronic calculators should be used.
If the degree of accuracy is not specified in the question, and if the answer is not exact, give the answer to three significant figures. Give answers in degrees to one decimal place.
For π, use either your calculator value or 3.142, unless the question requires the answer in terms of π.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.
The total number of marks for this paper is 100.

This document consists of **19** printed pages and **1** blank page.

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[Turn over

1 In 2017, Lauren had a monthly income of $1800.

(a) How much was her total income in 2017?

$ ..... [1]

(b) From her monthly income of $1800, Lauren paid the following.

Rent	$500
Bills	$250
Food	$120
Travel	$240
Clothes	$ 70

(i) Each month, Lauren saved the rest of her income.

What percentage of the $1800 did she save?

..... % [3]

(ii) Lauren's monthly rent was increased by 3.6%.

Calculate the new monthly rent.

$ ..... [2]

(c) In 2017, Lauren's monthly income of $1800 was 25% less than her monthly income in 2016.

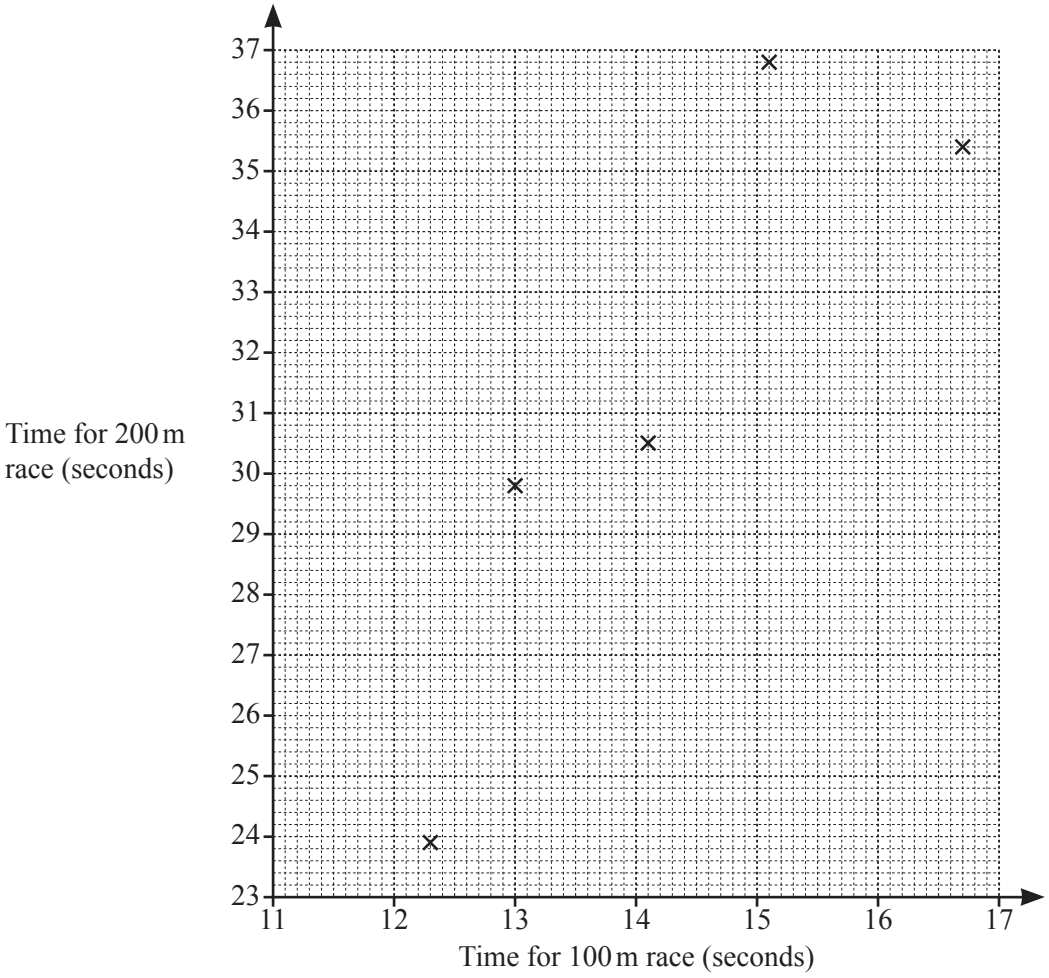
Calculate her monthly income in 2016.

$ ..... [2]

2 Ten boys ran in a 100 m race and a 200 m race.
The table below shows their times in seconds.

Time for 100 m race	12.3	14.1	15.1	16.7	13.0	14.7	13.7	12.9	15.2	16.1
Time for 200 m race	23.9	30.5	36.8	35.4	29.8	32.5	28.4	26.1	33.5	36.0

(a) Complete the scatter diagram.
The first five points have been plotted for you.



[2]

(b) What type of correlation is shown in the scatter diagram?

..... [1]

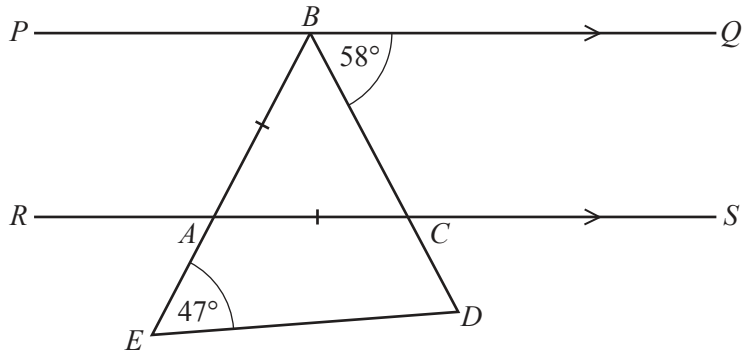
(c) Draw a line of best fit. [1]

(d) Another boy recorded a time of 27.5 s in the 200 m race.

Use your graph to estimate the time it would take him to run 100 m.

..... s [1]

3 (a)



NOT TO SCALE

PBQ and *RACS* are parallel lines.
BAE and *BCD* are straight lines.
$AB = AC$, $Q\hat{B}C = 58°$ and $A\hat{E}D = 47°$.

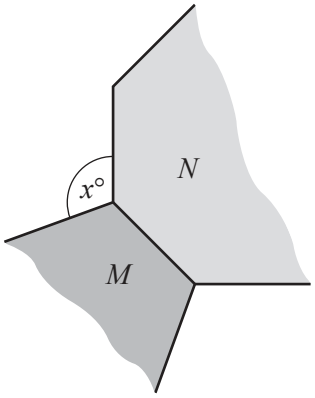
(i) Calculate $B\hat{A}C$, giving reasons for each step in your working.

[3]

(ii) Calculate $C\hat{D}E$.

$C\hat{D}E =$ ..... [1]

(b)



NOT TO SCALE

The shaded region M shows part of a regular pentagon and the shaded region N shows part of a regular octagon.

Calculate x.

$x =$ ..... [3]

4 **(a)** Express as a fraction in its simplest form.

(i) $\frac{6y}{35} \div \frac{10y^2}{7}$

..... [2]

(ii) $\frac{k^2-16}{k^2-2k-8}$

..... [3]

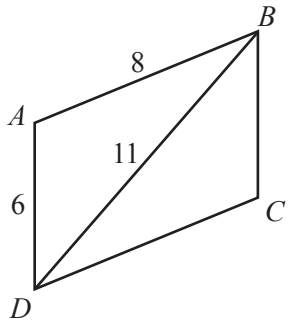
(b) Solve $3(x-4)+5=7$.

$x =$ ..... [2]

(c) Solve $3t^2 + 5t - 4 = 0$.
Show all your working and give your answers correct to 2 decimal places.

$t =$ ..... or $t =$ ..... [3]

5 (a)



NOT TO SCALE

$ABCD$ is a parallelogram.
$AD = 6$ cm, $AB = 8$ cm and $BD = 11$ cm.

(i) **Using a ruler and compasses only**, construct an accurate drawing of $ABCD$.
AD has been drawn for you.

[3]

(ii) Measure $D\hat{A}B$.

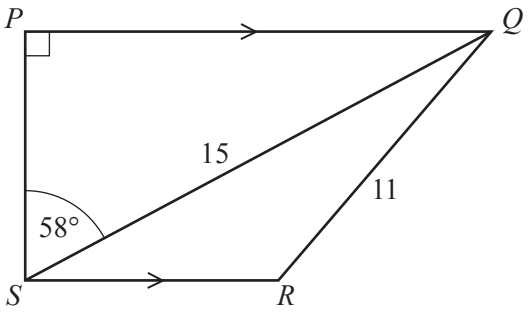
$D\hat{A}B =$ ..... [1]

(iii) E is the point on BD such that AE is the shortest distance from A to BD.

Draw and measure AE.

$AE =$ ..... cm [1]

(b)



NOT TO SCALE

$PQRS$ is a trapezium with PQ parallel to SR and $S\hat{P}Q = 90°$.
$SQ = 15$ cm, $QR = 11$ cm and $P\hat{S}Q = 58°$.

(i) Calculate PS.

$PS =$ ..... cm [2]

(ii) Calculate the obtuse angle SRQ.

Angle $SRQ =$ ..... [4]

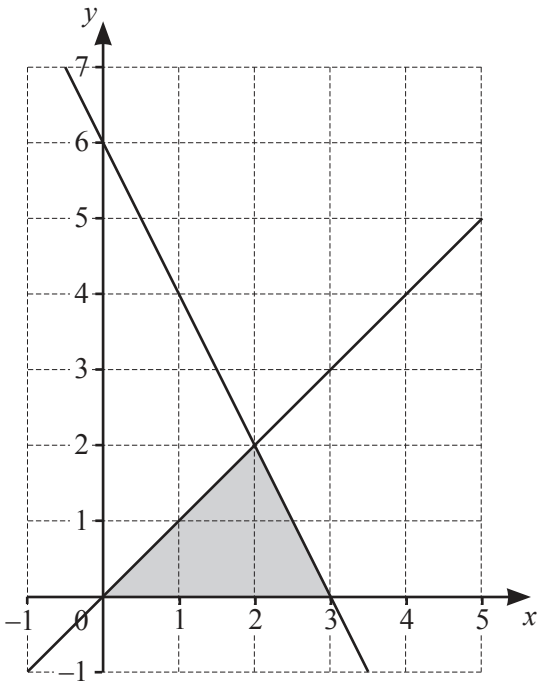
6 **(a)** **(i)** Solve the inequality $10 < 3(x+1) \leqslant 24$.

..... [3]

(ii) State the number of integers, x, satisfying $10 < 3(x+1) \leqslant 24$.

..... [1]

(b)



Find the 3 inequalities which define the region **shaded** in the diagram.

.....

.....

..... [3]

7 $f(x) = 5x - 7$ $g(x) = \frac{x+4}{3}$

(a) Find f(6).

..... [1]

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

$g^{-1}(x) =$ ..... [2]

(c) Given that $f(p) = g(p) - 2$, find p.

$p =$ ..... [3]

(d) $g(5x - 7) = ax + b$.

Find a and b.

$a =$ ..... $b =$ ..... [3]

8 The table summarises the distances, d m, that 80 women threw the javelin.

Distance (d m)	Frequency
$20 < d \leqslant 25$	6
$25 < d \leqslant 30$	16
$30 < d \leqslant 35$	25
$35 < d \leqslant 40$	18
$40 < d \leqslant 45$	13
$45 < d \leqslant 50$	2

(a) One of these women is chosen at random.

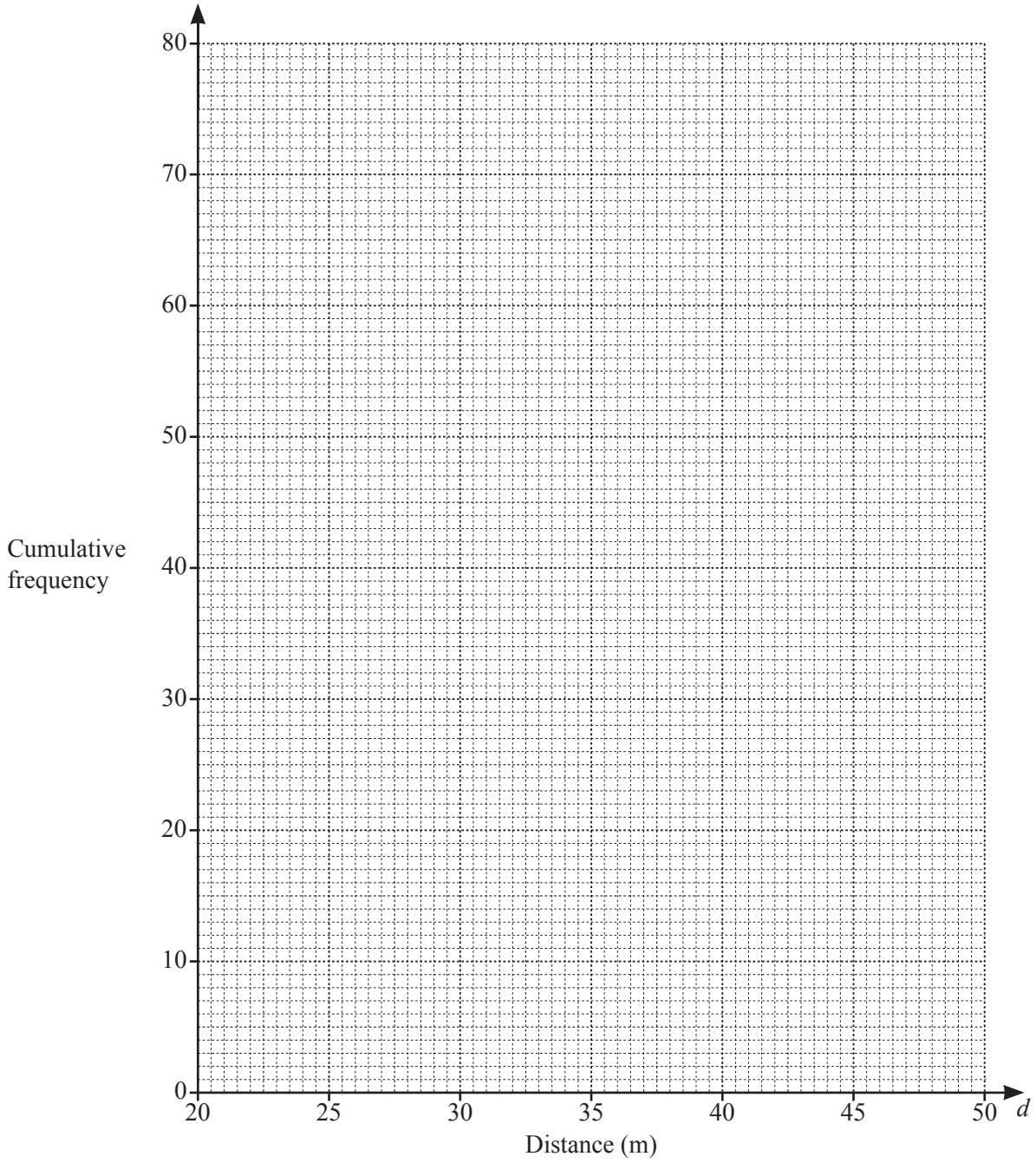
Find the probability that she threw the javelin 30 metres or less.

..... [1]

(b) Calculate an estimate of the mean distance the javelin was thrown.

..... m [3]

(c) Draw the cumulative frequency diagram for this data on the grid on the next page.



[3]

(d) Use your graph to find an estimate for

(i) the median,

..... m [1]

(ii) the interquartile range.

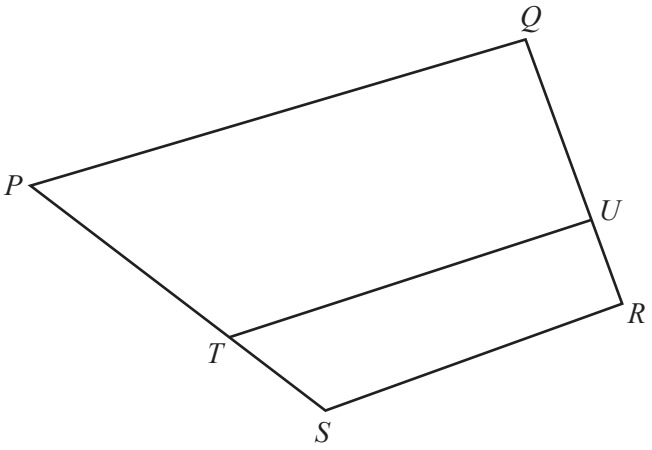
..... m [2]

(e) Women who threw the javelin more than 43 m qualified for a regional competition.

Use your graph to estimate the number of women who qualified for this competition.

..... [2]

9 (a)



NOT TO SCALE

In the diagram, $\overrightarrow{PQ} = 4\mathbf{p}$, $\overrightarrow{QR} = 3\mathbf{q}$ and $\overrightarrow{PT} = \mathbf{p} + 2\mathbf{q}$.

$\overrightarrow{QU} = \frac{2}{3}\overrightarrow{QR}$ and $\overrightarrow{PT} = \frac{2}{3}\overrightarrow{PS}$.

(i) Express, as simply as possible, in terms of **p** and/or **q**,

(a) $\overrightarrow{PS}$,

$\overrightarrow{PS} =$ ..... [1]

(b) $\overrightarrow{SR}$.

$\overrightarrow{SR} =$ ..... [2]

(ii) State the name of the special quadrilateral *PQRS*.
Using vectors, give a reason for your answer.

..... because .....

..... [2]

(iii) Find, in its simplest form, the ratio $\left|\overrightarrow{PQ}\right| : \left|\overrightarrow{SR}\right|$.

..... : ..... [2]

(b) $\overrightarrow{AB} = \begin{pmatrix} 3 \\ 2 \end{pmatrix}$ $\overrightarrow{BC} = \begin{pmatrix} 6 \\ -2 \end{pmatrix}$ $\overrightarrow{CD} = \begin{pmatrix} -7 \\ -3 \end{pmatrix}$

(i) Find $\overrightarrow{AD}$.

$\overrightarrow{AD} = \begin{pmatrix} \quad \\ \quad \end{pmatrix}$ [1]

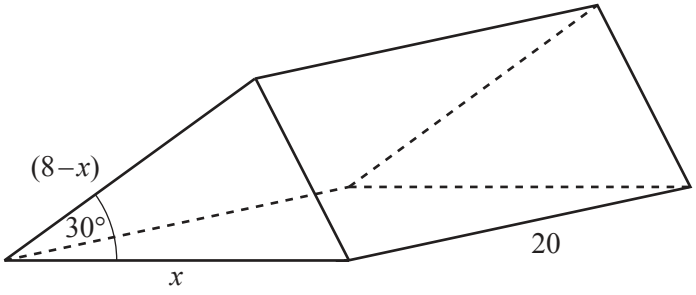
(ii) Find $\left|\overrightarrow{BC}\right|$.

..... [2]

(iii) Given that E is the midpoint of BC, find $\overrightarrow{AE}$.

$\overrightarrow{AE} = \begin{pmatrix} \quad \\ \quad \end{pmatrix}$ [2]

10

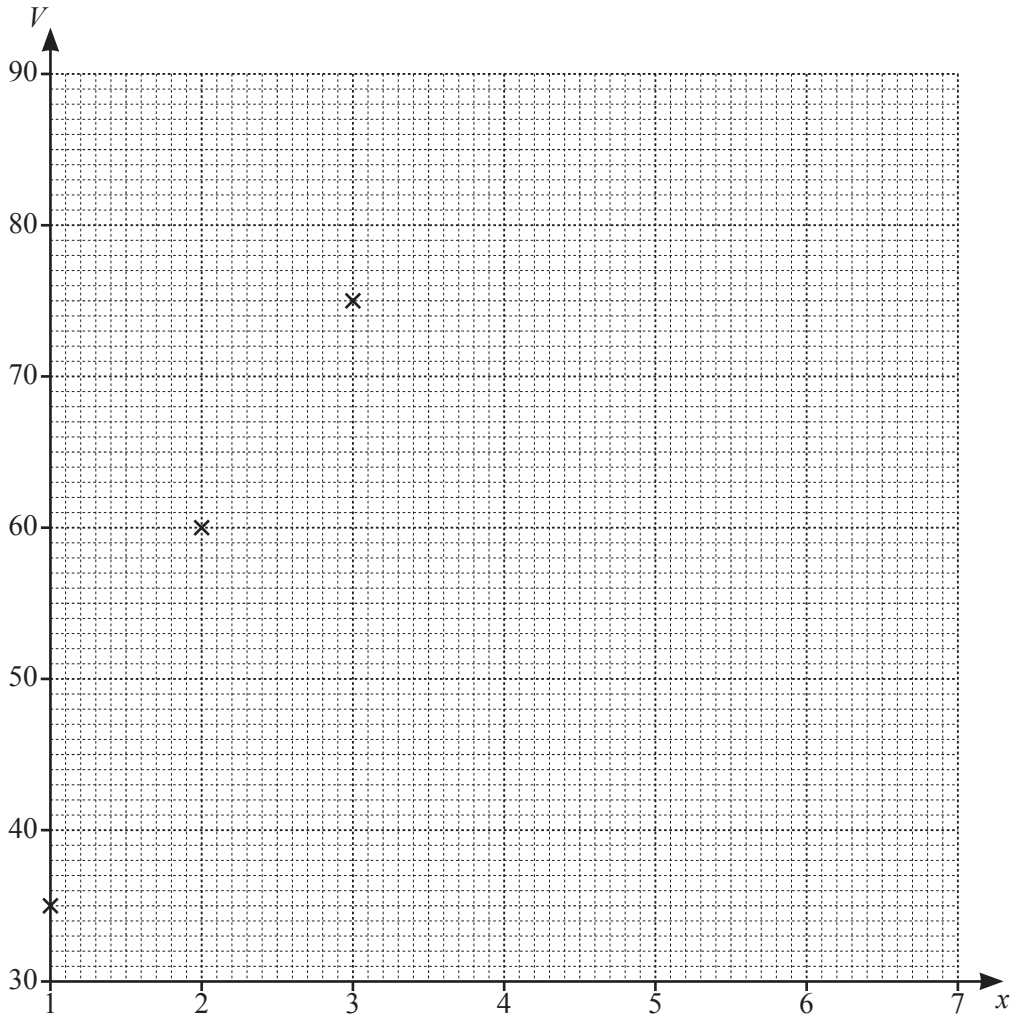


The diagram shows a triangular prism.
All lengths are in centimetres.

(a) Show that the volume, $V\,\text{cm}^3$, of the prism is given by $V = (40x - 5x^2)$.

[3]

(b) On the grid on the next page, draw the graph of $V = 40x - 5x^2$ for $1 \leqslant x \leqslant 7$.
Three of the points have been plotted for you.



[3]

(c) Use your graph to find the possible values of x for one of these prisms with a volume of $50\,cm^3$.

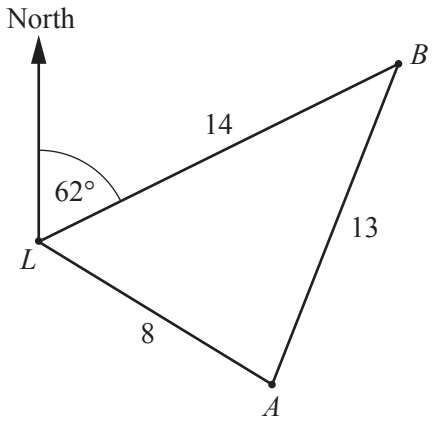
$x =$ ..... or $x =$ ..... [2]

(d) A cuboid has length 4 cm, width 3 cm and height x cm.

By drawing a suitable line on your graph, find the value of x when the prism and the cuboid have the same volume.

$x =$ ..... [3]

11



NOT TO SCALE

The diagram shows the positions of two ports, A and B, and a lighthouse L.
The bearing of B from L is 062°.
$AB = 13$ km, $BL = 14$ km and $AL = 8$ km.

(a) Calculate the bearing of A from L.

..... [4]

(b) A boat is located at C.
C is 11 km from B and $B\hat{C}A = 90°$.
The boat travels to port A in a straight line.

Find the distance the boat travels.

..... km [2]

(c) The boat then travels in a straight line from port *A* to port *B*.
It travels at an average speed of 3.75 km/h.

Calculate the time taken for the boat to travel from port *A* to port *B*.
Give your answer in hours and minutes.

..... hours ..... minutes [2]

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