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4024/21

May/June 2019

2 hours 30 minutes

Additional Materials: Geometrical instruments
Electronic calculator

READ THESE INSTRUCTIONS FIRST

DO **NOT** WRITE IN ANY BARCODES.

Essential working must be shown for full marks to be awarded.

Electronic calculators should be used.

For π , use either your calculator value or 3.142, unless the question requires the answer in terms of π .

The total number of marks for this paper is 100.

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

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.

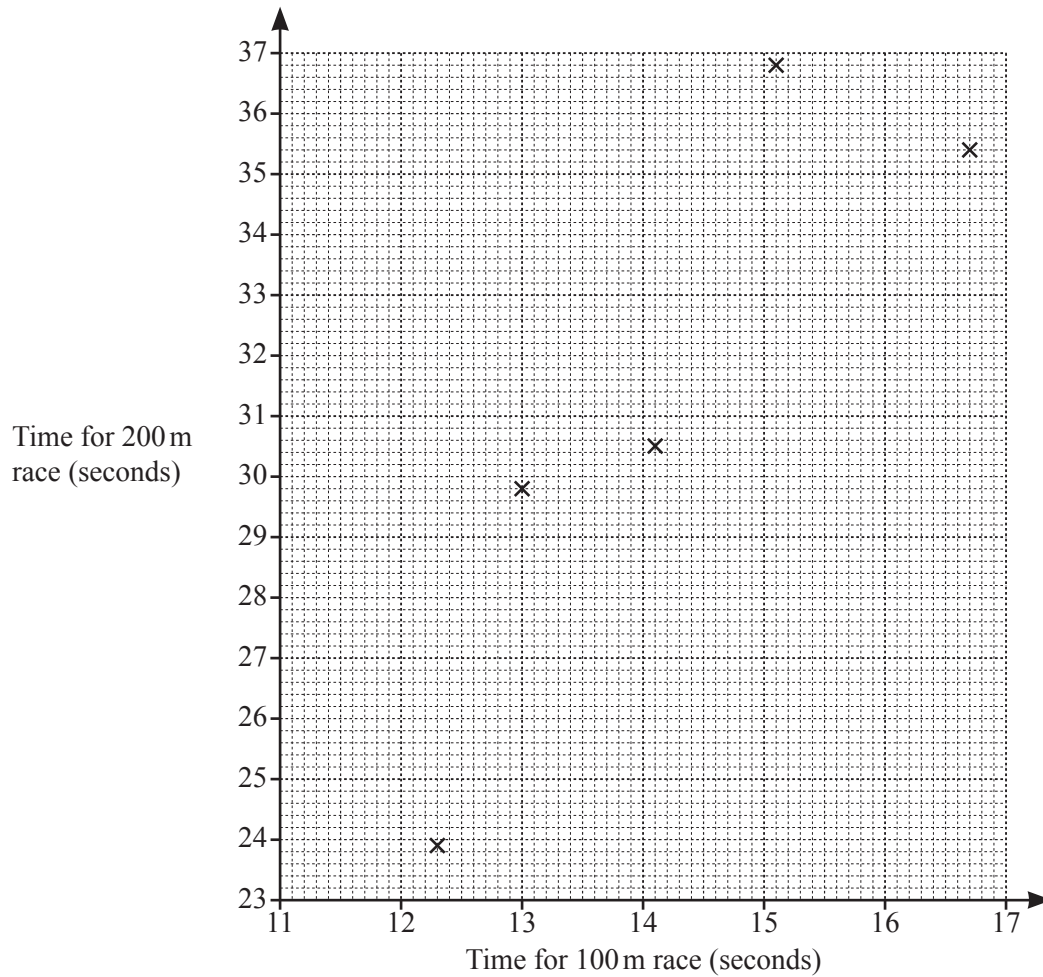
Calculate her monthly income in 2016.

\$ [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.

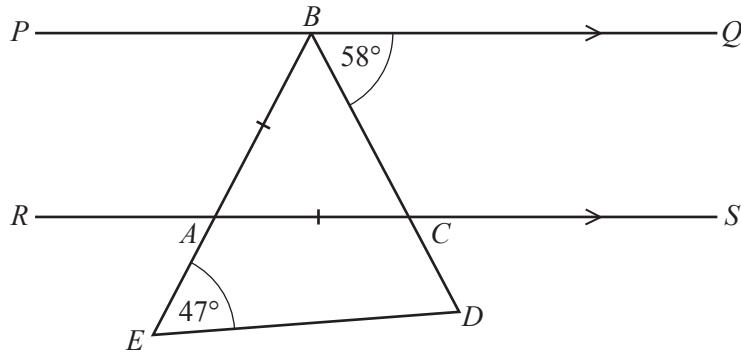
[1]

- (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.
 $AB = AC$, $\angle QBC = 58^\circ$ and $\angle AED = 47^\circ$.

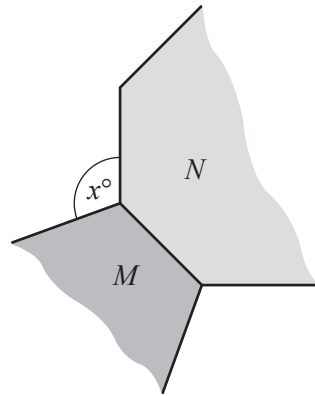
- (i) Calculate $\angle BAC$, giving reasons for each step in your working.

[3]

- (ii) Calculate $\angle CDE$.

$\angle CDE = \dots\dots\dots$ [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 .

$x = \dots\dots\dots$ [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 $3(x-4) + 5 = 7$.

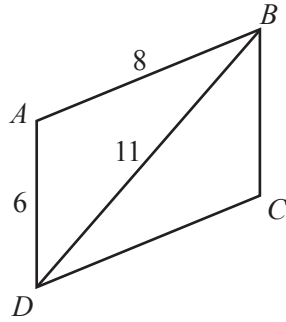
$x =$ [2]

(c) Solve $3t^2 + 5t - 4 = 0$.

Show all your working and give your answers correct to 2 decimal places.

$t = \dots\dots\dots$ or $t = \dots\dots\dots$ [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]

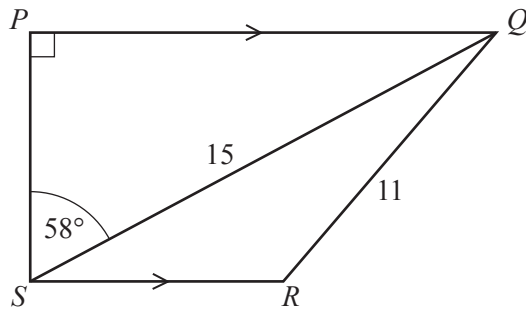
- (ii) Measure $\angle DAB$.

 $\angle DAB = \dots\dots\dots$ [1]

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

Draw and measure AE .
 $AE = \dots\dots\dots$ cm [1]

(b)

NOT TO
SCALE

$PQRS$ is a trapezium with PQ parallel to SR and $\angle SPQ = 90^\circ$.
 $SQ = 15$ cm, $QR = 11$ cm and $\angle PSQ = 58^\circ$.

(i) Calculate PS .

$PS = \dots\dots\dots$ cm [2]

(ii) Calculate the obtuse angle SRQ .

Angle $SRQ = \dots\dots\dots$ [4]

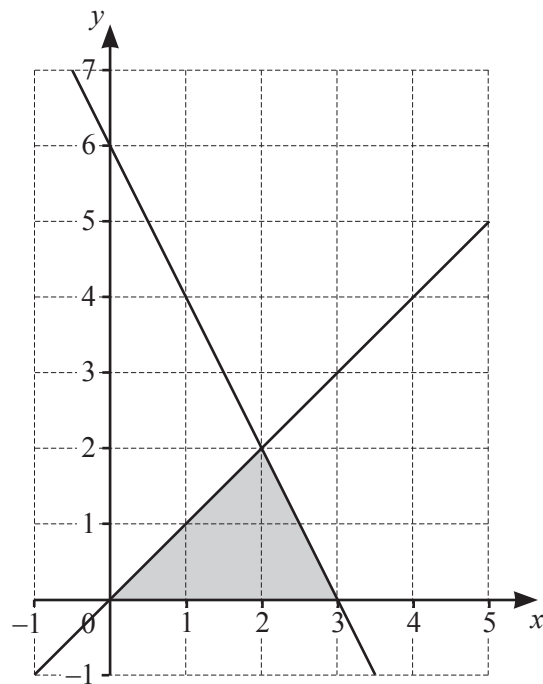
- 6 (a) (i) Solve the inequality $10 < 3(x+1) \leq 24$.

..... [3]

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

..... [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
$20 < d \leq 25$	6
$25 < d \leq 30$	16
$30 < d \leq 35$	25
$35 < d \leq 40$	18
$40 < d \leq 45$	13
$45 < d \leq 50$	2

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

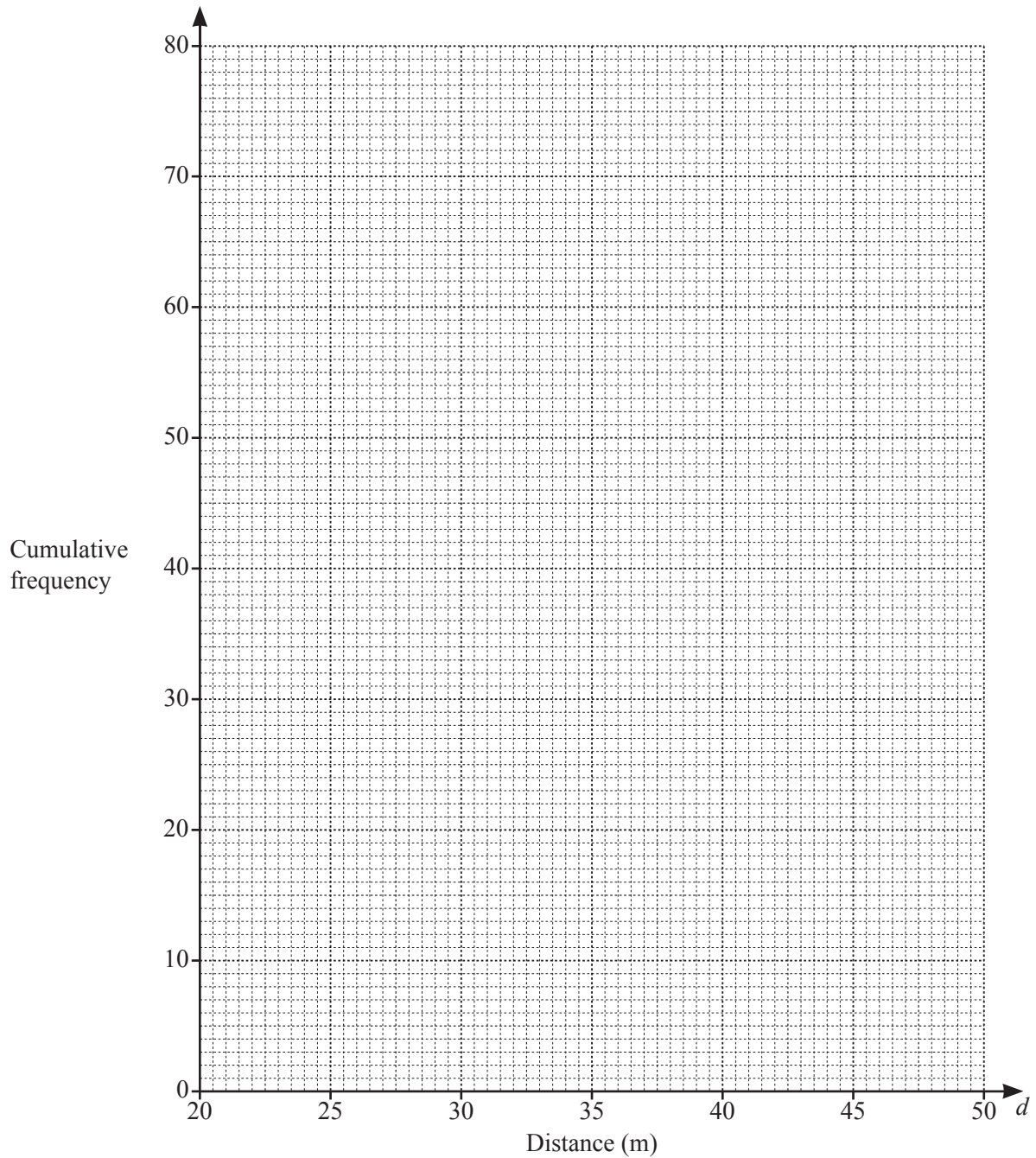
Find the probability that she threw the javelin 30 metres or less.

..... [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.



(d) Use your graph to find an estimate for

(i) the median,

..... m [1]

(ii) the interquartile range.

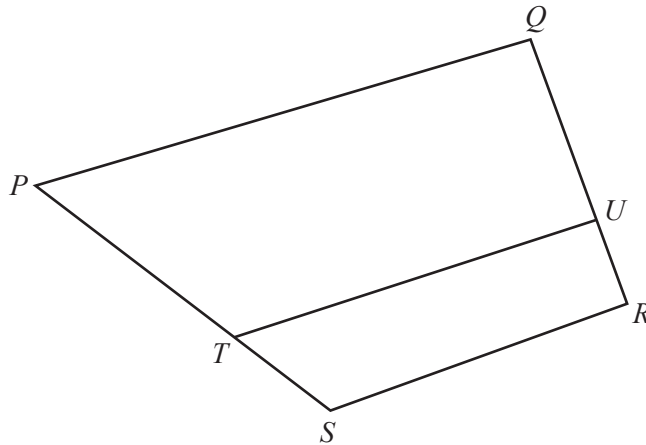
..... m [2]

(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 $\mathbf{p}$ and/or $\mathbf{q}$,

(a) $\overrightarrow{PS}$,

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

(b) $\overrightarrow{SR}$.

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

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

$\dots\dots\dots$ because $\dots\dots\dots$

$\dots\dots\dots$ [2]

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

$\dots\dots\dots : \dots\dots\dots$ [2]

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

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

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

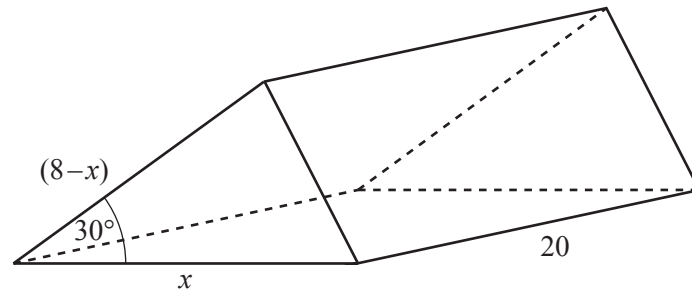
(ii) Find $|\overrightarrow{BC}|$.

..... [2]

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

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

10

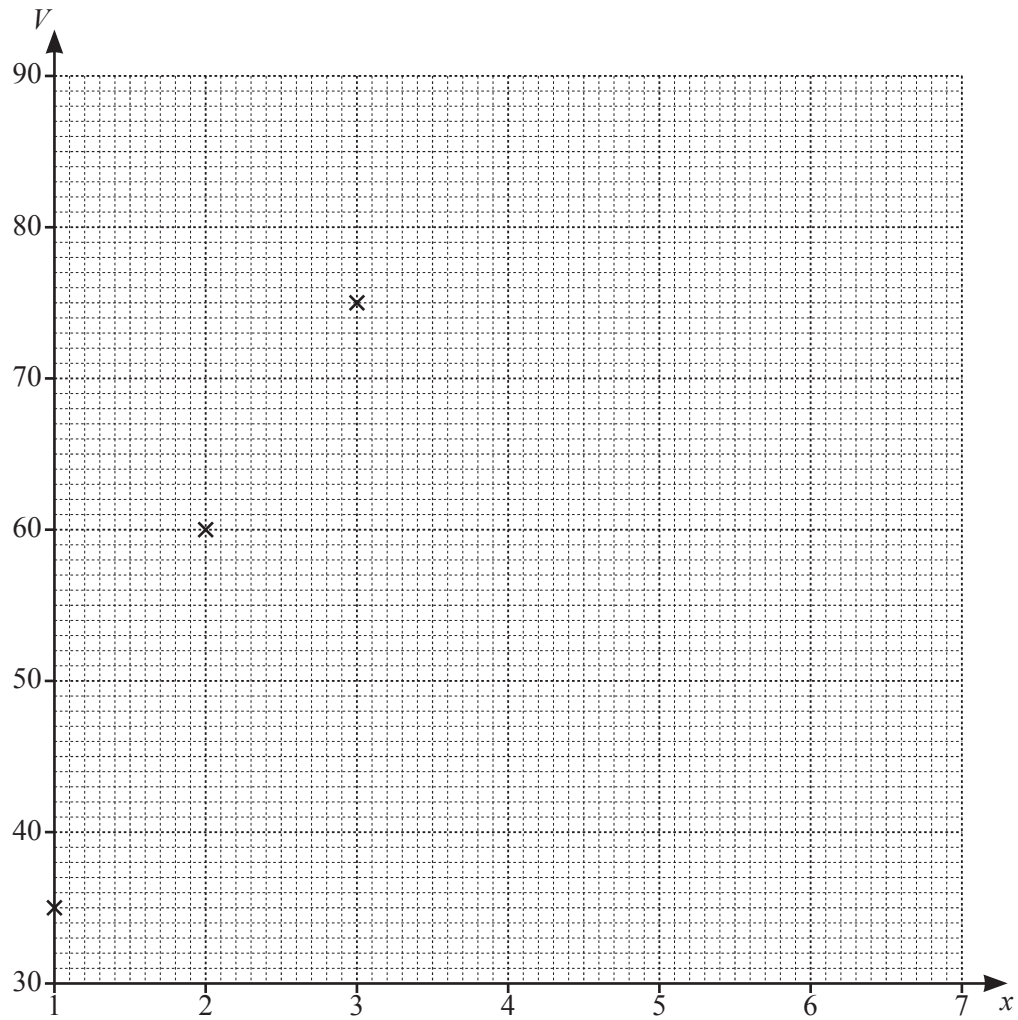


The diagram shows a triangular prism.
All lengths are in centimetres.

- (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 $1 \leq x \leq 7$.
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 .

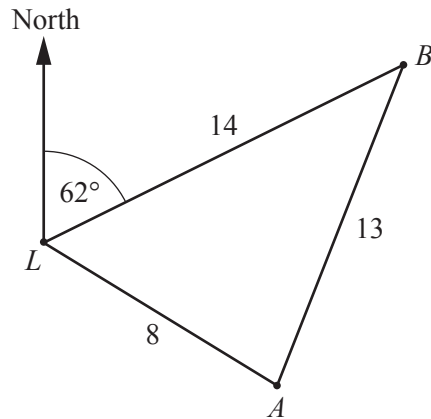
$x = \dots\dots\dots$ or $x = \dots\dots\dots$ [2]

- (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.

$x = \dots\dots\dots$ [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 $\angle BCA = 90^\circ$.
 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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