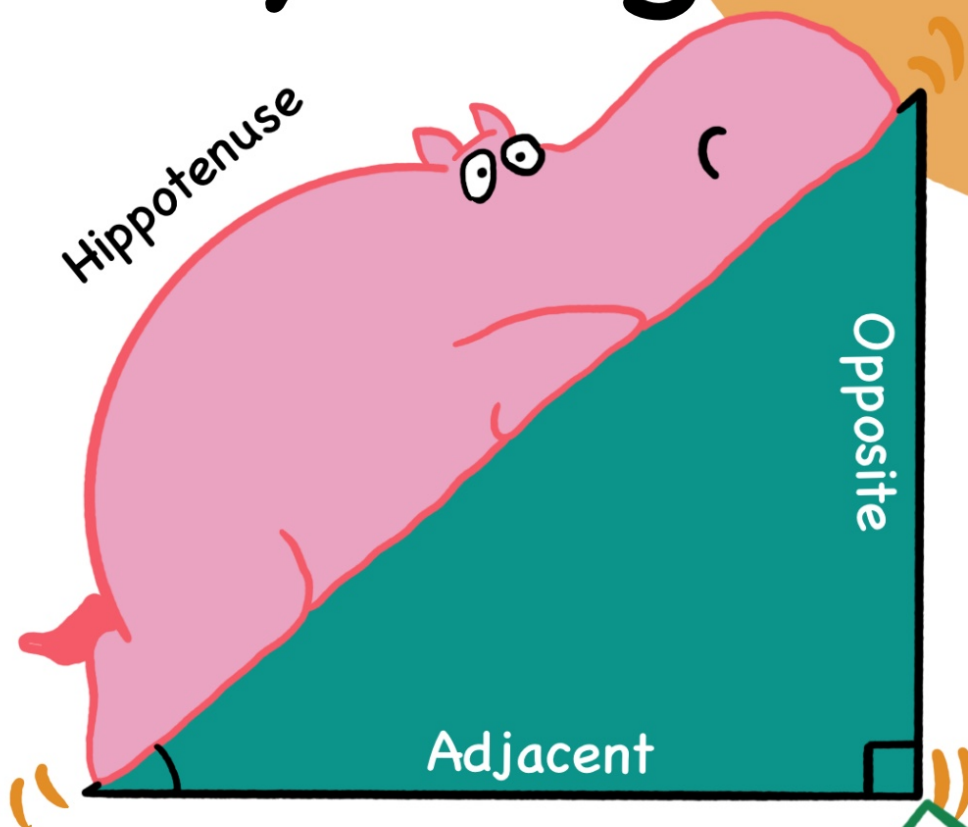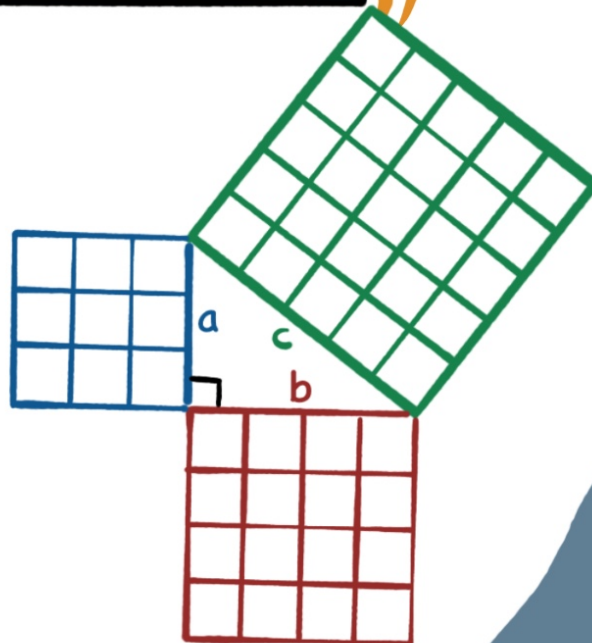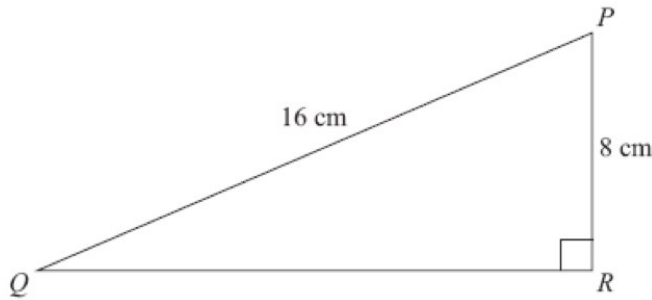# Pythagoras

Hippotenuse

Opposite

Adjacent

$$a^2 + b^2 = c^2$$
$$3^2 + 4^2 = 5^2$$
$$9 + 16 = 25$$

a

c

b

1.

Diagram **NOT**
accurately drawn

PQR is a right-angled triangle.
PQ = 16 cm.
PR = 8 cm.

Calculate the length of *QR*.
Give your answer correct to 2 decimal places.

$$QR^2 = 16^2 - 8^2$$
$$QR = \sqrt{16^2 - 8^2}$$
$$= 13.86 \text{ cm}$$

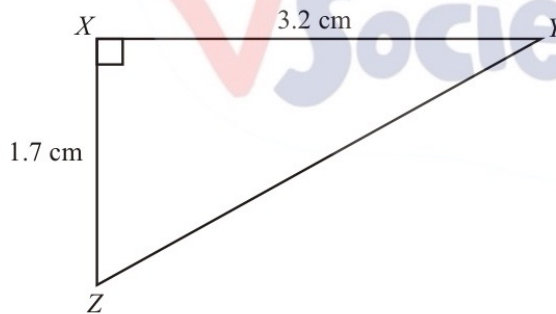..........13.86.............. cm

(3 marks)

2.

Diagram **NOT**
accurately drawn

XYZ is a right-angled triangle.
XY = 3.2 cm.
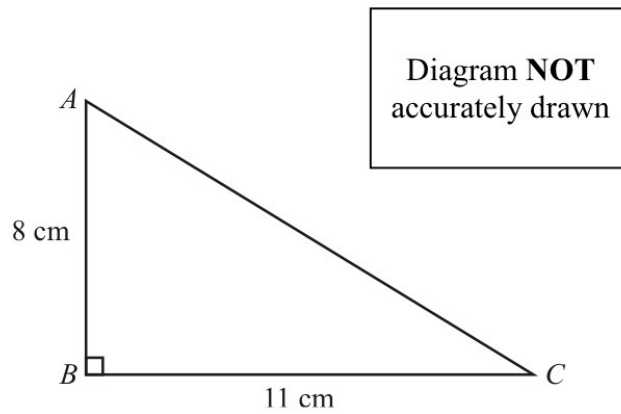*XZ* = 1.7 cm.

Calculate the length of *YZ*.

Give your answer correct to 3 significant figures.

$$YZ^2 = 1.7^2 + 3.2^2$$
$$YZ = \sqrt{1.7^2 + 3.2^2}$$
$$= 3.62 \text{ cm}$$

..........3.62.............. cm

(3 marks)

The Maths Society

3.

A

8 cm

B 11 cm C

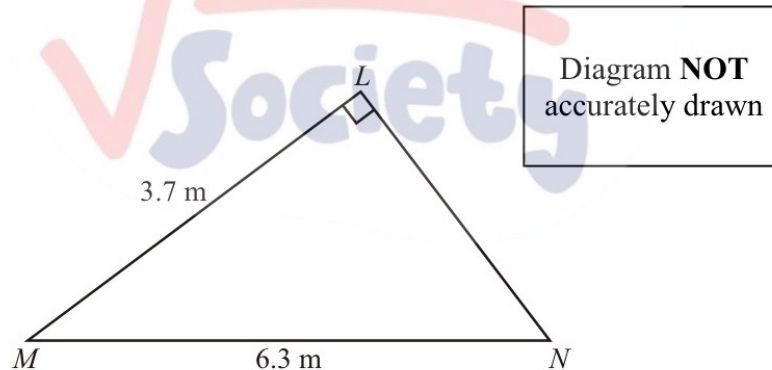Diagram **NOT** accurately drawn

ABC is a right-angled triangle.

AB = 8 cm,
BC = 11 cm.

Calculate the length of *AC*.
Give your answer correct to 3 significant figures.

$$AC^2 = 8^2 + 11^2$$
$$AC = \sqrt{8^2 + 11^2}$$
$$= 13.6 \text{ cm}$$

........................13.6........................ cm

(3 marks)

4.

L

3.7 m

M 6.3 m N

Diagram **NOT** accurately drawn

Angle *MLN* = 90°.
LM = 3.7 m.
MN = 6.3 m.

Work out the length of *LN*.
Give your answer correct to 3 significant figures.

$$LN^2 = 6.3^2 - 3.7^2$$
$$LN = \sqrt{6.3^2 - 3.7^2}$$
$$= 5.10 \text{ m}$$

LN = ...5.10........................ m
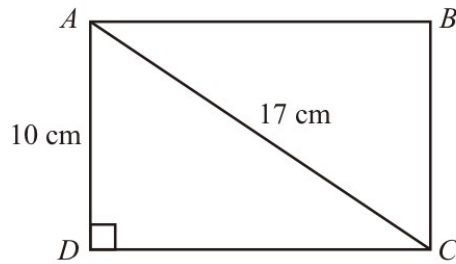
(3 marks)

The Maths Society

5.

Diagram **NO**T accurately drawn

ABCD is a rectangle.
AC = 17 cm.
AD = 10 cm.

Calculate the length of the side *CD*.
Give your answer correct to one decimal place.

$$CD^2 = 17^2 - 10^2$$
$$CD = \sqrt{17^2 - 10^2}$$
$$= 13.7 cm$$

.................13.7................. cm

(3 marks)

6.

Diagram **NOT** accurately drawn

The diagram shows three cities.
Norwich is 168 km due East of Leicester.
York is 157 km due North of Leicester.

Calculate the distance between Norwich and York.
Give your answer correct to the nearest kilometre.

$$x^2 = 157^2 + 168^2$$
$$x = \sqrt{157^2 + 168^2}$$
$$= 229.9$$
$$= 230 km$$

.................130................. km
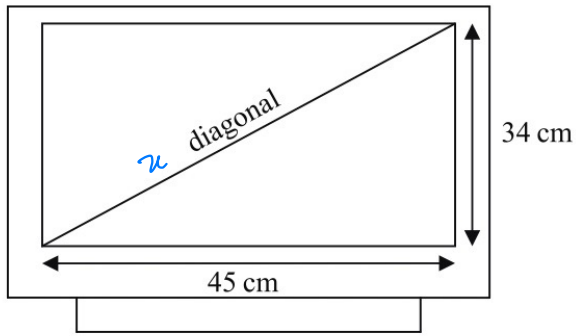
(3 marks)

The Maths Society

7.

Diagram **NOT**
accurately drawn

A rectangular television screen has a width of 45 cm and a height of 34 cm.

Work out the length of the diagonal of the screen.
Give your answer correct to the nearest centimetre.

$$x^2 = 45^2 + 34^2$$

$$x = \sqrt{45^2 + 34^2}$$

$$= 56 \, cm$$

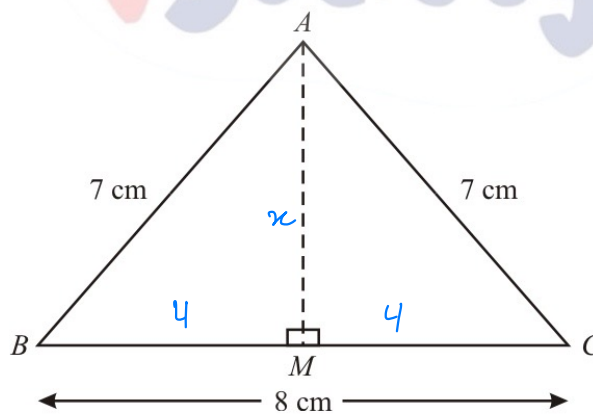........................56................. cm

(4 marks)

8.

Diagram **NOT** accurately drawn

Work out the length, in centimetres, of *AM*.
Give your answer correct to 2 decimal places.

$$x^2 = 7^2 - 4^2$$

$$x = \sqrt{7^2 - 4^2}$$

$$= 5.74 \, cm$$

....................5.74............. cm

(3 marks)

The Maths Society

9.

A ——— 2.1 m ——— D

1.9 m   1.9   3.2 m
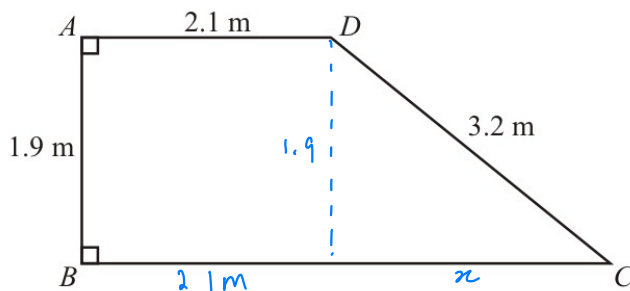
B   2.1 m x C

Diagram **NOT** accurately drawn

ABCD is a trapezium.
AD is parallel to *BC*.
Angle *A* = angle *B* = 90.
AD = 2.1 m,   *AB* = 1.9 m,   *CD* = 3.2 m.

Work out the length of *BC*.
Give your answer correct to 3 significant figures.

$$x^2 = 3.2^2 - 1.9^2$$

$$x = \sqrt{3.2^2 - 1.9^2}$$

$$= 2.5748$$

$$BC = 2.1 + 2.5748$$

$$= 4.67 \, m$$

.... 4.67 .... m

(4 marks)
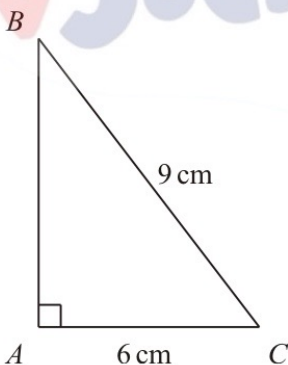
10.

B

9 cm

A   6 cm   C

Diagram **NOT** accurately drawn

ABC is a right-angled triangle.

AC = 6 cm.
BC = 9 cm.

Work out the length of *AB*.
Give your answer correct to 3 significant figures.

$$AB^2 = 9^2 - 6^2$$

$$AB = \sqrt{9^2 - 6^2}$$

$$= 6.71 \, cm$$

.... 6.71 .... cm

(3 marks)

The Maths Society

11.

B

10 cm

A

20 cm

C
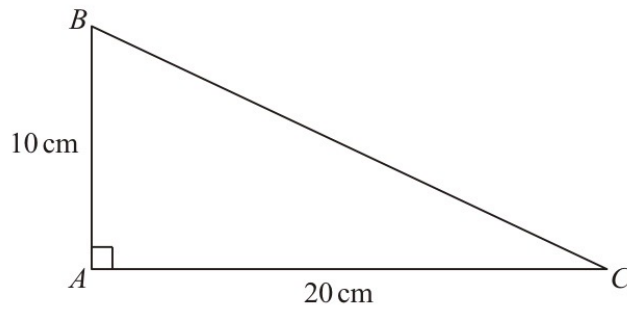
Diagram **NOT** accurately drawn

In triangle *ABC*,

AB = 10 cm
AC = 20 cm
angle *BAC* = 90°

Work out the length of *BC*.
Give your answer correct to 3 significant figures.
You must state the units in your answer.

$BC^2 = 10^2 + 20^2$

$BC = \sqrt{10^2 + 20^2}$

$= 22.4 \text{ cm}$

............22.4............ ......cm.......

(4 marks)

12.

X

5.6 cm

Y

10.5 cm

Z
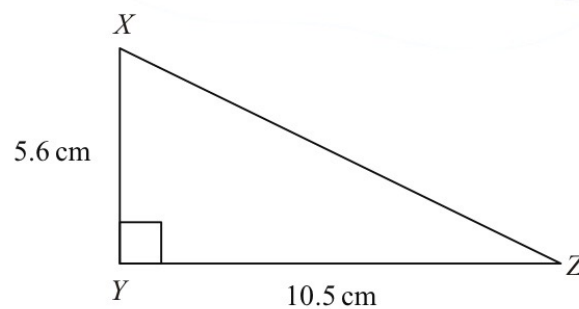
Diagram **NOT**
accurately drawn

In the triangle *XYZ*

XY = 5.6 cm

YZ = 10.5 cm

angle *XYZ* = 90

Work out the length of *XZ*.

$XZ^2 = 5.6^2 + 10.5^2$

$XZ = \sqrt{5.6^2 + 10.5^2}$

$= 11.9 \text{ cm}$

............11.9............ cm

(3 marks)

The Maths Society

13. *ABCD* is a trapezium.

A

6

10 cm

9 cm

y

D

3 cm

B

8

C
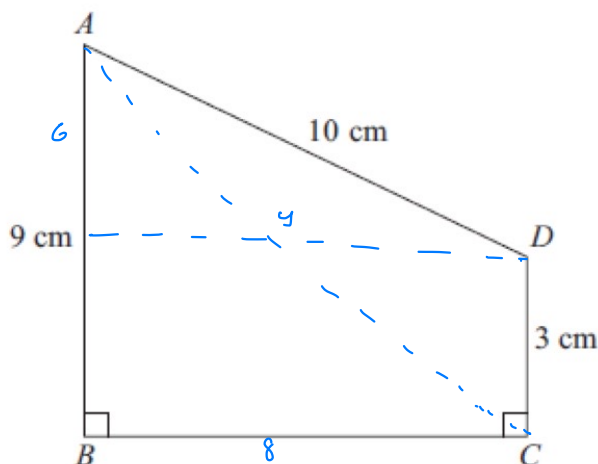
$AD = 10$ cm
$AB = 9$ cm
$DC = 3$ cm
Angle ABC = angle $BCD = 90°$

Calculate the length of *AC*.
Give your answer correct to 3 significant figures.

$$y^2 = 10^2 - 6^2$$
$$y = \sqrt{10^2 - 6^2}$$
$$= 8cm$$

$$AC^2 = 9^2 + 8^2$$
$$AC = \sqrt{9^2 + 8^2}$$
$$= 12.0 cm$$

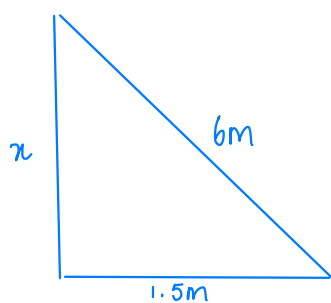.................... 12.0 .... cm

(5 marks)

14. A ladder is 6 m long.
The ladder is placed on horizontal ground, resting against a vertical wall.

The instructions for using the ladder say that the bottom of the ladder must **not** be closer than 1.5 m from the bottom of the wall.

How far up the wall can the ladder reach?
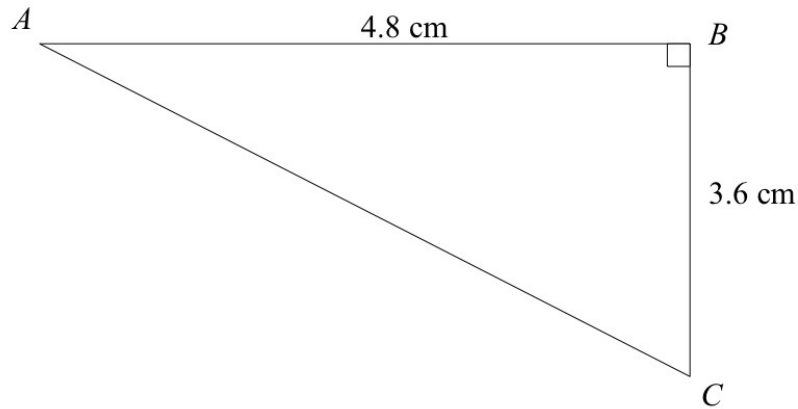Give your answer correct to 1 decimal place.

x

6m

1.5m

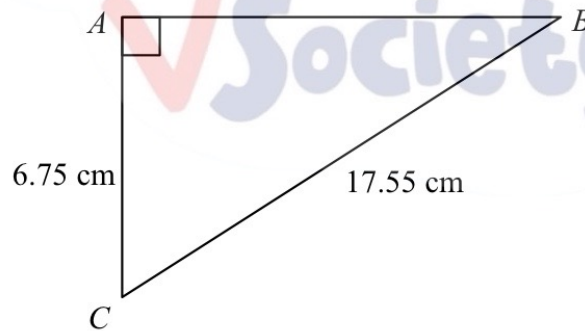$$x^2 = 6^2 - 1.5^2$$
$$x = \sqrt{6^2 - 1.5^2}$$
$$= 5.8m$$

.... 5.8m .... m

(4 marks)

The Maths Society

1

A ————— 4.8 cm ————— B
3.6 cm
C

Calculate the length of AC.

$$AC^2 = 4.8^2 + 3.6^2$$
$$AC = \sqrt{4.8^2 + 3.6^2}$$
$$= 6 \text{ cm}$$

…..............6........................cm

(Total for question 1 is 3 marks)

2

A
B
6.75 cm
17.55 cm
C

Calculate the length of AB.

$$AB^2 = 17.55^2 - 6.75^2$$
$$AB = \sqrt{17.55^2 - 6.75^2}$$
$$= 16.2 \text{ cm}$$

…..............16.2........................cm

(Total for question 2 is 3 marks)
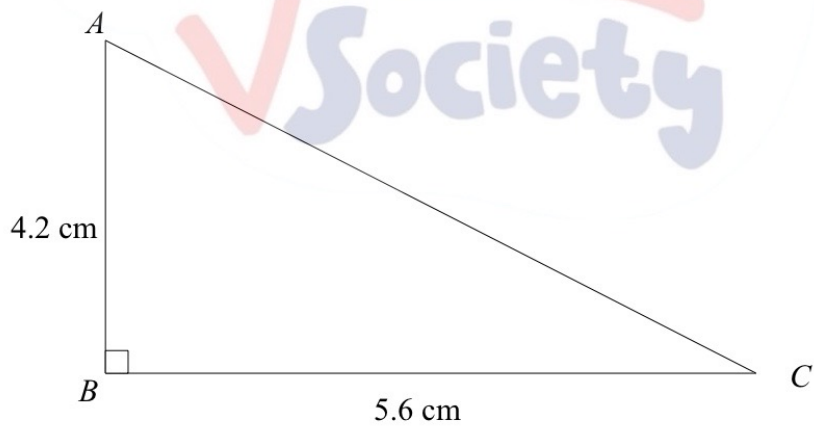
The Maths Society

3

A

14 cm

6 cm

B

C
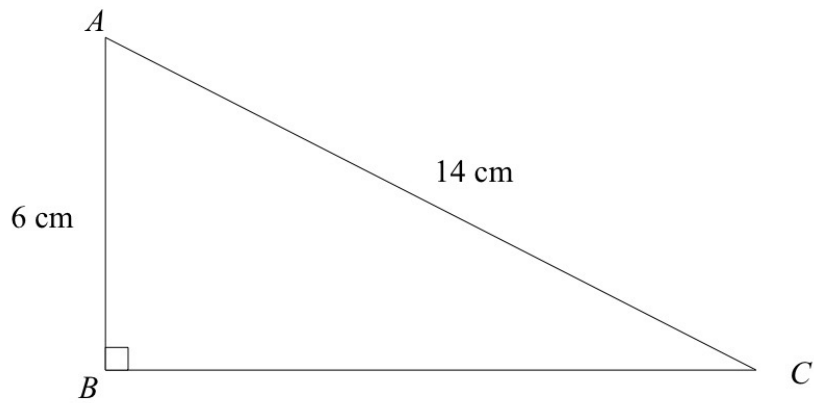
Calculate the length of BC.
Give your answer to 1 decimal place.

$$BC^2 = 14^2 - 6^2$$
$$BC = \sqrt{14^2 - 6^2}$$
$$= 12.6 \ cm$$

…..............................12.6..........................cm

(Total for question 3 is 3 marks)

4

A

4.2 cm

B

5.6 cm

C

Calculate the length of AC.

$$AC^2 = 4.2^2 + 5.6^2$$
$$AC = \sqrt{4.2^2 + 5.6^2}$$
$$= 7 \ cm$$

…...........7...........................cm

(Total for question 4 is 3 marks)

The Maths Society

5 Calculate the length of the *AD*.
Give your answer to 3 significant figures.

C ———10 m——— D

19 m

B   14 m   A
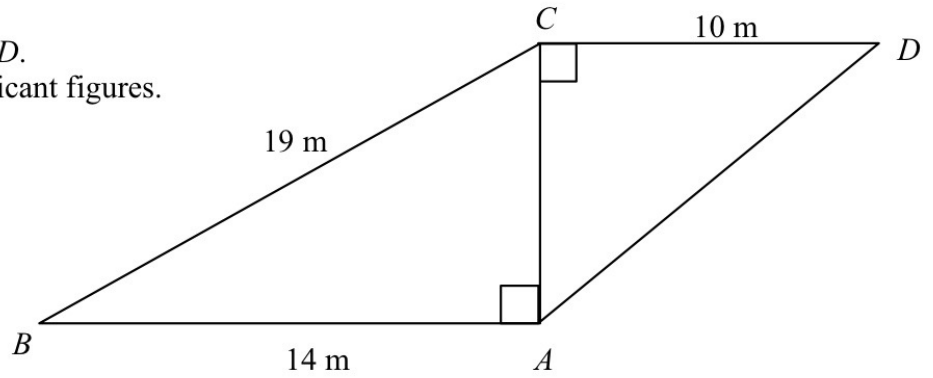
$$AC^2 = 19^2 - 14^2$$
$$AC = \sqrt{19^2 - 14^2}$$

$$= 12.84523528$$
$$AD^2 = 10^2 + 12.8^2$$
$$AD = \sqrt{10^2 + 12.8^2}$$

........16.3........m

$$= 16.3m$$

(Total for question 5 is 4 marks)

---

6 Calculate the length of the *AB*.
Give your answer to 3 significant figures.

B

9.5 cm

A   C

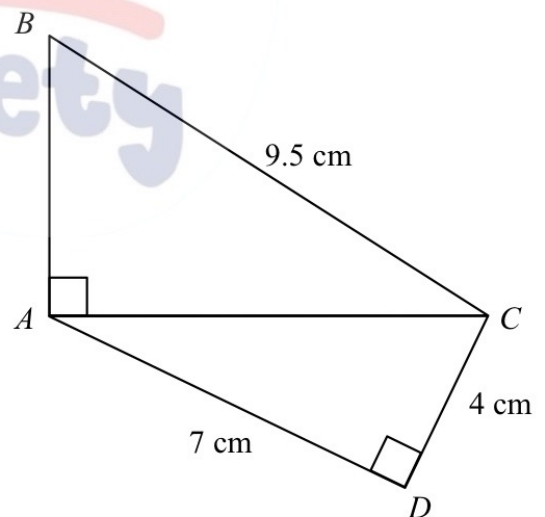7 cm   4 cm

D

$$AC^2 = 7^2 + 4^2$$
$$AC = \sqrt{7^2 + 4^2}$$

$$= 8.06$$

$$AB^2 = 9.5^2 - 8.06^2$$
$$AB = \sqrt{9.5^2 - 8.06^2}$$

$$= 5.02 cm$$

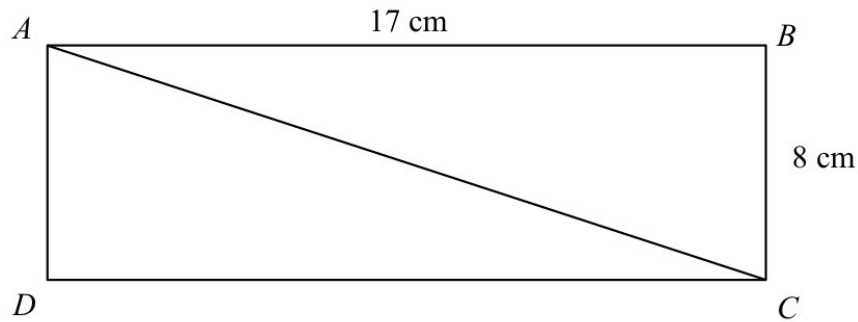........5.02........cm

(Total for question 5 is 4 marks)

The Maths Society

7

A 17 cm B

8 cm

D C

ABCD is a rectangle .
Calculate the length of the diagonal *AC*.

Give your answer correct to 1 decimal place.

$$AC^2 = 17^2 + 8^2$$
$$AC = \sqrt{17^2 + 8^2}$$
$$= 18.8 cm$$

.... 18.8 ....cm

(Total for question 7 is 3 marks)

---

8   *ABCD* is a trapezium.

Calculate the length of *BC*.

$$y^2 = 17^2 - 15^2$$
$$y = \sqrt{17^2 - 15^2}$$

$$= 8 cm$$

$$BC = 12 - 8$$

$$= 4 cm$$

A 15 cm B

12 cm   ?

15cm

y 17 cm

8cm

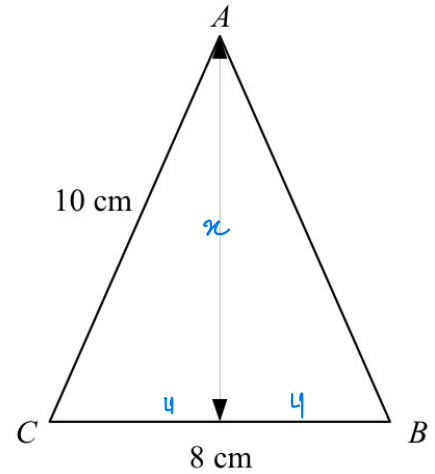D C
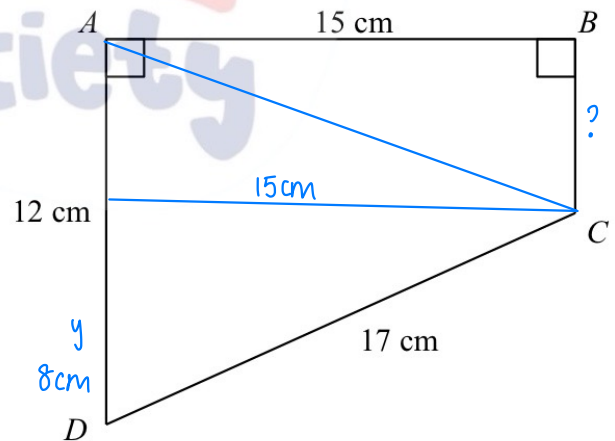
.... 4 ....cm

(Total for question 8 is 3 marks)

9 *ABC* is an isosceles triangle.

Calculate the perpendicular height of *ABC*.
Give your answer correct to 3 significant figures..

$x^2 = 10^2 - 4^2$

$x = \sqrt{10^2 - 4^2}$

$= 9.17 cm$

10 cm

x

C — 4 — 4 — *B*

8 cm

A
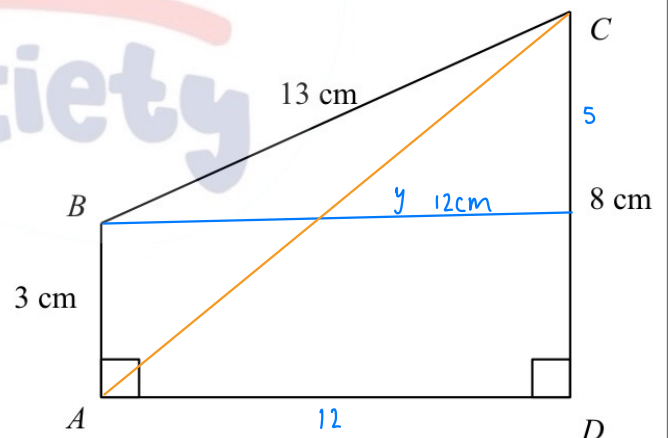
…........................9.17...........................cm

(Total for question 9 is 3 marks)

10 *ABCD* is a trapezium.

Calculate the length of *AC*.
Give your answer correct to 3 significant figures..

$y^2 = 13^2 - 5^2$

$y = \sqrt{13^2 - 5^2}$

$= 12 cm$

$AC^2 = 12^2 + 5^2$

$AC = \sqrt{12^2 + 5^2}$

$= 13 cm$

C

13 cm

5

B y 12cm   8 cm

3 cm

A   12   *D*

…........................13...........................cm

(Total for question 10 is 4 marks)

The Maths Society

11   A ship leaves point A and sails for 3.7 km due North.
The ship then sails for 2.4 km due East to reach point B.

Calculate the the shortest distance between point A and point B.
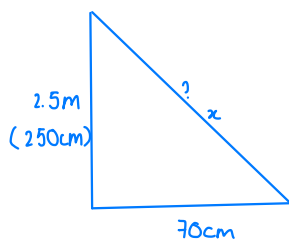Give your answer correct to 1 decimal place.
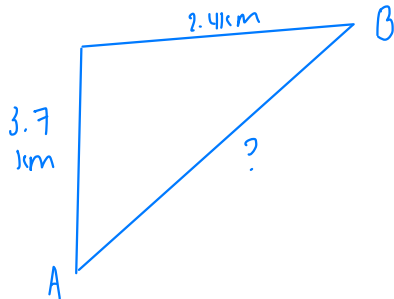
$$AB^2 = 3.7^2 + 2.4^2$$

$$AB = \sqrt{3.7^2 + 2.4^2}$$

$$= 4.4 \, km$$

..................................4.4..................................km

(Total for question 11 is 3 marks)

---

12   A ladder reaches 2.5 m up a vertical wall.
The base of the ladder is 70 cm from the base of the wall on a horizontal ground.

Find the length of the ladder.

2.5m
(250cm)   ? x

70cm

$$x^2 = 250^2 + 70^2$$

$$x = \sqrt{250^2 + 70^2}$$

$$= 259.6 \, cm$$

$$= 2.6 \, m$$

..................2.6m..................................

(Total for question 12 is 4 marks)

The Maths Society

13 *ABCD* is a square.
The diagonal of the square is 8 m.

Calculate the perimeter of the square.
Give your answer correct to one decimal place.

$$x^2 + x^2 = 8^2$$
$$2x^2 = 64$$
$$x^2 = 32$$
$$x = \sqrt{32}$$
$$= 5.7 \text{ m}$$

$$P = 5.7 \times 4$$
$$= 22.8$$

A — — — B

8 m x

D x C
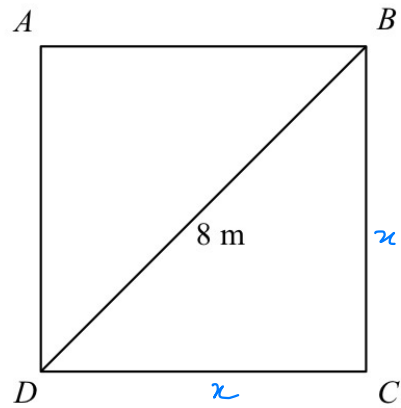
…...............22.8...................m

(Total for question 13 is 3 marks)

14 A television has a diagonal length of 50 inches.

The ratio of the length of the television to the width of the television is 4:3

Calculate the length and the width of the television.
Give your answers correct to 1 decimal place.

$4x$ 50 $3x$
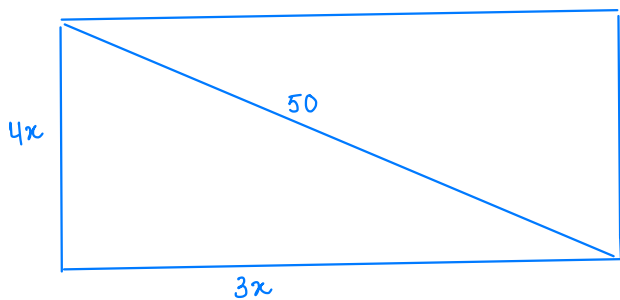
$$4x^2 + 3x^2 = 50^2$$
$$7x^2 = 2500$$
$$x^2 = 357.14..$$
$$x = \sqrt{357.14..}$$
$$= 18.9$$

$(l)\ 4x = 18.9 \times 4$
$$= 75.6$$
$(w)\ 3x = 18.9 \times 3 = 56.7$

Length …..............75.6.....................… inches

Width …....56.7........................... inches

(Total for question 14 is 3 marks)

The Maths Society

1. Shown below is a right angled triangle.

6cm

x

8cm
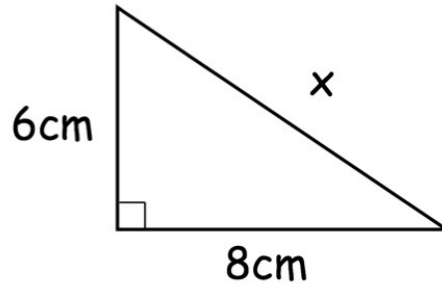
Not drawn accurately

Use Pythagoras' theorem to work out the value of x.

$$x^2 = 6^2 + 8^2$$
$$x = \sqrt{36 + 64}$$
$$= \sqrt{100}$$
$$= 10 \text{ cm}$$

...........10.......... cm

(3)

2.

Not drawn accurately

A

8cm

B

15cm

C
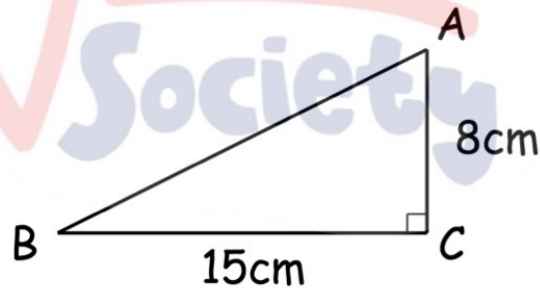
ABC is a right angled triangle.

AC = 8cm
BC = 15cm

Calculate the length of AB.

$$AB^2 = 15^2 + 8^2$$
$$AB = \sqrt{225 + 64}$$
$$= \sqrt{289}$$
$$= 17 \text{ cm}$$

...........17.......... cm

(3)

The Maths Society

3.

Not to scale

A

20cm

6cm

B   C
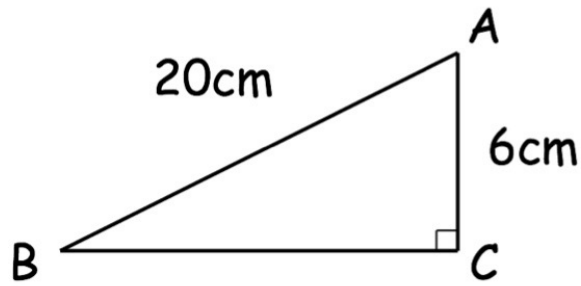
ABC is a right-angled triangle.

AC = 6cm
AB = 20cm

Calculate the length of BC.
Give your answer correct to 1 decimal place.

$$BC^2 = 20^2 - 6^2$$
$$BC = \sqrt{20^2 - 6^2}$$
$$= 19.1 \, cm$$

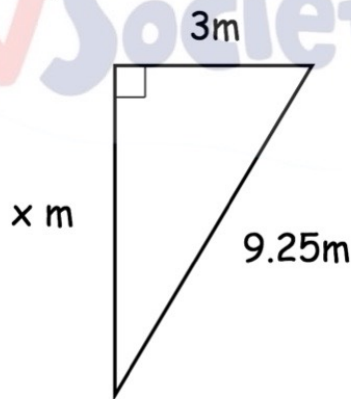....19.1........... cm

(3)

4.   Below is a right-angled triangle.

3m

x m

9.25m

Not drawn
accurately

Work out the value of x
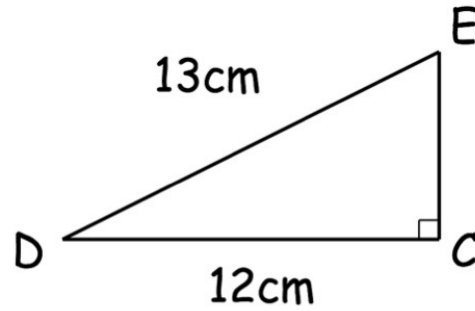
$$x^2 = 9.25^2 - 3^2$$
$$x = \sqrt{9.25^2 - 3^2}$$
$$= 8.75 \, m$$

.....8.75........m

The Maths Society

(3)

5. Shown below is a right angled triangle, CDE.

Not to scale

13cm

E

12cm

D   C

Work out the length of CE.

$$CE^2 = 13^2 - 12^2$$
$$CE = \sqrt{169 - 144}$$
$$= \sqrt{25}$$
$$= 5\,cm$$

.........5.........cm

(3)

6.

A

Not drawn
accurately

7cm

B   C
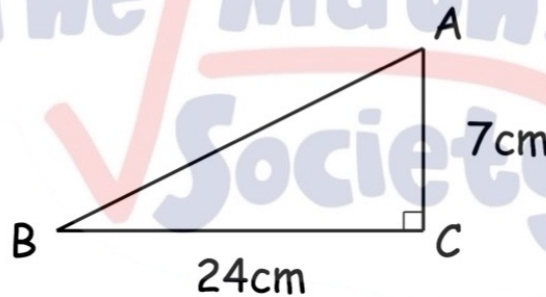
24cm

ABC is a right-angled triangle.

AC = 7cm.
BC = 24cm.

Calculate the length of AB.

$$AB^2 = 7^2 + 24^2$$
$$AB = \sqrt{7^2 + 24^2}$$
$$= 25\,cm$$

.........25......... cm

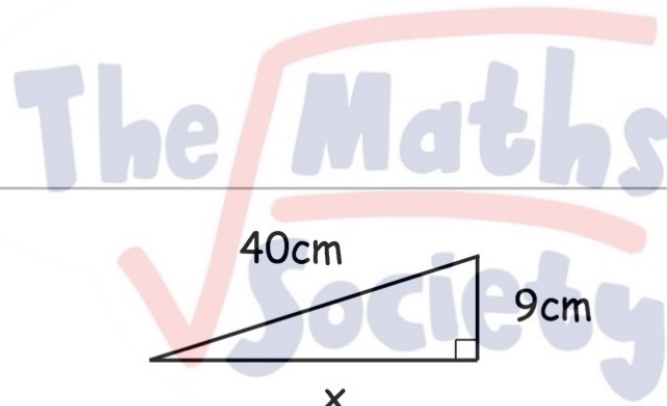**The Maths Society**   **(3)**
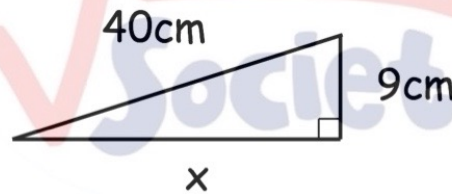
7. Shown is a right-angled triangle.

Not to scale

7cm

x

10cm
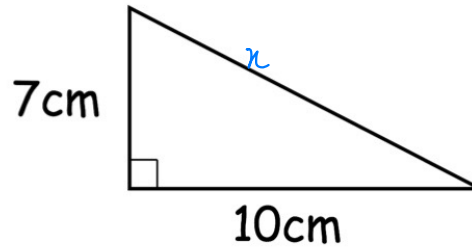
Work out the perimeter of the triangle
Give your answer to 1 decimal place.

$x^2 = 7^2 + 10^2$

$x = \sqrt{49 + 100}$

$= 12.2cm$

$P = 7 + 10 + 12.2$

$= 29.2cm$

.... 29.2 .... cm

(4)

8.

40cm

9cm

x

Charles says that the length of the missing side is 41cm.
Here is his method:

$$a^2 + b^2 = c^2$$
$$9^2 + 40^2 = x^2$$
$$81 + 1600 = x^2$$
$$x^2 = 1681$$
$$x = 41cm$$

Explain his mistake.

.... $x^2 \neq c^2$ ✓ .... $40^2 = c^2$ ....

....

The Maths Society

(1)

9.
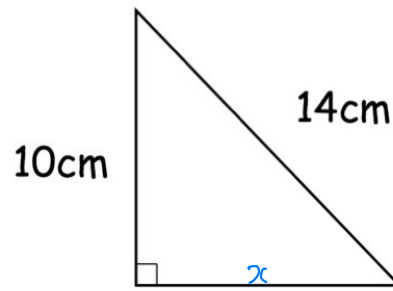
Not drawn to scale
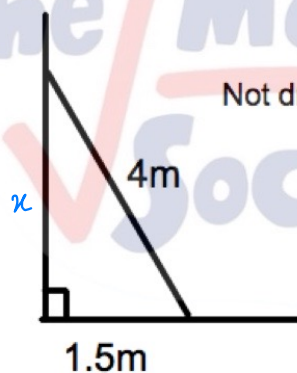
Shown is a right-angled triangle.

Calculate the area of the triangle

$$x^2 = 14^2 - 10^2$$
$$x = \sqrt{14^2 - 10^2}$$
$$= 9.80 \text{ cm}$$

$$\text{area} = \frac{1}{2} \times 9.80 \times 10$$
$$= 49.0 \text{ cm}^2$$

.........49.0......... cm²

(4)

10.

Not drawn to scale

A 4 metre ladder is placed against a vertical wall.
The base of the ladder is 1.5 metres from the base of the wall.
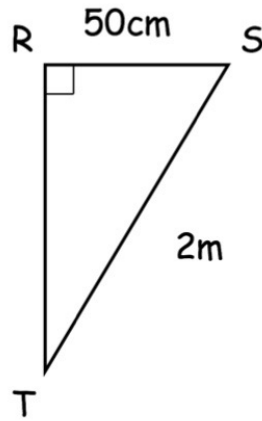
Work out how far the ladder reaches up the wall.

$$x^2 = 4^2 - 1.5^2$$
$$x = \sqrt{4^2 - 1.5^2}$$
$$= 3.7 \text{ m}$$

.........3.7......... m

(3)

The Maths Society

11.

R ——50cm—— S

□

2m

T

RST is a right-angled triangle.

RS is 50cm $= 0.5m$
ST is 2m
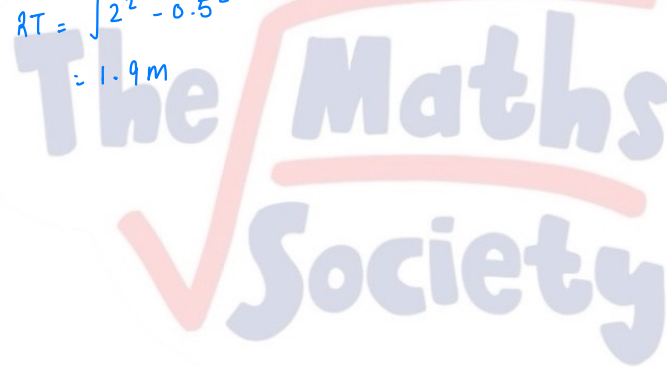
Calculate the length of RT
Give your answer in metres, correct to 1 decimal place.
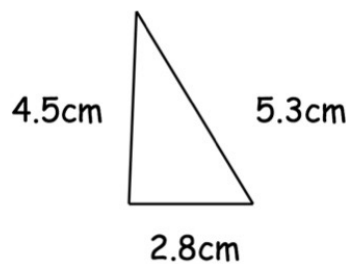
$$RT^2 = 2^2 - 0.5^2$$

$$RT = \sqrt{2^2 - 0.5^2}$$

$$= 1.9 m$$

Not drawn
accurately

..........1.9.......... m

(4)

---

12. Belinda sketches the triangle below.

4.5cm   5.3cm

2.8cm

Not drawn
accurately

Show that the triangle is right-angled.

$$4.5^2 + 2.8^2 = \sqrt{4.5^2 + 2.8^2}$$

$$= 5.3 cm$$

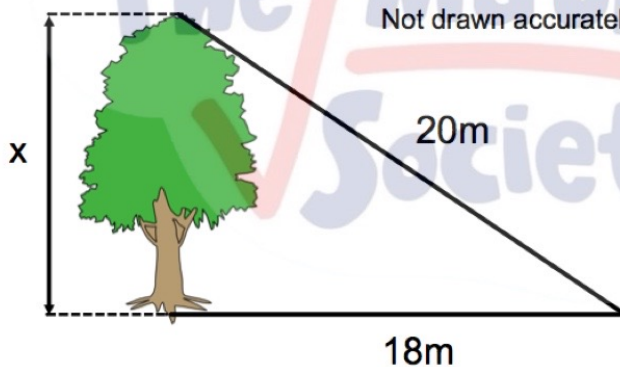**The Maths Society** **(2)**

13. Nicole draws a triangle.

The lengths of the sides are 4cm, 6cm and 7cm.

Is the triangle a right-angled triangle?
Explain your answer.

$4^2 + 6^2 = \sqrt{4^2 + 6^2} = 7.211 cm \neq 7cm$ (not right angled $\triangle$)

(2)

14.

Not drawn accurately

20m

x

18m

The distance from a point on the ground to the base of a tree is 18 metres.
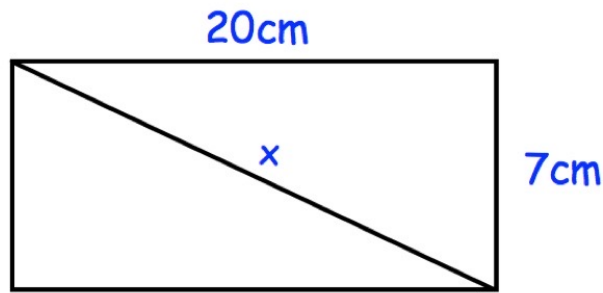The distance from a point on the ground to the top of a tree is 20 metres.

Calculate the height of the tree.
Give the answer correct to 1 decimal place.

$$x^2 = 20^2 - 18^2$$
$$x = \sqrt{20^2 - 18^2}$$
$$= 8.7 m$$

.....8.7..... m

(3)

15. Shown below is a rectangle.

20cm

x

7cm

Find the length of the diagonal, x.

$$x^2 = 20^2 + 7^2$$
$$x = \sqrt{20^2 + 7^2}$$
$$\approx 21.2 cm$$

............21.2............cm

(3)

16. Below is rectangle, ABCD

A   B

5cm   13cm

D   C
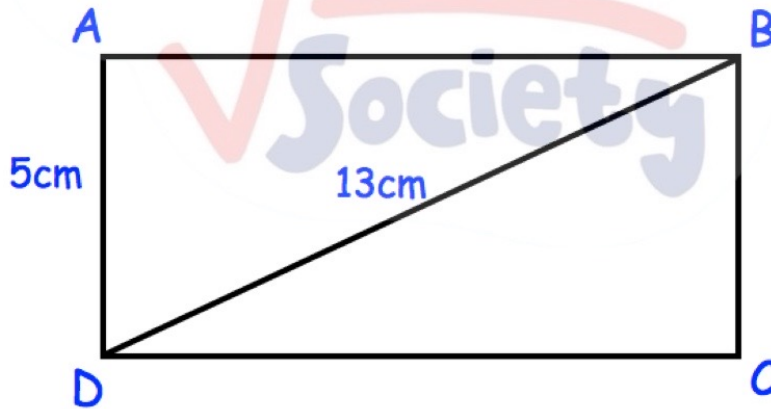
AD = 5cm
BD = 13cm

Calculate the area of rectangle ABCD.

$$AB^2 = 13^2 - 5^2$$
$$AB = \sqrt{13^2 - 5^2}$$
$$= 12cm$$
area $= 12cm \times 5cm$
$$= 60cm^2$$

......60...................cm²

The Maths Society

(3)

17. ABC is an isosceles triangle.
    AB = BC = 8cm
    AC = 5cm

B

Not drawn
accurately

8cm

h

2.5   2.5

A   5cm   **C**
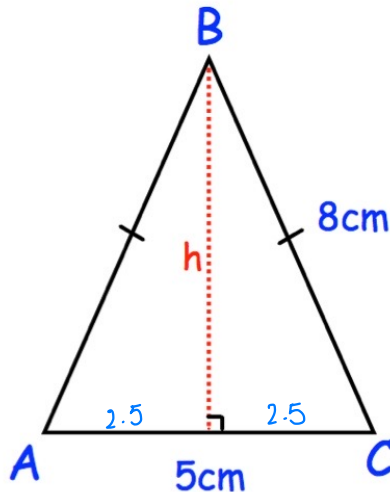
Calculate the height of the triangle, h.

$$h^2 = 8^2 - 2.5^2$$

$$= \sqrt{8^2 - 2.5^2}$$
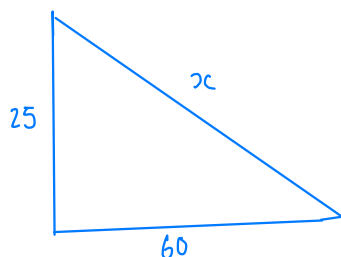
$$= 7.6\ cm$$

...........7.6............cm

(3)

18. A helicopter is flying from Redville to Leek.

The helicopter departs Redville, flies 60 miles **west**, then 25 miles **north** and arrives in Leek.

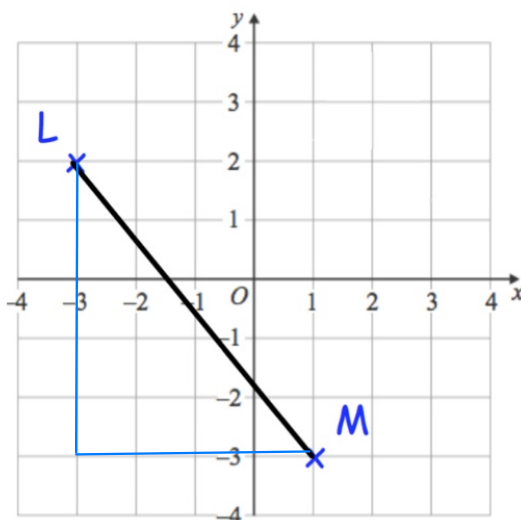Work out the direct distance of Leek from Redville.

25   x

60

$$x^2 = 25^2 + 60^2$$

$$x = \sqrt{25^2 + 60^2}$$

$$= 65\ miles$$

........65............miles

(3)

The Maths Society

19. A line joining the points L (–3, 2) and M(1, –3)

Work out the length of line LM.
Give your answer to 3 decimal places.
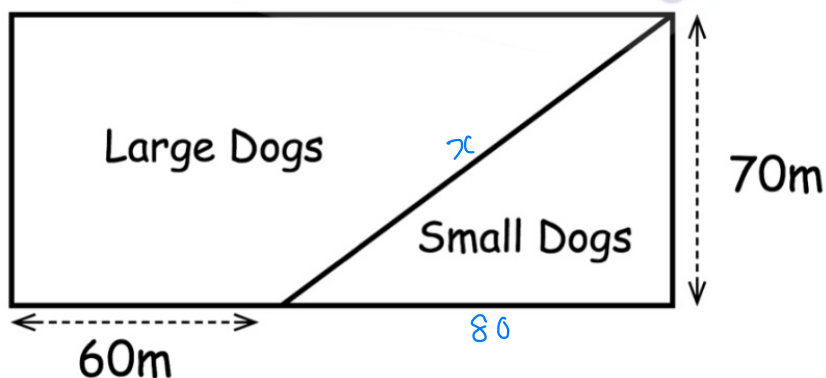
(3)

$$LM^2 = 5^2 + 4^2$$
$$LM = \sqrt{5^2 + 4^2}$$
$$= 6.403 \text{ cm}$$

20. A council are designing a dog park that will be in a rectangular field.
The length of the field is twice the width of the field.

The field will be divided by a wall into two sections, one for large dogs and the other for small dogs.

Large Dogs x
Small Dogs
70m
60m   80
140 - 60 = 80

Work out the length of the wall dividing the two sections.

$$x^2 = 80^2 + 70^2$$
$$x = \sqrt{80^2 + 70^2}$$
$$= 106.3 \text{ m}$$

.........106.3.........m

The Maths Society   **(4)**

21. Below are two triangles, ABC and BCD.
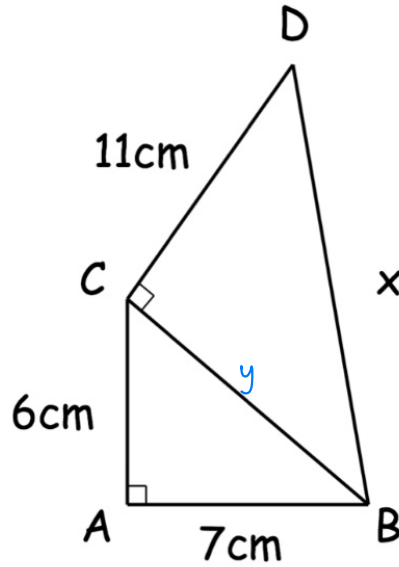
Find the length of BD.

$$BC^2 = 6^2 + 7^2$$
$$BC = \sqrt{6^2 + 7^2}$$
$$= 9.2 \, cm$$
$$BD^2 = 9.2^2 + 11^2$$

$$BD = \sqrt{9.2^2 + 11^2}$$
$$= 14.4 \, cm$$

...........14.4...........cm

(4)

22. A frame is made from wire.
The frame is a trapezium.
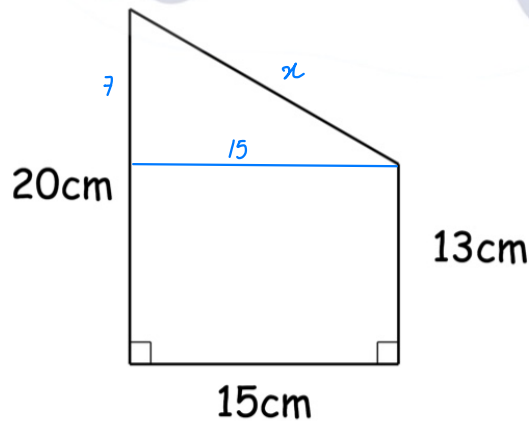
Calculate the total length of wire needed to make the frame.
Give your answer to 2 decimal places.

$$x^2 = 7^2 + 15^2$$
$$x = \sqrt{7^2 + 15^2}$$
$$= 16.55 \, cm$$

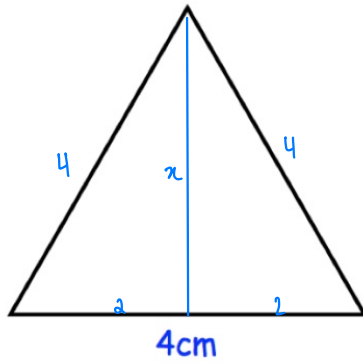$$total = 16.55 + 20 + 13 + 15$$
$$= 64.55 \, cm$$

...........64.55...........cm

The Maths Society   **(4)**

23. Shown below is an equilateral triangle of side length 4cm

Not drawn accurately

4cm

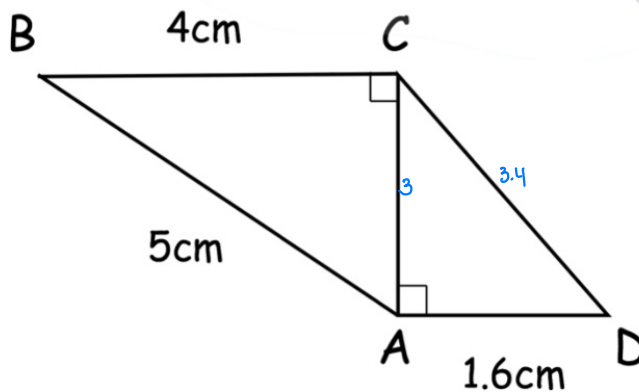Calculate the area of the triangle

$$x^2 = 4^2 - 2^2$$
$$x = \sqrt{4^2 - 2^2}$$
$$= 3.46$$
$$area = \frac{1}{2} \times 4 \times 3.46$$
$$= 6.9 \text{ cm}^2$$

..........6.9..........cm²

(5)

24. Rebecca makes a metal frame for a brooch by joining 5 pieces of wire.

B   4cm   C

Not drawn accurately

3   3.4

5cm

A   1.6cm   D
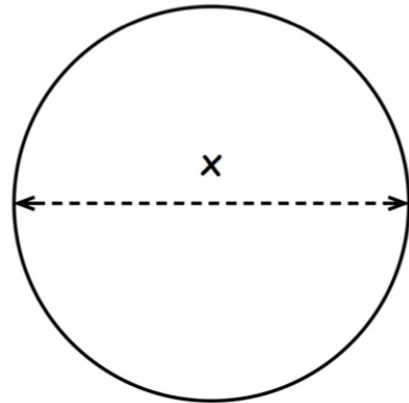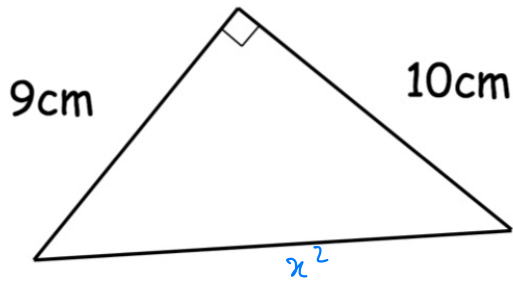
The mass of the wire is 0.489g per centimetre.

Calculate the mass of the metal frame.

$$AC^2 = 5^2 - 4^2$$
$$AC = \sqrt{5^2 - 4^2}$$
$$= 3cm$$
$$DC^2 = 3^2 + 1.6^2$$
$$DC = \sqrt{3^2 + 1.6^2}$$
$$= 3.4 cm$$

total $= 4 + 5 + 3 + 3.4 + 1.6$
$= 17$
mass $= 17 \times 0.489 = 8.313g$

..........8.313..........g
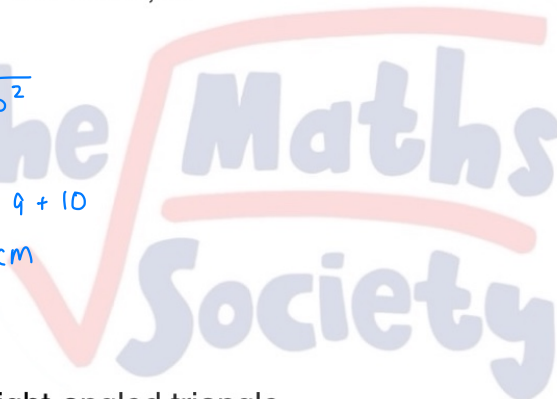
The Maths Society **(5)**

25. Shown below is a right-angled triangle and a circle.

9cm   10cm x^2

x

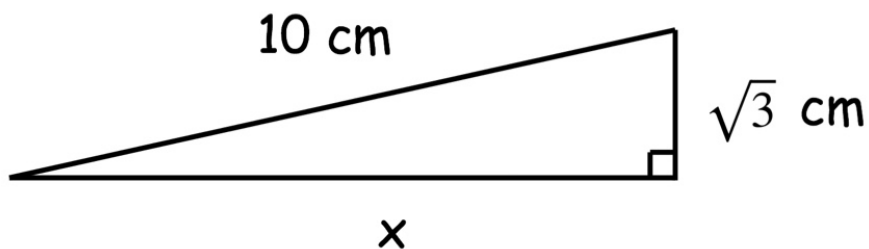The perimeter of the triangle is equal to the circumference of the circle.

Find the diameter of the circle, x.

$$x^2 = 9^2 + 10^2$$
$$x = \sqrt{9^2 + 10^2}$$
$$\approx 13.5 \text{ cm}$$

$$\text{diameter} = 13.5 + 9 + 10$$
$$= 32.5 \text{ cm}$$

..........32.5..........cm

(4)

26. Shown below is a right-angled triangle.

10 cm

$\sqrt{3}$ cm

x

Work out the length of x
Leave your answer as a surd.

$$x^2 = 10^2 - (\sqrt{3})^2$$
$$x = \sqrt{100 - 3}$$
$$= \sqrt{97} \text{ cm}$$

..........$\sqrt{97}$..........cm

The Maths Society **(3)**