

TOPIC 10: LENGTH, MASS AND CAPACITY



LENGTH

Conversion of metric units

Note:

To convert larger units to smaller units, multiply the value of the smaller units by the given units.

Example 1

Change 24km into cm.

K	H	D	M	d	c	m
1	0	0	0	0	0	

$1\text{km} = 100000\text{cm}$
 $24\text{km} = 24 \times 100000\text{cm}$
 $24\text{km} = 2400000\text{cm}$

Example 2

Change 9m into millimetres.

K	H	D	M	d	c	m
			1	0	0	0

$1\text{m} = 1000\text{cm}$
 $9\text{m} = 9 \times 1000\text{cm}$
 $9\text{m} = 9000\text{cm}$

Example 3

Convert 2.5km into metres.

K	H	D	M	d	c	m
1	0	0	0			

$1\text{km} = 1000\text{cm}$
 $2.5\text{km} = \frac{25}{10} \times 1000\text{cm}$
 $2.5\text{km} = 2500\text{cm}$

Exercise

- Change
 - 4km to metres
 - 16km to metres
 - 5m to centimetres
 - 125m to centimetres
 - 8cm to millimeters
 - 17 metres to millimetres
 - 625 decimetres to centimetres
 - 0.04km to centimetres
 - 2.6 km to metres
 - 6.25 km to metres
 - $4\frac{1}{8}\text{m}$ to centimetres
 - $2\frac{1}{5}\text{km}$ to metres
 - 0.75m to centimetres
 - $4\frac{3}{4}\text{cm}$ to millimetres
- Muuta covered a distance of 126km. How far did he go in metres?
- How many centimetres are in 7.6 metres?

Note:

To change smaller units to bigger units, we divide the value of the smaller units in the bigger unit.

Example 1

Change 300m to kilometres.

K	H	D	M	d	c	m
1	0	0	0			

$1000\text{m} = 1\text{km}$
 $300\text{m} = \frac{300}{1000}\text{km}$
 $300\text{m} = 0.3\text{km}$

Example 2

Convert 4000cm into metres.

K	H	D	M	d	c	m
			1	0	0	

$100\text{cm} = 1\text{m}$
 $4000\text{cm} = \frac{4000}{100}\text{m}$
 $4000\text{cm} = 40\text{m}$

Example 3

Convert 450cm to km.

K	H	D	M	d	c	m
1	0	0	0	0	0	

$100000\text{cm} = 1\text{km}$
 $450\text{cm} = \frac{450}{100000}\text{km}$
 $450\text{cm} = 0.0045\text{km}$

TOPIC 10: LENGTH, MASS AND CAPACITY



Exercise

- Change
 - 800 metres into km
 - 12000cm into metres
 - 70mm into decimetres .
 - 800cm into decimetres
 - 30cm into metres
 - 650m into kilometres
 - 900m into kilometres
 - 3.5cm into metres
 - 0.3 m into kilometres
 - 600cm into kilometres
 - 2.5 cm into Hm
 - 8.65cm into kilometres
 - 0.6mm into cm
 - $7\frac{1}{2}$ cm into metres
- A wire is $20\frac{1}{2}$ metres long. Express this in kilometres.
- A cyclist covered 0.6m. How far did he go in kilometres?
- Express 20.24 centimetres into kilometres.

Addition and subtraction of metric units.

Example 1

Work out:

Km	m
6	486
+ 2	724
9	210

Example 2

Subtract:

m	cm
8	26
- 3	59
4	67

Exercise

- Work out:
 - | | |
|-----|-----|
| Km | m |
| 8 | 764 |
| + 2 | 397 |
 - | | |
|-----|-----|
| Km | m |
| 14 | 400 |
| + 2 | 700 |
 - | | |
|-----|----|
| m | cm |
| 7 | 80 |
| + 2 | 20 |
 - | | |
|-----|----|
| m | cm |
| 8 | 98 |
| + 2 | 53 |
 - | | | |
|-----|----|----|
| m | cm | mm |
| 8 | 98 | 7 |
| + 2 | 53 | 9 |
 - | | | |
|-----|-----|-----|
| km | m | cm |
| 7 | 349 | 876 |
| + 2 | 867 | 124 |
- Work out:
 - | | |
|-----|-----|
| Km | m |
| 7 | 500 |
| - 3 | 249 |
 - | | |
|-----|-----|
| Km | m |
| 8 | 200 |
| - 1 | 500 |
 - | | |
|-----|-----|
| Km | m |
| 12 | 234 |
| - 5 | 892 |
 - | | |
|-----|----|
| m | cm |
| 8 | 86 |
| - 2 | 19 |
 - | | |
|-----|----|
| m | cm |
| 8 | 36 |
| - 2 | 74 |
 - | | | |
|-----|----|----|
| m | cm | mm |
| 10 | 64 | 2 |
| - 2 | 78 | 3 |

TOPIC 10: LENGTH, MASS AND CAPACITY



3. Add 7km 267m to 3km 932m.
4. Take away 7cm from 8m.

Multiplication of metric units.

Example 1

$$\begin{array}{r} \text{Work out:} \quad \text{m} \quad \text{cm} \\ 8 \quad 42 \\ \times \quad 5 \\ \hline 42 \quad 10 \end{array}$$

Example 2

$$\begin{array}{r} \text{Work out:} \quad \text{km} \quad \text{m} \\ 3 \quad 427 \\ \times \quad 4 \\ \hline 13 \quad 708 \end{array}$$

Exercise

Work out:

$$\begin{array}{r} \text{a) } \quad \text{m} \quad \text{cm} \\ 3 \quad 40 \\ \times \quad 2 \\ \hline \end{array}$$

$$\begin{array}{r} \text{b) } \quad \text{m} \quad \text{cm} \\ 6 \quad 72 \\ \times \quad 3 \\ \hline \end{array}$$

$$\begin{array}{r} \text{c) } \quad \text{m} \quad \text{mm} \\ 6 \quad 678 \\ \times \quad 5 \\ \hline \end{array}$$

$$\begin{array}{r} \text{d) } \quad \text{km} \quad \text{m} \\ 2 \quad 600 \\ \times \quad 2 \\ \hline \end{array}$$

$$\begin{array}{r} \text{e) } \quad \text{km} \quad \text{m} \\ 5 \quad 397 \\ \times \quad 6 \\ \hline \end{array}$$

$$\begin{array}{r} \text{f) } \quad \text{km} \quad \text{m} \\ 8 \quad 965 \\ \times \quad 9 \\ \hline \end{array}$$

Division of metric units

Example 1

A man's stride is 60cm. How many strides will he make to cover 0.3 km?

0.3km to metres

$$1\text{km} = 100000\text{m}$$

$$0.3\text{km} = \frac{3}{10} \times 100000\text{m}$$

$$0.3\text{km} = 30000\text{m}$$

Number of strides

$$30000\text{cm} \div 60\text{cm}$$

500 strides

Example 2

Kamyufu bought a wire of length $10\frac{1}{2}\text{m}$

He cut it into pieces of 15cm each.

How many pieces did he get?

$10\frac{1}{2}$ metres to centimetres

$$1\text{m} = 100\text{cm}$$

$$10\frac{1}{2}\text{m} = \frac{21}{2} \times 100\text{cm}$$

$$= 21 \times 50\text{cm}$$

$$= 1050\text{cm}$$

Number of pieces of wire

$$1050\text{cm} \div 15\text{cm} = 70 \text{ pieces}$$

Exercise

1. A man's stride is 80cm. How many strides does he make to cover 12.8 metres?
2. Town X is 4.2km away from town Y. A snail covers 70 metres per day. How long will it take to move from town X to town Y?

TOPIC 10: LENGTH, MASS AND CAPACITY



3. The length of a book is 21cm. How many similar books are needed to make a total length of 1.26 metres?
4. Tunzi bought 4.05 metres to make table cloths of length 45cm each.
 - a) How many table cloths did she make?
 - b) If each table cloth was sold at sh. 2500, how much money did she collect altogether?
5. Muna bought 2.8km of wire at sh.1,400,000. He cut it into piece of 70 metres each. Each piece of wire was sold at sh. 50,000. How much profit did he make?

Perimeter of polygons

Note:

- *Perimeter is the total distance around plane shape.*
- *Perimeter of a regular polygon is equal to length of each side times the number of sides .*
- *Opposite sides of a rectangle are equal.*
- *Equal sides are shown by the same type of marks.*

Example 1

Find the perimeter of each of the following.

a)



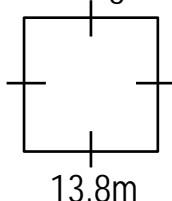
$$P = 2(l + w)$$

$$P = 2(8\text{cm} + 4.5\text{cm})$$

$$P = 2 \times 12.5\text{cm}$$

$$P = 25\text{cm}$$

b)

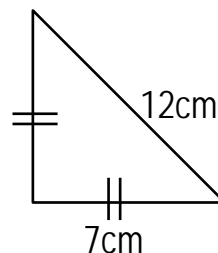


$$P = 4s$$

$$P = 4 \times 13.8\text{m}$$

$$P = 55.2\text{m}$$

c



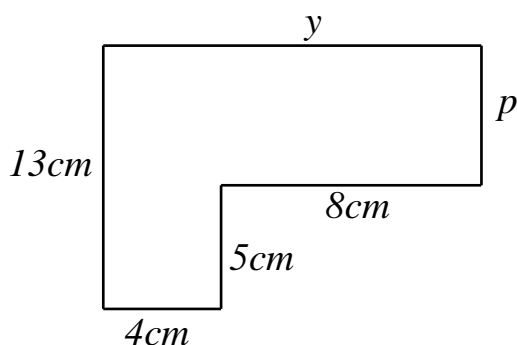
$$P = s + s + s$$

$$P = 12\text{cm} + 7\text{cm} + 7\text{cm}$$

$$P = 26\text{cm}$$

Example 2

Study the figure below and use it to answer questions that follow.



a) Find the value of

i) y

$$y = 8\text{cm} + 4\text{cm}$$

$$y = 12\text{cm}$$

ii) p

$$p = 13\text{cm} - 5\text{cm}$$

$$p = 8\text{cm}$$

b) Calculate the perimeter of the figure above.

$$P = s + s + s + s + s + s$$

$$P = 4\text{cm} + 5\text{cm} + 8\text{cm} + 8\text{cm} + 12\text{cm} + 13\text{cm}$$

$$P = 50\text{cm}$$

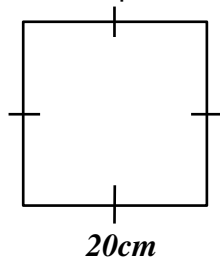
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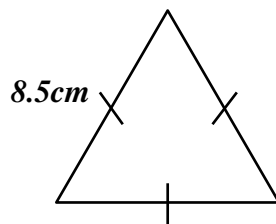
Exercise .

1. Calculate the perimeter of the following.

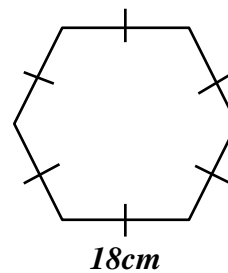
a)



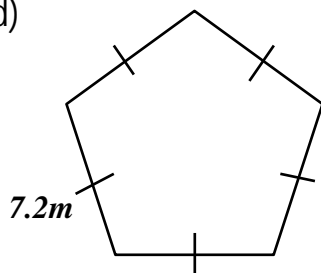
b)



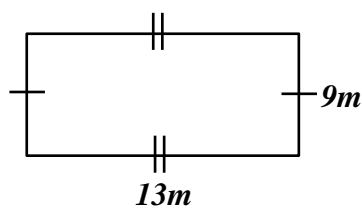
c)



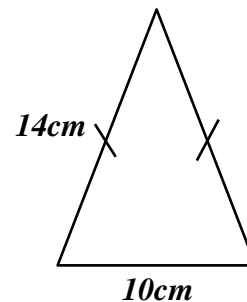
d)



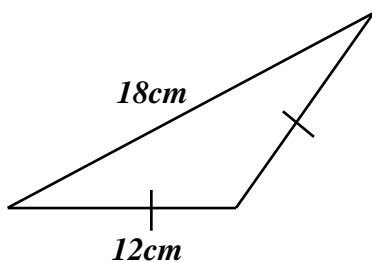
e)



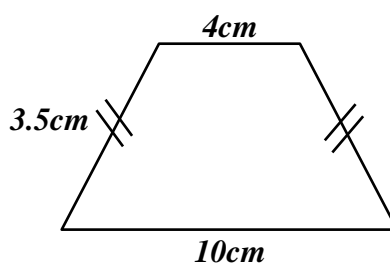
f)



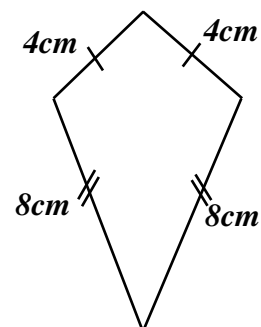
g)



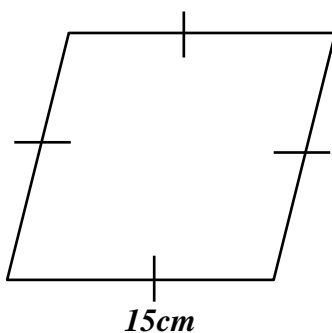
h)



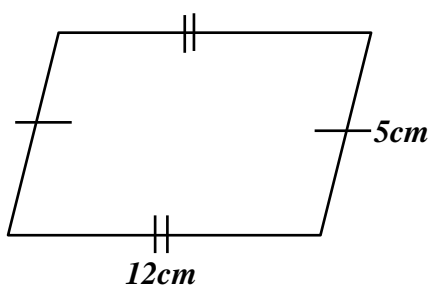
i)



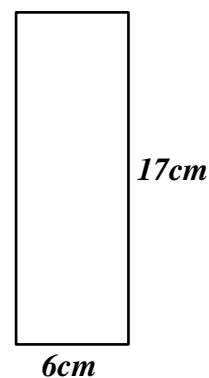
j)



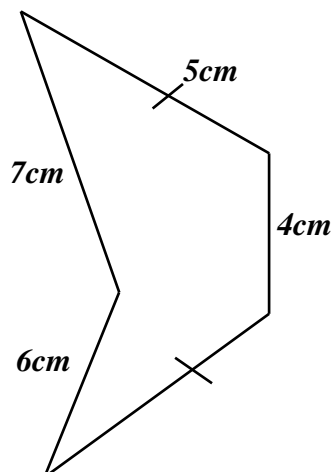
k)



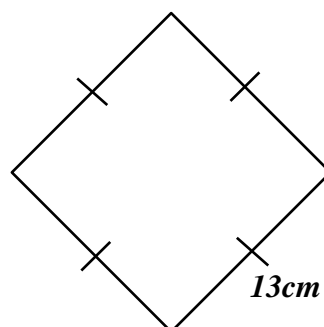
l)



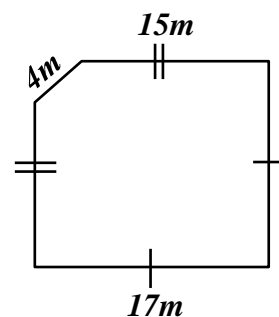
m)



n)



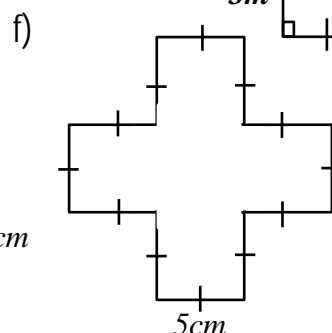
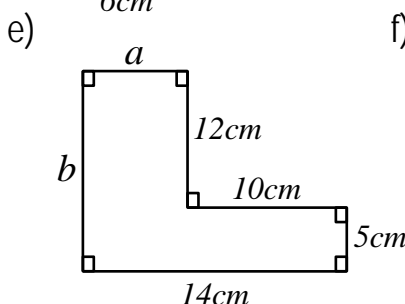
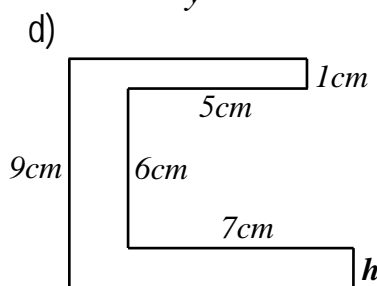
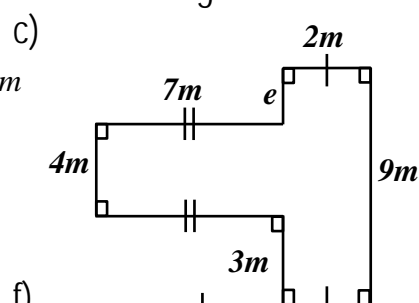
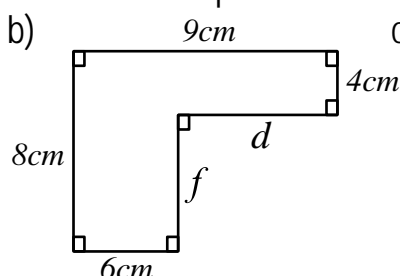
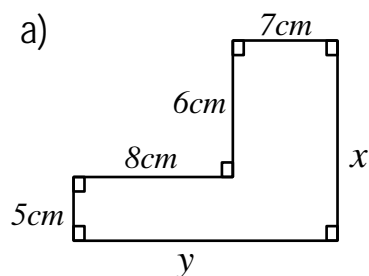
o)



TOPIC 10: LENGTH, MASS AND CAPACITY



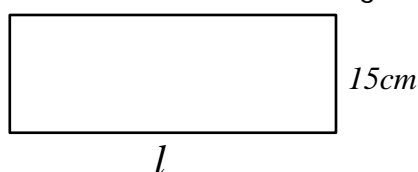
2. Find the value of the unknown then find the perimeter of each of the figures.



Finding length of sides of a figure when perimeter is given.

Example 1

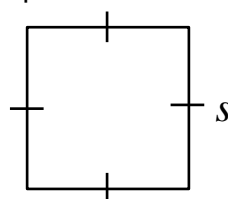
The perimeter of a rectangle is 64cm. Its width is 15cm. Find its length.



$$\begin{aligned}
 2(l + w) &= P \\
 2(l + 15\text{cm}) &= 64\text{cm} \\
 2l + 30\text{cm} &= 64\text{cm} \\
 2l + 30\text{cm} - 30\text{cm} &= 64\text{cm} - 30\text{cm} \\
 2l &= 34\text{cm} \\
 \frac{2l}{2} &= \frac{34\text{cm}}{2} \\
 l &= 17\text{cm}
 \end{aligned}$$

Example 2

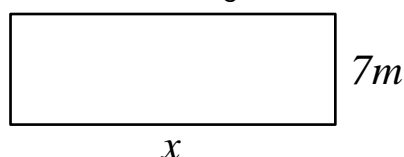
Find the length each sides of a square whose perimeter is 216 metres.



$$\begin{aligned}
 4s &= P \\
 4s &= 216\text{m} \\
 \frac{4s}{4} &= \frac{216\text{m}}{4} \\
 s &= 54\text{m}
 \end{aligned}$$

Exercise

1. The perimeter of the rectangle below is 32m. Find the value of x.

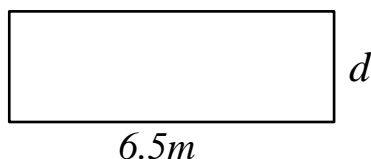


- The total distance around a square plot of land is 448m. Find the length of one side of the plot of land.
- Find the width of a rectangle whose perimeter is 80cm and length 23cm.

TOPIC 10: LENGTH, MASS AND CAPACITY



4. The perimeter a square is 17cm. Find the length of each side.
5. The perimeter of the figure below is 20 metres. Find the value of d in centimetres.



Application of perimeter in real life situation.

Example 1

Poles were fixed 20 metres apart a long one side of road a distance of 2.4km. How many poles were used?

1km = 1000m	<u>Number of poles</u>
$2.4\text{km} = \frac{24}{10} \times 1000\text{m}$	$\left(\frac{\text{Distance}}{\text{Interval}}\right) + 1$
$2.4\text{km} = 2400\text{m}$	$\left(\frac{2400\text{m}}{20\text{m}}\right) + 1$
	$120 + 1$
	121 poles

Example 2

Thirty five pupils stood 2 metres apart in a line. Calculate the length of the line.

Method 1

Spaces

$$35 - 1$$

34 spaces

Distance

$$\text{Distance} = \text{Spaces} \times \text{Interval}$$

$$= 34 \times 2\text{m}$$

$$= 68\text{m}$$

The line was 68 metres long

Method 2

$$\left(\frac{\text{Distance}}{\text{Interval}}\right) + 1 = \text{Number of poles}$$

$$\frac{d}{2\text{m}} + 1 = 35$$

$$\left(2\text{m} \times \frac{d}{2\text{m}}\right) + (1 \times 2\text{m}) = 35 \times 2\text{m}$$

$$d + 2\text{m} = 70\text{m}$$

$$d + 2\text{m} - 2\text{m} = 70\text{m} - 2\text{m}$$

$$d = 68\text{m}$$

The line was 68 metres long

Example 3

Fifty six poles were fixed a long one side of farm through a distance of 275 metres. Find the distance between poles.

Spaces

$$56 - 1$$

55 spaces

Interval

$$\frac{275\text{m}}{55}$$

$$5\text{m}$$

5 metres

TOPIC 10: LENGTH, MASS AND CAPACITY



Exercise

- Find the number of pupils who can stand 3 metres apart through a distance of 30 metres?
- Poles were fixed 8 metres apart through a distance of 240 metres. How many poles were used?
- A farmer planted his bananas in 25 rows. Each row was 105 metres long. If the bananas were planted 2.5 metres apart.
 - How many bananas were planted along each row?
 - Find the number of bananas he planted altogether.
- Masaka is 120km away from Kampala. Fruit trees were planted 60 metres apart along one side of the road from Masaka to Kampala. Find the number of fruit trees which were planted.
- Forty poles are fixed in a straight line along one side of the road. The poles are fixed at intervals of 10metres. Calculate the length of the road.
- Ninety nine solders stood 1.5 metres a part in a straight line. Find the distance from the first and the last soldiers in the line.
- Arnold drew a straight line and marked of 16 points 1.5cm apart. Find the length of the line which Arnold drew.
- One hundred sixty six poles were fixed along one side of a straight road. The poles were fixed at intervals of 15 metres. Find the distance of the road in kilometres.
- Sixteen pupils stood in a straight line the distance from the first pupils to the last pupil was 60 metres. Find the distance between two consecutive pupils.
- Thirty five poles were fixed on a straight line along one side of the road. The road is 51 metres long. Find the distance from the 8th to the 21st pole.

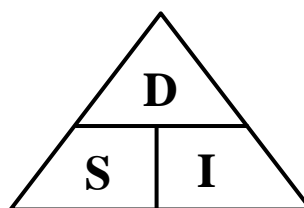
Note:

On a closed fence,

* Number of poles = Number of spaces

* Number of spaces = $\frac{\text{Distance / Perimeter}}{\text{Interval}}$

So, number of poles = $\frac{\text{Distance}}{\text{Interval}}$



Example 1

A rectangular flower garden 24 metres by 6 metres was fenced with poles placed at intervals of 120cm. Find the number of poles which were used.

Perimeter

$$P = 2(l + w)$$

$$P = 2(24m + 6m)$$

$$P = 2 \times 30m$$

$$P = 60m$$

Perimeter in centimetres

$$1m = 100cm$$

$$60m = 60 \times 100cm$$

$$60m = 6000cm$$

Number of poles

$$\left(\frac{6000cm}{120cm}\right) \text{poles}$$

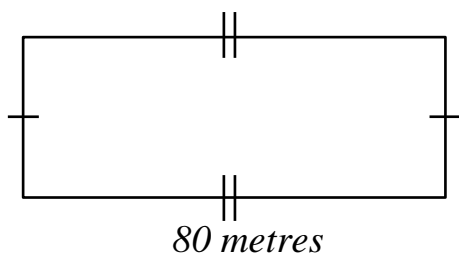
50 poles

TOPIC 10: LENGTH, MASS AND CAPACITY



Example 2

A school used 56 poles to fence the rectangular garden shown in the figure below. The poles were fixed at intervals of 5 metres.



- a) Find the perimeter of the rectangular garden.

$$\text{Perimeter} = \text{Spaces} \times \text{Interval}$$

$$\text{Perimeter} = 56 \times 5\text{m}$$

$$\text{Perimeter} = 280\text{m}$$

- b) Find the width of the garden.

Method 1

$$2(l + w) = P$$

$$2(80\text{m} + w) = 280\text{m}$$

$$160\text{m} + 2w = 280\text{m}$$

$$160\text{m} - 160\text{m} + 2w = 280\text{m} - 160\text{m}$$

$$2w = 120\text{m}$$

$$\frac{2w}{2} = \frac{120\text{m}}{2}$$

$$w = 60\text{m}$$

Method 2

$$\text{Width} = \left(\frac{\text{Perimeter}}{2} \right) - \text{Length}$$

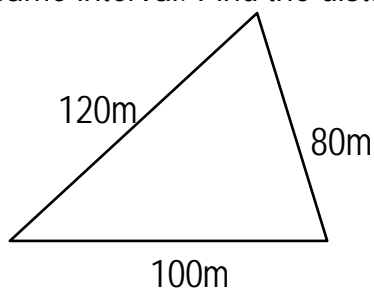
$$\text{Width} = \left(\frac{280\text{m}}{2} \right) - 80\text{m}$$

$$\text{Width} = 140\text{m} - 80\text{m}$$

$$\text{Width} = 60\text{m}$$

Example 3

A farmer used 75 poles to fence her triangular plot of land. The poles were fixed at the same interval. Find the distance between poles.



Perimeter

$$P = S + S + S$$

$$P = 120\text{m} + 100\text{m} + 80\text{m}$$

$$P = 300\text{m}$$

$$75 \text{ poles} = 75 \text{ spaces}$$

Interval

$$\text{Interval} = \frac{\text{Distance}}{\text{Spaces}}$$

$$\text{Interval} = \frac{300\text{m}}{75}$$

$$\text{Interval} = 4\text{m}$$

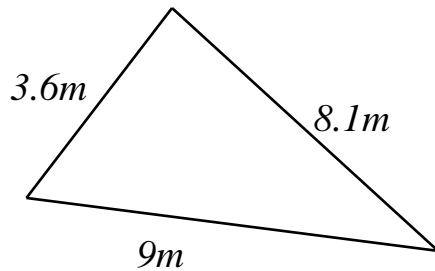
Exercise

- A school wants to fence a rectangular flower garden 12 metres by the 8 metres using poles placed at intervals of 80cm.
 - How many poles are needed to fence the flower garden?
 - If each pole costs sh. 8000, how much money will the school spend on the poles.
- Muzimbi built rectangular based house using poles placed at intervals of 0.6 metres. The length and width of the house was 9 metres and 7.5 metres respectively. How many poles were used?

TOPIC 10: LENGTH, MASS AND CAPACITY

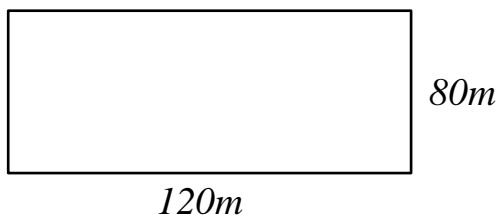


3. The figure below shows a triangular piece of land which was fenced using poles placed at intervals of 90cm.



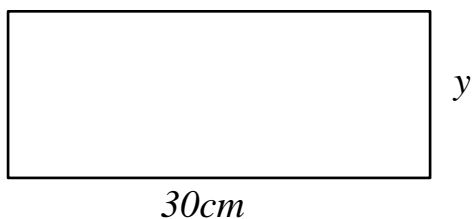
Find the number of poles which were used.

4. A rectangular field was fenced using poles fixed at intervals of 40cm as shown below.



Find the number of poles which were used.

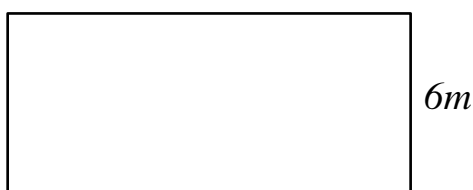
5. Lutabi placed 17 beans on a rectangular sheet of paper. The beans were placed 6cm apart.



a) Find the perimeter of the paper.

b) Find the value of y.

6. Seventy five poles fixed at intervals of 40cm were used to fence a rectangular garden shown in the figure below.

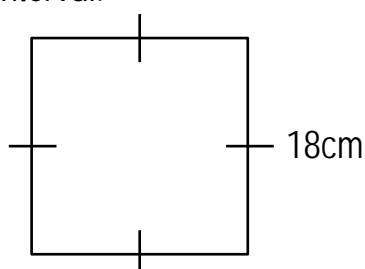


a) Calculate the total distance around the garden.

b) Find the length of the garden in centimetres.

7. Mulaalo fenced his square farm with 1500 poles fixed 80cm. Find the length of each side of the farm in kilometres.

8. Below is a square flower garden. It was fenced using 120 poles fixed at the same interval.



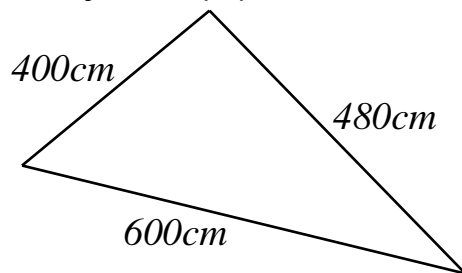
a) Find the perimeter of the garden.

a) Calculate the distance from one pole to another.

TOPIC 10: LENGTH, MASS AND CAPACITY

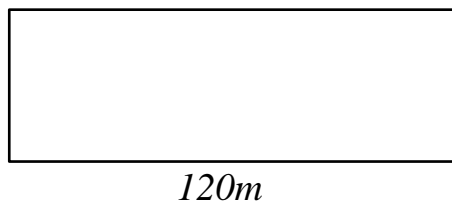


9. Thirty seven pupils stood around a triangular carpet shown in the figure below.



- Find the total distance around the carpet.
- If the pupils stood at regular intervals, find their distance apart.

10. Sarah ran 5 times around the rectangular field shown in the figure below. She covered 2.1km.



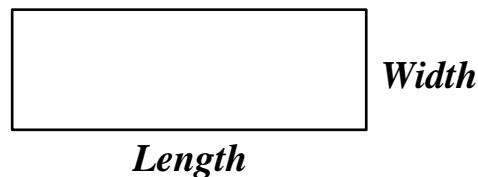
- Find the width of the field.
- If the rectangular field was fenced using poles fixed at intervals of 60cm. How many poles were used?

AREA OF A RECTANGLE AND SQUARE

Rectangle

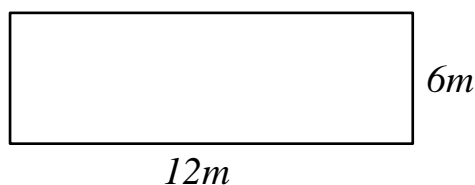
Note:

Area of rectangle = Length x Width



Example 1

Find the area of the rectangle below.



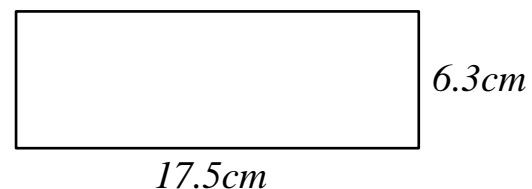
$$A = l \times w$$

$$A = 12m \times 6m$$

$$A = 72m^2$$

Example 2

Calculate the area of the figure.



$$A = l \times w$$

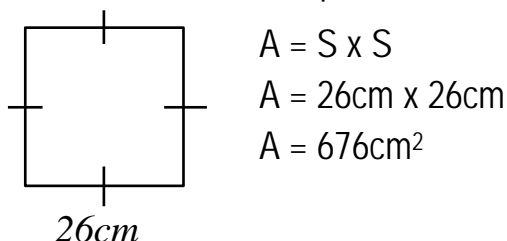
$$A = 17.5cm \times 6.3cm$$

$$A = 110.25cm^2$$

Square

Example 1

Find the area of the square below.



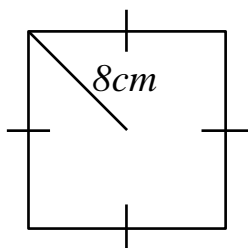
$$A = S \times S$$

$$A = 26cm \times 26cm$$

$$A = 676cm^2$$

Example 2

Calculate the area of the figure below



$$8cm + 8cm = 16cm$$

$$A = \frac{1}{2} \times d_1 \times d_2$$

$$A = \frac{1}{2} \times 16cm \times 16cm$$

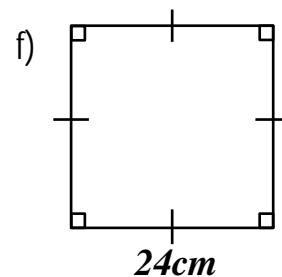
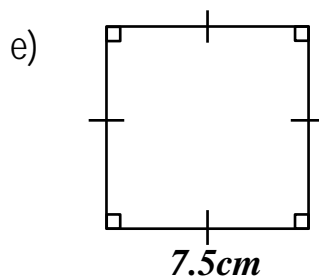
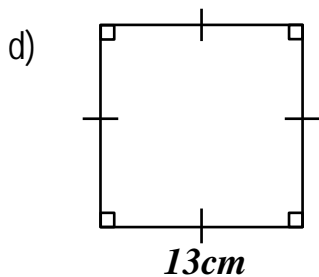
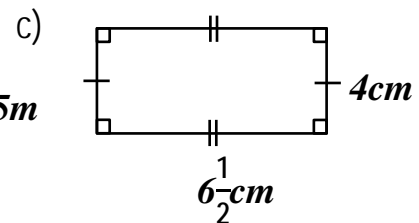
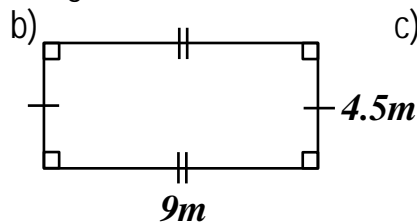
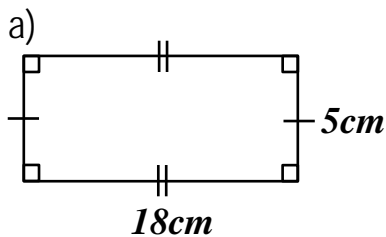
$$A = 128cm^2$$

TOPIC 10: LENGTH, MASS AND CAPACITY

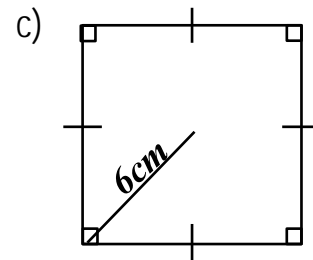
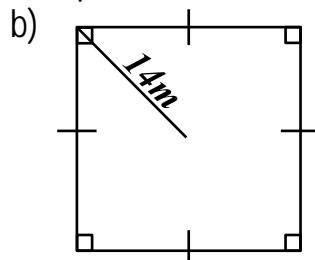
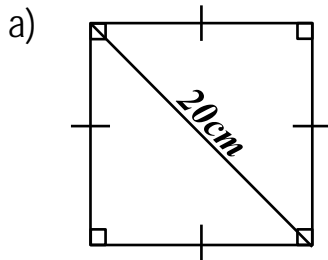


Exercise

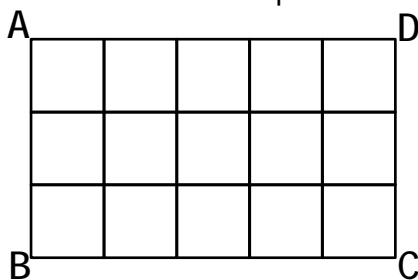
1. Work out the area of the following;



2. Calculate the area of the given square.



- Find the area of a rectangle whose length is 13m and width 8m.
- The length of each diagonal of a square piece of paper is 18cm. Find its area.
- Find the area of a square whose diagonal is 18cm.
- The area of each square in the rectangle ABCD below is 36cm².

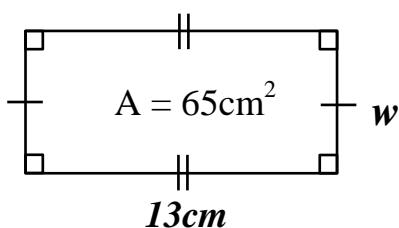


Find the area of rectangle ABCD

Finding the unknown side when area is given .

Example 1

The area of a rectangle is 65cm². Its length is 13cm. Find its width.



Method 1

$$\begin{aligned}
 l \times w &= A \\
 13\text{cm} \times w &= 65\text{cm}^2 \\
 \frac{13\text{cm} \times w}{13\text{cm}} &= \frac{65\text{cm} \times \text{cm}}{13\text{cm}} \\
 w &= 5\text{cm}
 \end{aligned}$$

Method 2

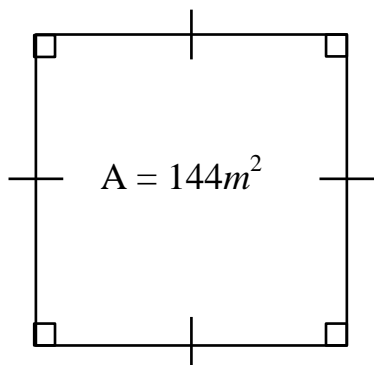
$$\begin{aligned}
 \text{Width} &= \frac{\text{Area}}{\text{Length}} \\
 \text{Width} &= \frac{65\text{cm}^2}{13\text{cm}} \\
 \text{Width} &= 5\text{cm}
 \end{aligned}$$

TOPIC 10: LENGTH, MASS AND CAPACITY



Example 2

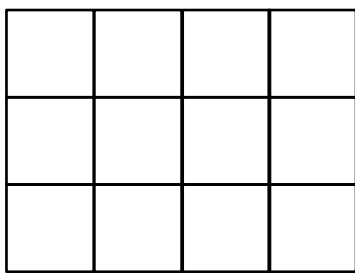
The area of a square is 144m^2 . Find the length of each side.



$$\begin{aligned} S \times S &= A \\ S^2 &= 144\text{m}^2 \\ \sqrt{S^2} &= \sqrt{144\text{m}^2} \\ \sqrt{(S \times S)} &= \sqrt{(2 \times 2) \times (2 \times 2) \times (3 \times 3) \times (\text{m} \times \text{m})} \\ S &= 2 \times 2 \times 3 \times \text{m} \\ S &= 12\text{m} \\ \text{Length of each side is } 12\text{m} \end{aligned}$$

Example 3

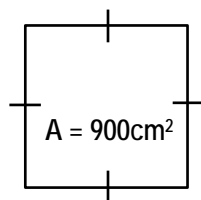
The diagram below show a rectangular floor covered by square tiles. Use it to answer questions that follow.



- a) If the area of each square tile is 900cm^2 , calculate the area of the rectangular floor.

$$\begin{aligned} \text{Area} &= 12 \times 900\text{cm}^2 \\ \text{Area} &= 10800\text{cm}^2 \end{aligned}$$

- b) Find the actual length and actual width of the floor.



$$\begin{aligned} S \times S &= A \\ S^2 &= 900\text{cm}^2 \\ S^2 &= 900\text{cm}^2 \\ \sqrt{S^2} &= \sqrt{900\text{cm}^2} \\ S &= 30\text{cm} \end{aligned}$$

Calculate the total distance around the floor.

$$\begin{aligned} P &= 2(l + w) \\ P &= 2(120\text{cm} + 90\text{cm}) \\ P &= 2 \times 210\text{cm} \\ P &= 420\text{cm} \end{aligned}$$

Length

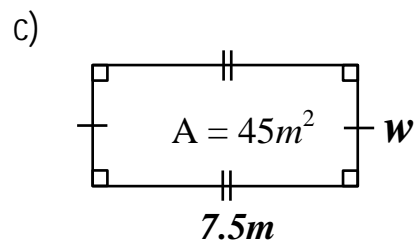
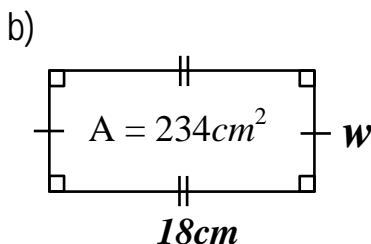
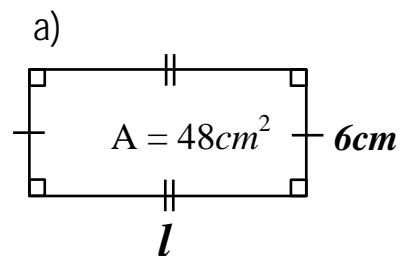
$$4 \times 30\text{cm} = 120\text{cm}$$

Width

$$3 \times 30\text{cm} = 90\text{cm}$$

Exercise

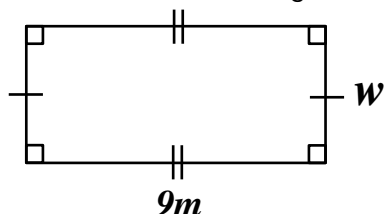
1. Find the unknown sides of the following rectangles whose area is given.



TOPIC 10: LENGTH, MASS AND CAPACITY



2. The area of the rectangle below is 63m^2 .



- Find its width.
- Calculate the perimeter of the figure.

3. A rectangular sheet of paper has an area of 126cm^2 . Its width is 9cm .

- Find its length.
- Calculate its perimeter.

4. The area of a rectangular garden is 500m^2 . Its length is 25 metres .

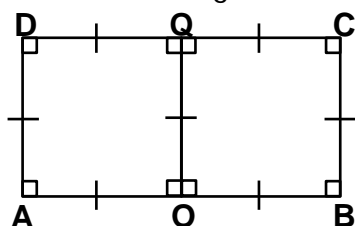
- Find its width.
- Calculate the total distance around the garden.

5. Find the length of each side of a square whose area is 144cm^2 .

6. The area of a square flower garden is 169m^2 .

- Find the length of each side.
- Calculate its perimeter.

7. The area of the figure below is 72cm^2 .



- Find length AB in cm.
- Calculate the perimeter of figure ABCD.

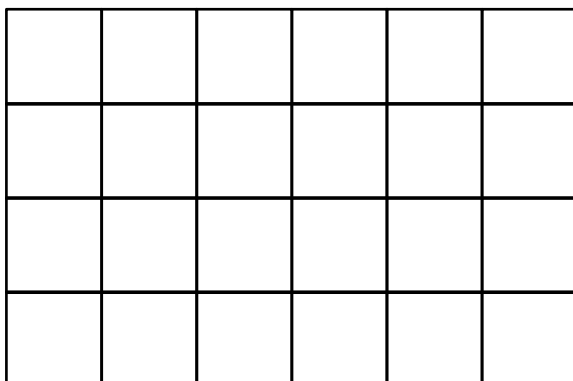
8. Calculate the perimeter of a square whose area is;

- | | | |
|-------------------|---------------------|---------------------|
| a) 9m^2 | c) 16cm^2 | e) 64cm^2 |
| b) 25m^2 | d) 100cm^2 | f) 0.81m^2 |

9. Calculate the perimeter of a rectangle whose

- | | |
|--|--|
| a) area is 12cm^2 and width is 7cm . | d) area is 112cm^2 and length is 14m . |
| b) area is 35cm^2 and length is 7cm . | e) area is 2m^2 and width is 80cm . |
| c) area is 270cm^2 and width is 15cm . | |

10. The figure below represents a rectangular floor which were covered by square tile of area 324cm^2 each. Use it to answer the questions that follow.

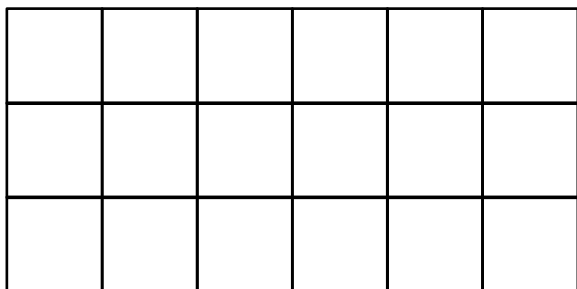


- Find the area of the rectangular floor.
- Calculate the perimeter of the rectangular floor.

TOPIC 10: LENGTH, MASS AND CAPACITY

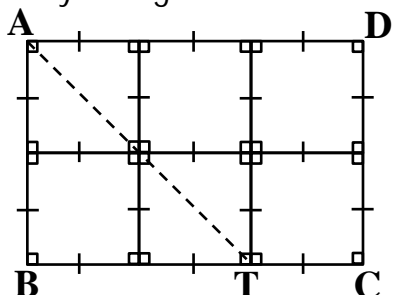


11. Square piece of cloth of the same size were put together to form a rectangle piece of cloth as shown below. The area of the rectangular cloth formed was 0.72m^2 .



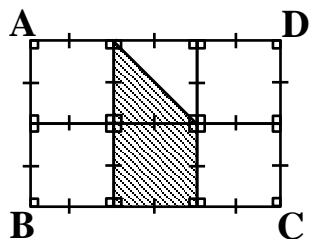
- Find in square centimetres, the area of each square piece of cloth.
- Calculate the total distance around the rectangular piece of cloth formed.

12. Study the figure below carefully and use it to answer that follow.



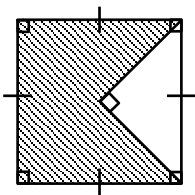
If $AT = 28\text{cm}$, find the area of ABCD

13. The area of the shaded part in the figure below is 24cm^2 .



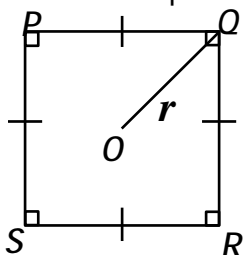
- Find length BC.
- Calculate the perimeter of ABCD.

14. The figure below shows a square flower garden. The un shaded part represents the area without flowers. Given that the area covered by flowers is 48m^2 .



- Find the area of the flower garden.
- Calculate the total distance around the garden.

15. In the figure below, PQRS is a square with centre O. Study it carefully and use it to answer the question that follows.



Find in cm, the value of r if the area of PQRS is 288m^2 .

16. Find the length of each diagonal of a square whose area is 98cm^2 .

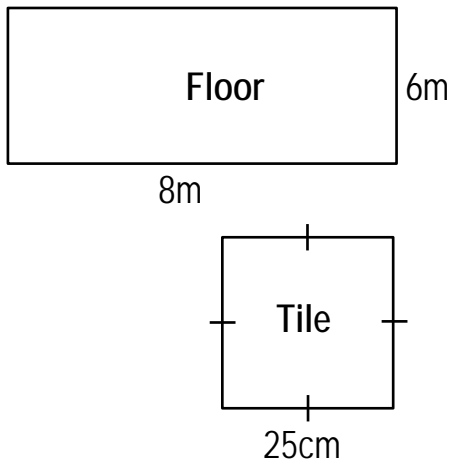
TOPIC 10: LENGTH, MASS AND CAPACITY



Comparing different areas

Example 1

Square tiles of side 25cm were used to cover a rectangular floor 8m by 6m as shown in the drawing below. How many tiles were used?



Along length

$$8 \times 100\text{cm} = 800\text{cm}$$

$$\frac{800\text{cm}}{25\text{cm}} = 32 \text{ tiles}$$

Along width

$$6 \times 100\text{cm} = 600\text{cm}$$

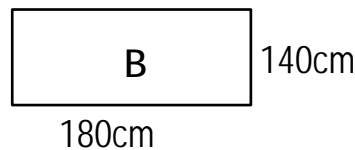
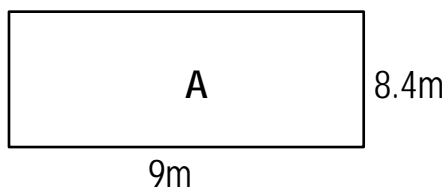
$$\frac{600\text{cm}}{25\text{cm}} = 24 \text{ tiles}$$

Number of tiles used

$$32 \times 24 = 768 \text{ tiles}$$

Example 2

In the drawings below, figure **A** is a rectangular floor 9m by 8.4m and figure **B** is a rectangular carpet 180 cm by 140cm.



If each carpet costs sh. 15000, how much money is needed to buy such carpets that can cover the rectangular floor.

Along length

$$9 \times 100\text{cm} = 900\text{cm}$$

$$\frac{900\text{cm}}{180\text{cm}} = 5 \text{ carpets}$$

Along width

$$8.4 \times 100\text{cm} = 840\text{cm}$$

$$\frac{840\text{cm}}{140\text{cm}} = 6 \text{ carpets}$$

Number of carpets

$$5 \times 6 = 30 \text{ carpets}$$

Amount of money needed

$$\text{sh. } 15000 \times 30$$

$$\text{sh. } 450,000$$

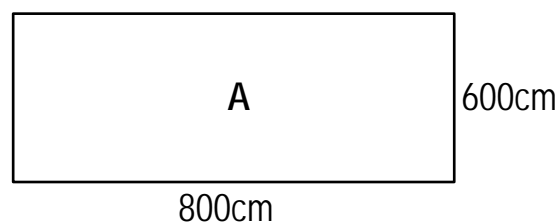
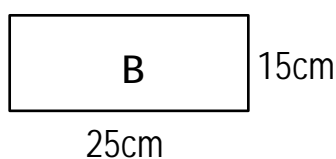
Exercise

- How many square tiles of side 20cm each are needed to cover a square floor of side 12metres?
- Find the number of square tiles each 25cm that are needed to cover a dining room 10 metres by 8 metres.

TOPIC 10: LENGTH, MASS AND CAPACITY

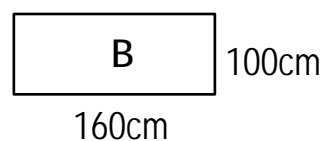
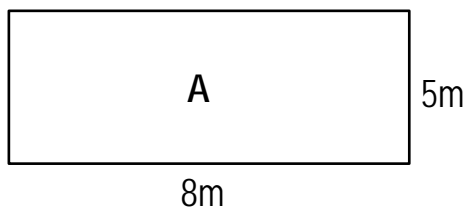


3. Find the number of square mats 15cm that can cover a ground of 15m by 3m.
4. A table cloth 5m by 3m has square patterns each of area 400cm^2 . How many squares are there?
5. Find the number of rectangular iron sheets 120cm by 40 cm that are required to cover a rectangular roof 9m by 6m.
6. A school used small rectangular bricks each measuring 20cm by 15 cm to cover a rectangular compound 48 metres by 15 metres.
 - a) How many small bricks were used?
 - b) If each small brick was bought at sh. 50, how much money was spent altogether?
7. Mats of size A were used to cover a rectangular floor of size B.



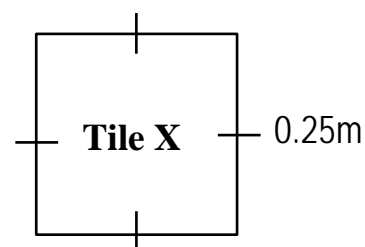
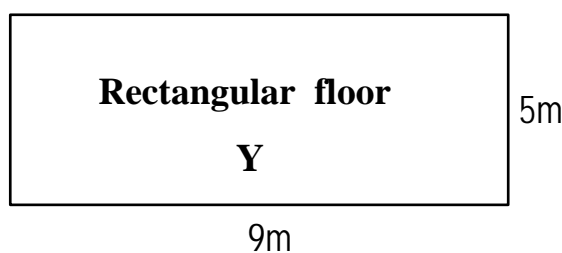
How many mats were used?

8. A table of size A was covered with table mats of size B.



Find the number of table mats used.

9. Square tiles of size X were used to cover a rectangular floor Y show in the drawing below.



- a) How many tiles were used?
 - b) A box that holds 30 tiles cost sh 125,000. Calculate the total amount of money that was spent on tiles.
10. A man used 375 square tiles to cover a rectangular floor. The area of each square tile was 400cm^2 .
 - a) Calculate the area of the rectangular floor in square metres.
 - b) If he fixed 25 tiles along the length, find in metres
 - i) the actual length of the floor.
 - ii) the perimeter of the rectangular floor.

TOPIC 10: LENGTH, MASS AND CAPACITY

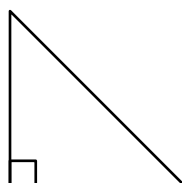


Area of a triangle

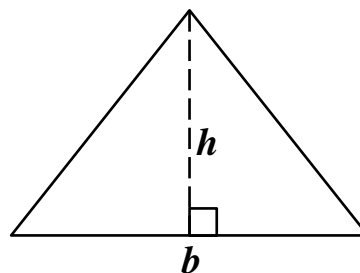
$$\text{Area} = \frac{1}{2} \times \text{base} \times \text{height}$$

$$\text{Area} = \frac{1}{2} \times b \times h$$

height



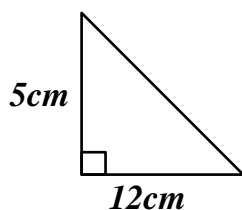
base



Example

Find the area of the triangles below.

a)



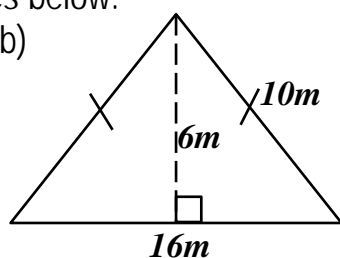
$$A = \frac{1}{2} \times b \times h$$

$$A = \frac{1}{2} \times 12\text{cm} \times 5\text{cm}$$

$$A = 6\text{cm} \times 5\text{cm}$$

$$A = 30\text{cm}^2$$

b)



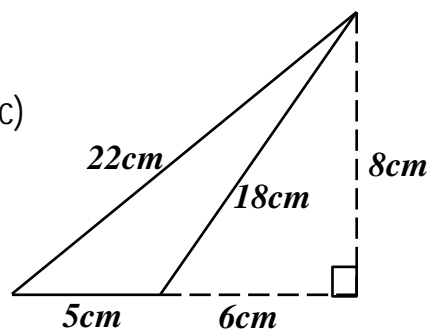
$$A = \frac{1}{2} \times b \times h$$

$$A = \frac{1}{2} \times 16\text{m} \times 6\text{m}$$

$$A = 8\text{m} \times 6\text{m}$$

$$A = 48\text{m}^2$$

c)



$$A = \frac{1}{2} \times b \times h$$

$$A = \frac{1}{2} \times 5\text{cm} \times 8\text{cm}$$

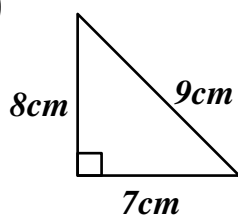
$$A = 5\text{cm} \times 4\text{cm}$$

$$A = 20\text{cm}^2$$

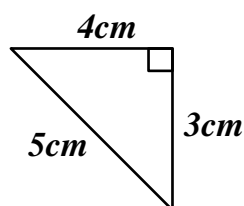
Exercise

1. Calculate the area of the triangles.

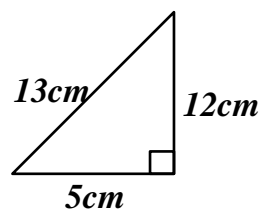
a)



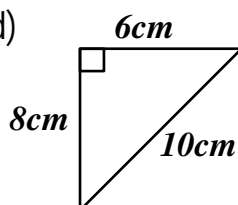
b)



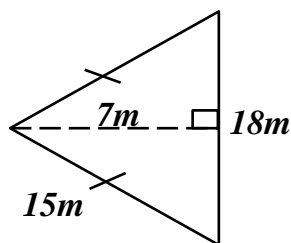
c)



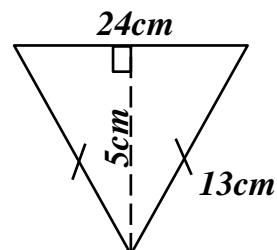
d)



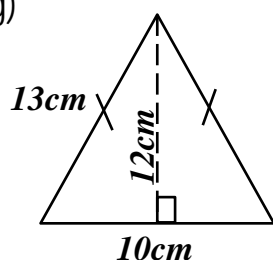
e)



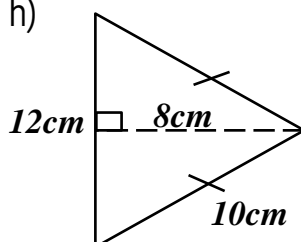
f)



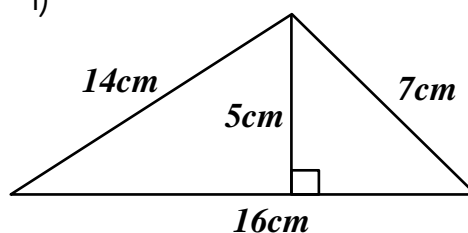
g)



h)



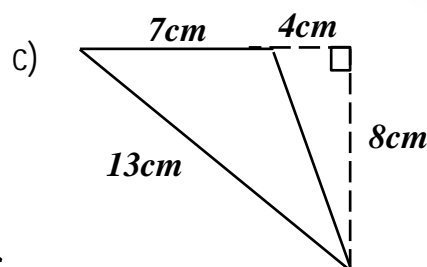
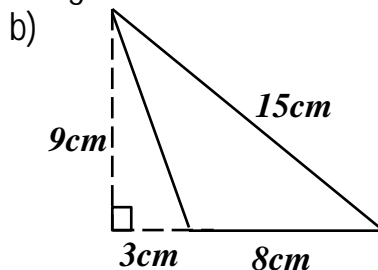
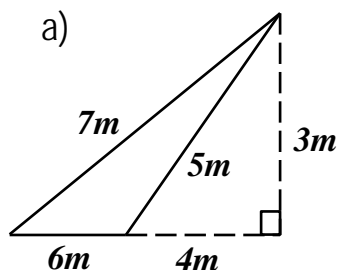
i)



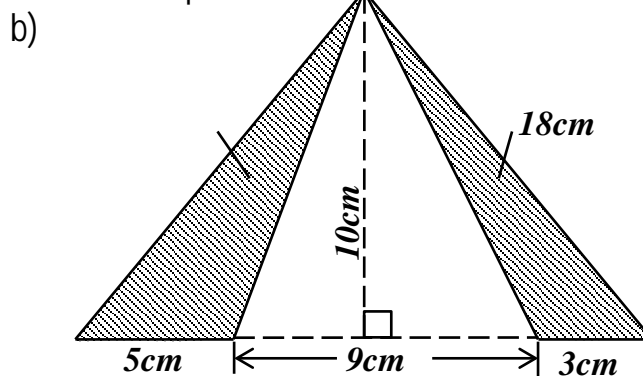
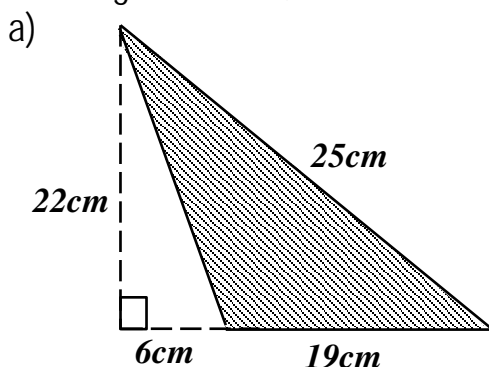
TOPIC 10: LENGTH, MASS AND CAPACITY



2. Calculate the area of the figures.

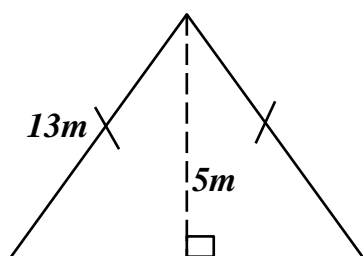


3. In the figures below, find the area of the shaded part.

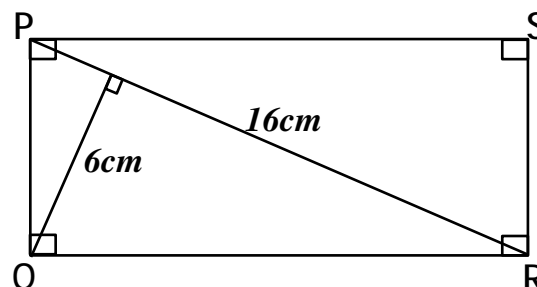


4. Calculate the area of a triangular sheet of paper whose base is 13.5cm and height is 28cm.

5. The perimeter of the figure below is 50m. Find its area.



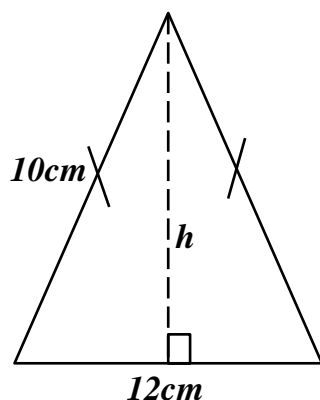
6. Find the area of the rectangle PQRS.



Finding the unknown sided of the triangle when area is given.

Example

The area of the triangle below is 48cm^2 .



Find its height.

$$\begin{aligned} \frac{1}{2} \times b \times h &= A \\ \frac{1}{2} \times 12\text{cm} \times h &= 48\text{cm}^2 \\ 6\text{cm} \times h &= 48\text{cm}^2 \\ \frac{6\text{cm} \times h}{6\text{cm}} &= \frac{48\text{cm}^2 \times \text{cm}}{6\text{cm}} \\ h &= 8\text{cm} \end{aligned}$$

Calculate its perimeter.

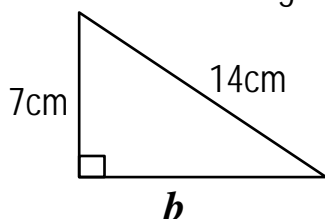
$$\begin{aligned} P &= S + S + S \\ P &= 12\text{cm} + 10\text{cm} + 10\text{cm} \\ P &= 32\text{cm} \end{aligned}$$

TOPIC 10: LENGTH, MASS AND CAPACITY



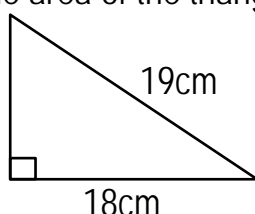
Exercise

- Find the height of a triangular garden whose base is 6m and area 15m².
- The triangle is 78cm². Its height is 4cm. Find its base.
- Find the base of a triangle whose area is 60cm² and height 8cm.
- The area of the triangle below is 42cm². Its height is 7cm.



- Find its base.
- Calculate its perimeter.

- The area of the triangle below is 63cm². Calculate its perimeter.



Calculate its perimeter.

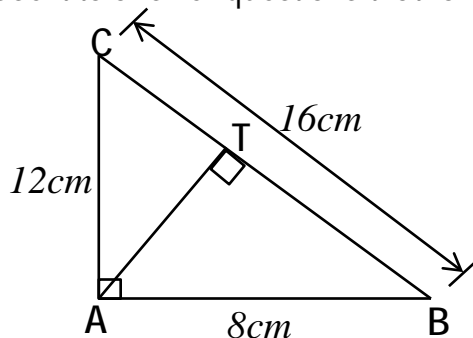
More problems involving area of a triangle

Note :

Different heights of the same triangle give the same area.

Example 1

In the figure below ABC is a right angled triangle, AB = 8cm, AC = 12cm and CB = 16cm. Use it to answer questions that follow.



Find the area of triangle.

$$A = \frac{1}{2} \times b \times h$$

$$A = \frac{1}{2} \times 8\text{cm} \times 12\text{cm}$$

$$A = 4\text{cm} \times 12\text{cm}$$

$$A = 48\text{cm}^2$$

Find the length AT in cm.

Method 1

$$\frac{1}{2} \times b \times h = A$$

$$\frac{1}{2} \times 16\text{cm} \times h = 48\text{cm}^2$$

$$8\text{cm} \times h = 48\text{cm}^2$$

$$\frac{8\text{cm} \times h}{8\text{cm}} = \frac{48\text{cm} \times \text{cm}}{8\text{cm}}$$

$$h = 6\text{cm}$$

Length AT = 6cm

Method 2

$$\frac{1}{2} \times b \times h = \frac{1}{2} \times b \times h$$

$$\frac{1}{2} \times 16\text{cm} \times h = \frac{1}{2} \times 8\text{cm} \times 12\text{cm}$$

$$8\text{cm} \times h = 48\text{cm}^2$$

$$\frac{8\text{cm} \times h}{8\text{cm}} = \frac{48\text{cm} \times \text{cm}}{8\text{cm}}$$

$$h = 6\text{cm}$$

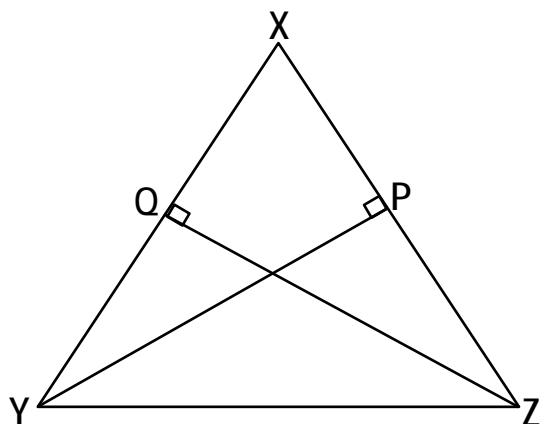
Length AT = 6cm

TOPIC 10: LENGTH, MASS AND CAPACITY



Example 2

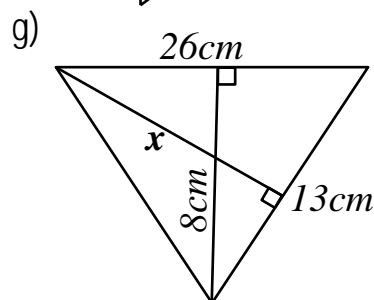
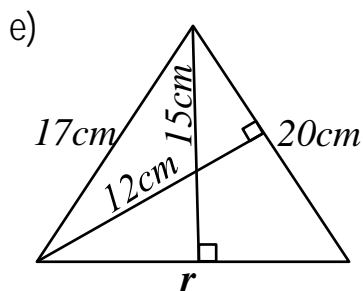
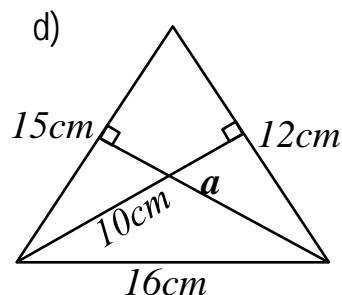
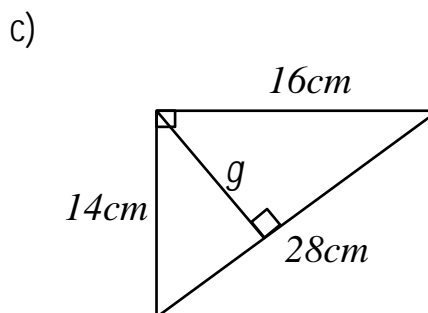
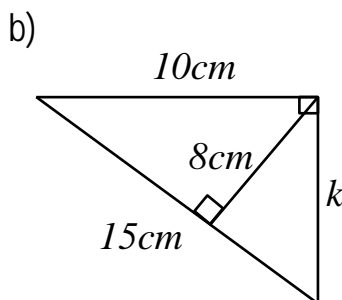
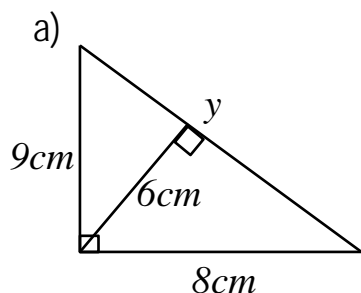
In the triangle below, $XY = 12\text{cm}$, $ZQ = 10\text{cm}$ and $XZ = 16\text{cm}$. Use the triangle to answer the question that follows. Find length YP .



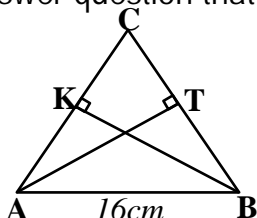
$$\begin{aligned}\frac{1}{2} \times b \times h &= \frac{1}{2} \times b \times h \\ \frac{1}{2} \times 16\text{cm} \times h &= \frac{1}{2} \times 12\text{cm} \times 10\text{cm} \\ 8\text{cm} \times h &= 60\text{cm}^2 \\ \frac{8\text{cm} \times h}{8\text{cm}} &= \frac{60\text{cm} \times \text{cm}}{8\text{cm}} \\ h &= 7\frac{1}{2}\text{cm} \\ \text{Length } YP &= 7\frac{1}{2}\text{cm}\end{aligned}$$

Exercise

1. Find the value of the unknown sides marked with letters.

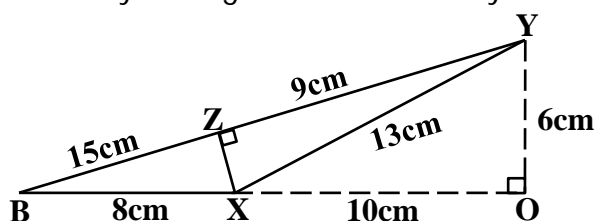


2. In the triangle below, $AB = 16\text{cm}$, $AC = 8\text{cm}$, $CB = 12\text{cm}$ and $KB = 15\text{cm}$. Use it to answer question that follow.



- Calculate the area of triangle ABC.
- Find length AT in centimetres.

3. Study the figure below carefully and use it to answer the questions that follows.

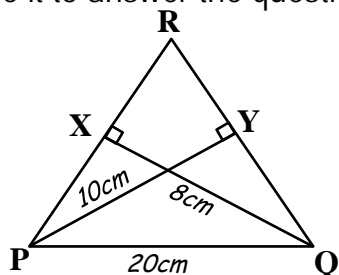


Find length ZX

TOPIC 10: LENGTH, MASS AND CAPACITY



4. In the triangle PQR below, PQ = 20 cm, QR = 12cm, YP = 10cm and XQ = 8cm. Use it to answer the question that follows.



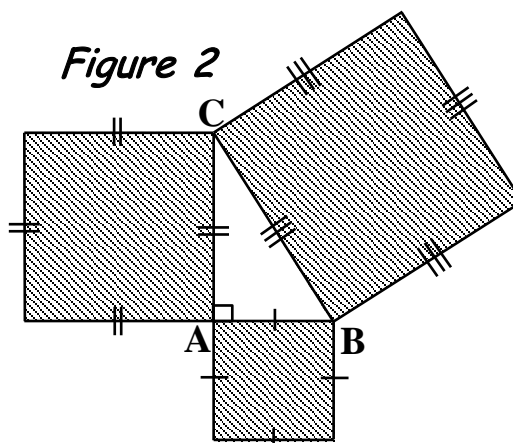
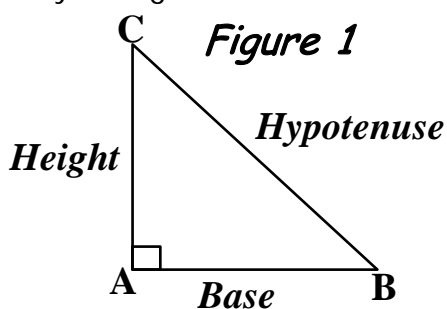
Calculate the perimeter of triangle PQR.

PYTHAGORAS THEOREM

The Pythagoras theorem which is also referred to as Pythagorean theorem explains the relationship between the three sides of a right angled triangle.

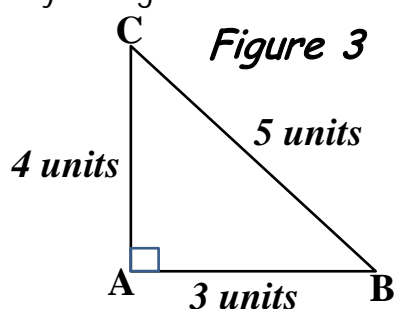
According to Pythagoras theorem, the square of the hypotenuse is equal to the sum of the squares of the other two sides of a right angled triangle.

Study the figures below.



From figure 2, $AB^2 + AC^2 = CB^2$

Study the figures below.



$AB^2 = 9$ square units
 $AC^2 = 16$ square units
 $CB^2 = 25$ square units

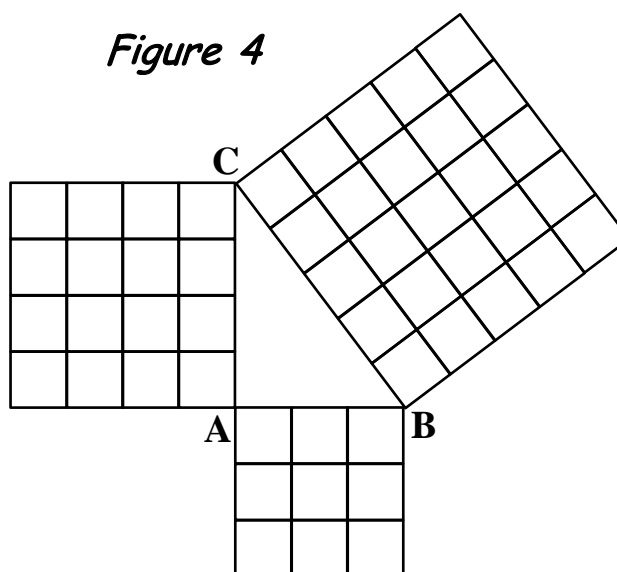
Therefore;

$$CB^2 = AB^2 + AC^2$$

$$AB^2 = CB^2 - AC^2$$

$$AC^2 = CB^2 - AB^2$$

Figure 4



$$9 \text{ sq. units} + 16 \text{ sq. units} = 25 \text{ sq. units}$$

TOPIC 10: LENGTH, MASS AND CAPACITY

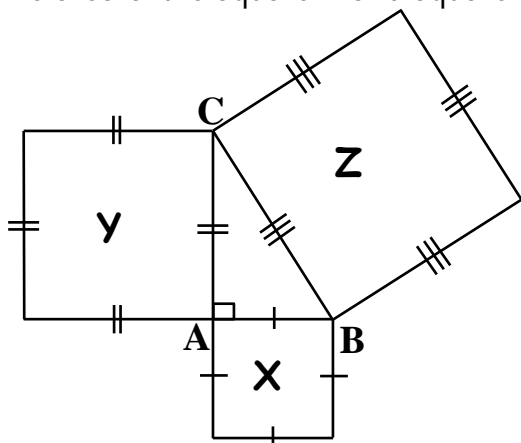


Problems involving applying Pythagoras theorem.

Example 1

Squares X, Y and Z were arranged form a right angled triangle ABC as shown in the figure below.

The area of the square X and square Y is 9cm^2 and 16cm^2 respectively.



a) Find the area of square Z.

$$\text{Square Z} = \text{Square X} + \text{Square Y}$$

$$\text{Square Z} = 9\text{cm}^2 + 16\text{cm}^2$$

$$\text{Square Z} = 25\text{cm}^2$$

b) Find the area of the right angled triangle ABC.

Base

$$AB^2 = 16\text{cm}^2$$

$$\sqrt{AB^2} = \sqrt{16\text{cm}^2}$$

$$AB = 4\text{cm}$$

Height

$$AC^2 = 9\text{cm}^2$$

$$\sqrt{AC^2} = \sqrt{9\text{cm}^2}$$

$$AC = 3\text{cm}$$

Area

$$A = \frac{1}{2} \times b \times h$$

$$A = \frac{1}{2} \times 4\text{cm} \times 3\text{cm}$$

$$A = 2\text{cm} \times 3\text{cm}$$

$$A = 6\text{cm}^2$$

c) Calculate the perimeter of the triangle ABC.

Length CB

$$BC^2 = 25\text{cm}^2$$

$$\sqrt{BC^2} = \sqrt{25\text{cm}^2}$$

$$BC = 5\text{cm}$$

Perimeter

$$P = S + S + S$$

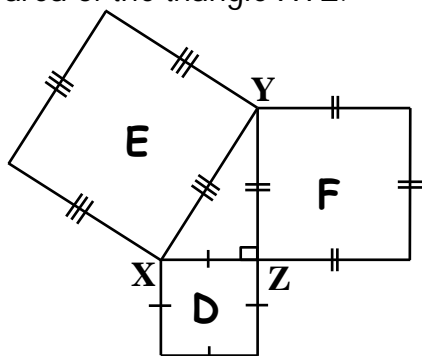
$$P = 4\text{cm} + 3\text{cm} + 5\text{cm}$$

$$P = 12\text{cm}$$

Example 2

Study the figure below carefully.

Given that the area of square E is 100cm^2 and the area of square D is 36cm^2 , calculate the area of the triangle XYZ.



Area of square E

$$100\text{cm}^2 - 36\text{cm}^2$$

$$64\text{cm}^2$$

Length YZ

$$YZ^2 = 64\text{cm}^2$$

$$\sqrt{YZ^2} = \sqrt{64\text{cm}^2}$$

$$YZ = 8\text{cm}$$

Length YZ

$$ZX^2 = 36\text{cm}^2$$

$$\sqrt{ZX^2} = \sqrt{36\text{cm}^2}$$

$$ZX = 6\text{cm}$$

Area

$$A = \frac{1}{2} \times b \times h$$

$$A = \frac{1}{2} \times 6\text{cm} \times 8\text{cm}$$

$$A = 3\text{cm} \times 8\text{cm}$$

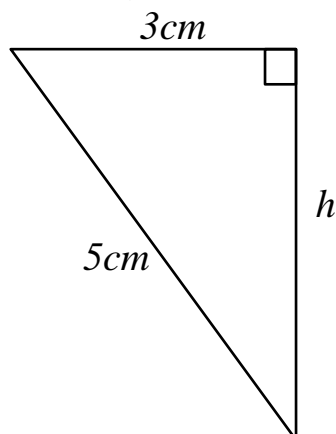
$$A = 24\text{cm}^2$$

TOPIC 10: LENGTH, MASS AND CAPACITY



Example 3

In the figure below, find the value of h and the area of the figure.



Value of h

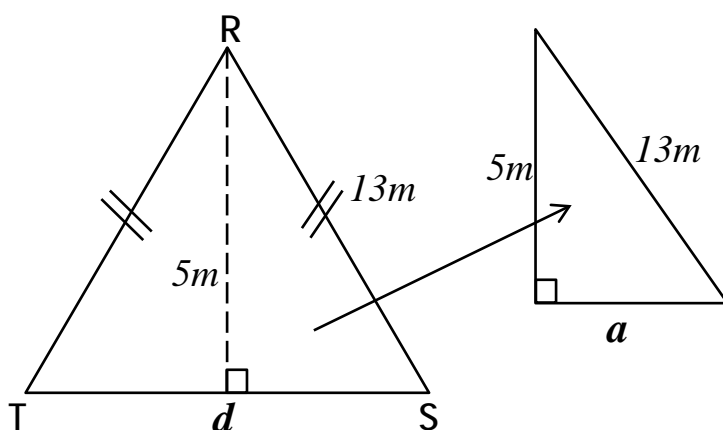
$$\begin{aligned} a^2 + b^2 &= c^2 \\ (3\text{cm})^2 + h^2 &= (5\text{cm})^2 \\ (3\text{cm} \times 3\text{cm}) + h^2 &= 5\text{cm} \times 5\text{cm} \\ 9\text{cm}^2 + h^2 &= 25\text{cm}^2 \\ 9\text{cm}^2 - 9\text{cm}^2 + h^2 &= 25\text{cm}^2 - 9\text{cm}^2 \\ h^2 &= 16\text{cm}^2 \\ \sqrt{h^2} &= \sqrt{16\text{cm}^2} \\ h &= 4\text{cm} \end{aligned}$$

Area of the triangle

$$\begin{aligned} A &= \frac{1}{2} \times b \times h \\ A &= \frac{1}{2} \times 3\text{cm} \times 4\text{cm} \\ A &= 3\text{cm} \times 2\text{cm} \\ A &= 6\text{cm}^2 \end{aligned}$$

Example 4

In the figure, find the value of d



$$\begin{aligned} a^2 + b^2 &= c^2 \\ a^2 + (5\text{m})^2 &= (13\text{m})^2 \\ a^2 + (5\text{m} \times 5\text{m}) &= 13\text{m} \times 13\text{m} \\ a^2 + 25\text{m}^2 &= 169\text{m}^2 \\ a^2 + 25\text{m}^2 - 25\text{m}^2 &= 169\text{m}^2 - 25\text{m}^2 \\ a^2 &= 144\text{m}^2 \\ \sqrt{a^2} &= \sqrt{144\text{m}^2} \\ a &= 12\text{m} \end{aligned}$$

Value of d

$$\begin{aligned} d &= 12\text{m} + 12\text{m} \\ d &= 24\text{m} \end{aligned}$$

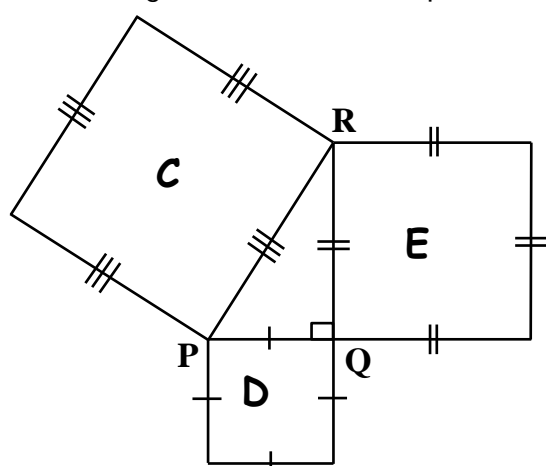
Exercise

- The area of the squares C and D in the figure are given below.

$$\text{Square C} = 36\text{cm}^2$$

$$\text{Square D} = 64\text{cm}^2$$

Use the figure to answer the questions.

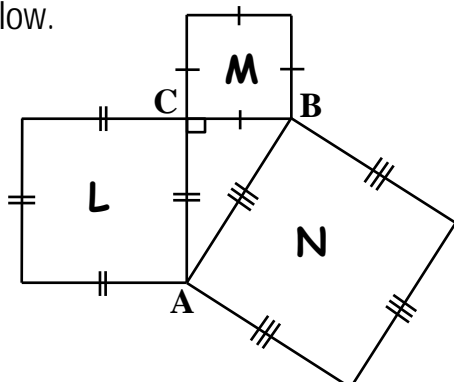


- Find the area of square E
- Find length PQ
- Calculate the
 - area of the triangle PQR
 - perimeter of the triangle PQR.

TOPIC 10: LENGTH, MASS AND CAPACITY

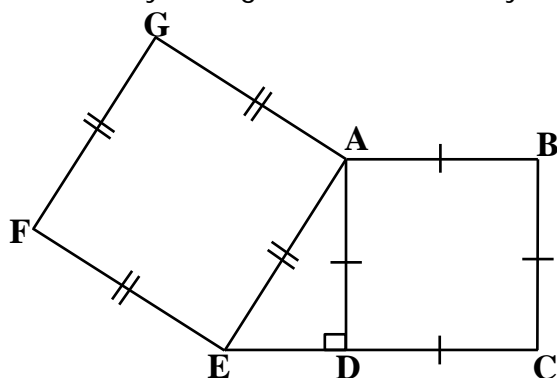


2. In the figure below, 169m^2 and 144m^2 are areas of the squares of N and L respectively. Study the figure below carefully and use it to answer questions that follow.



- Find length AC
- Calculate the perimeter of the ABCA.
- Find the area of triangle ABC.

3. Study the figure below carefully and use it to answer questions that follow.



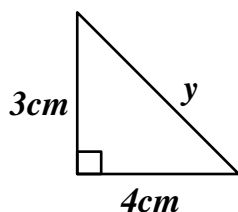
Given that $ABCD = 16\text{cm}^2$ and $AEFG = 25\text{cm}^2$.

Find the;

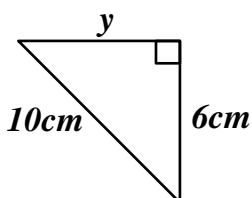
- area of triangle ADE.
- total distance around triangle ADE.

4. Study the figures below. Find the value of y and area of the triangle.

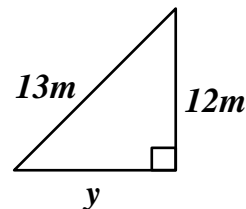
a)



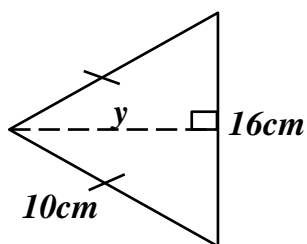
b)



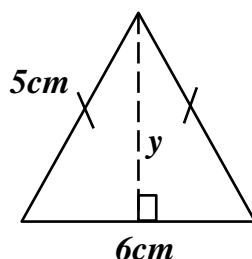
c)



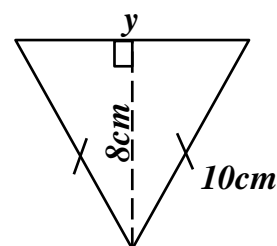
d)



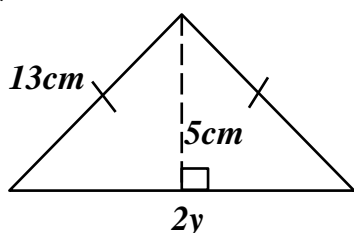
e)



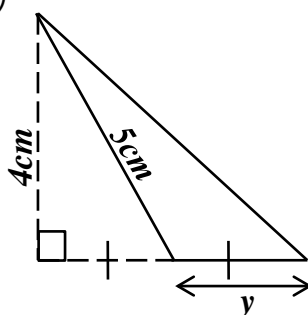
f)



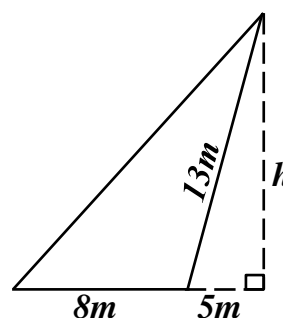
g)



h)



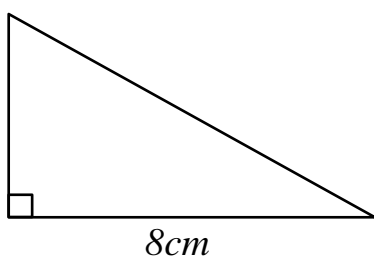
i)



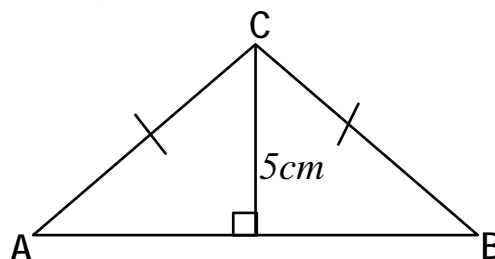
TOPIC 10: LENGTH, MASS AND CAPACITY



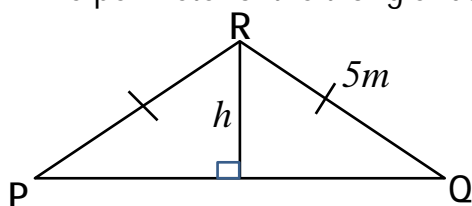
5. The area of the triangle below is 24m^2 . Calculate its perimeter.



6. Calculate the perimeter of the triangle ABC below if its area is 60cm^2 .

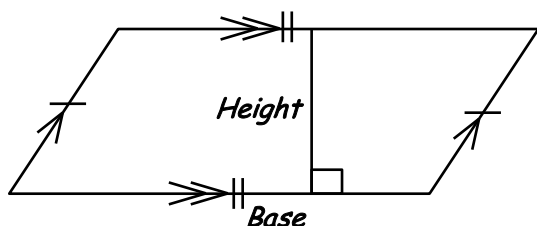


7. The perimeter of the triangle below is 18m .



- Find the value of h .
- Calculate the area of the triangle PQR.

Area of a parallelogram

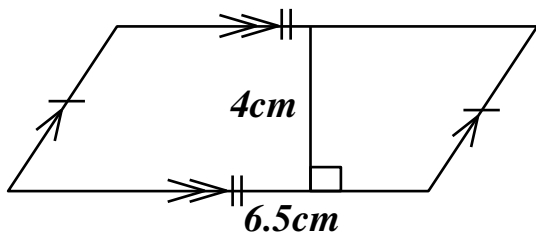


Area = Base x Perpendicular height

$$\text{Area} = b \times h$$

Example 1

Calculate the area of the figure below.



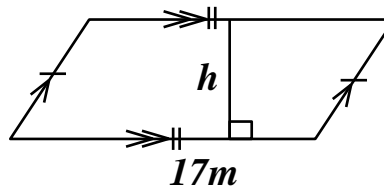
Area = Base x Height

$$\text{Area} = 6.5\text{cm} \times 4\text{cm}$$

$$\text{Area} = 26\text{cm}^2$$

Example 2

Find the height of a parallelogram whose area is 136m^2 and base 17m .



$$b \times h = A$$

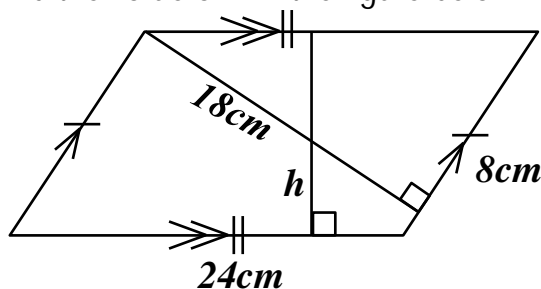
$$17\text{m} \times h = 136\text{m}^2$$

$$\frac{17\text{m} \times h}{17\text{m}} = \frac{136\text{m}^2}{17\text{m}}$$

$$h = 8\text{m}$$

Example 3

Find the value of h in the figure below.



$$b \times h = b \times h$$

$$24\text{cm} \times h = 8\text{cm} \times 18\text{cm}$$

$$\frac{24\text{cm} \times h}{24\text{cm}} = \frac{144\text{cm} \times \text{cm}}{24\text{cm}}$$

$$h = 6\text{cm}$$

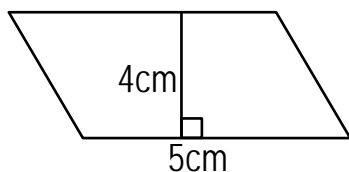
TOPIC 10: LENGTH, MASS AND CAPACITY



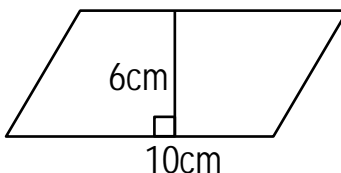
Exercise

1. Calculate the area of the following.

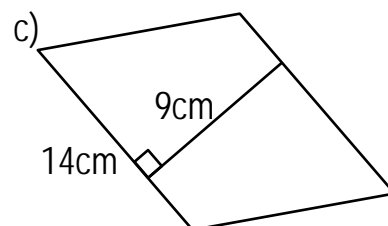
a)



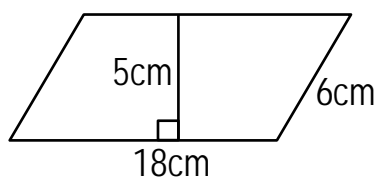
b)



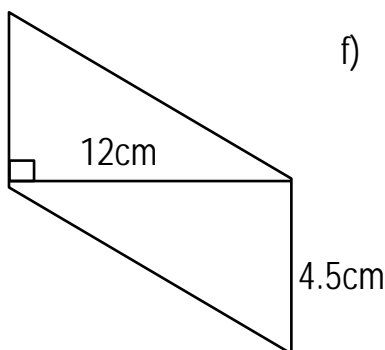
c)



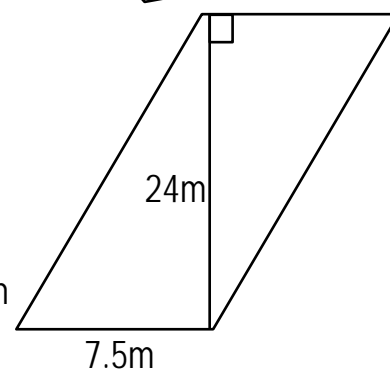
d)



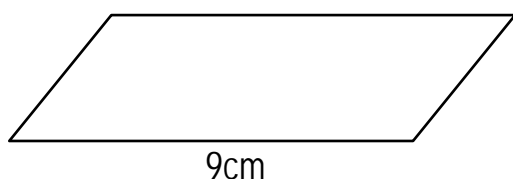
e)



f)



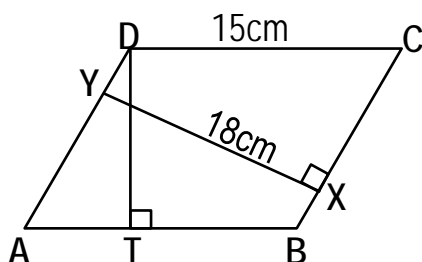
2. The area of the parallelogram below is 63cm^2 .



Find the its perpendicular height.

3. Find the base of a parallelogram whose area is 112cm^2 and perpendicular height 8cm.

4. The drawing below is a parallelogram $AB = DC = 15\text{cm}$, $CB = 10\text{cm}$ and $XY = 18\text{cm}$. Use it to answer questions that follow .

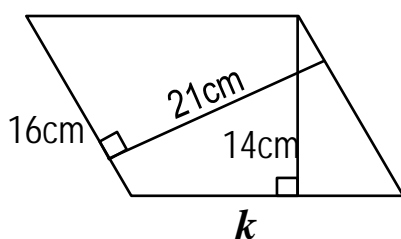


a) Find the area of parallelogram ABCD.

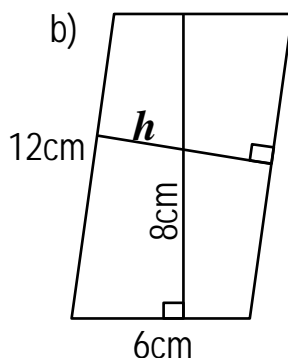
b) Find length DT.

5. Find unknown sides marked with letters.

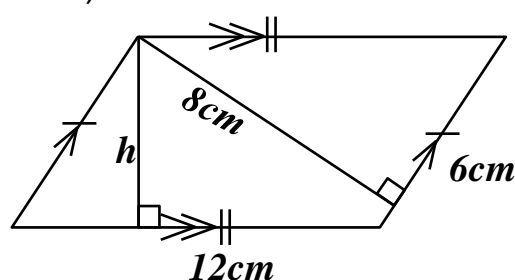
a)



b)



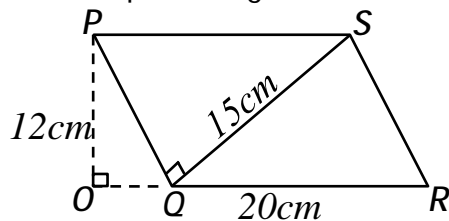
c)



TOPIC 10: LENGTH, MASS AND CAPACITY

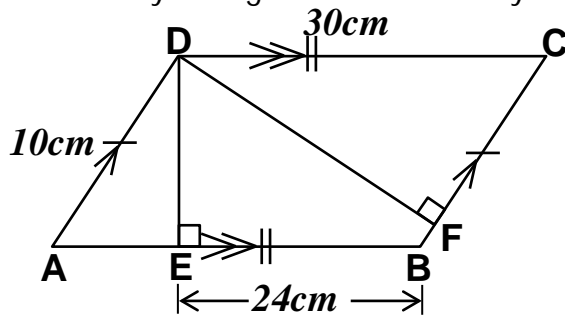


6. Below is parallelogram PQRS. Line QR = 20cm and diagonal QS = 15cm.



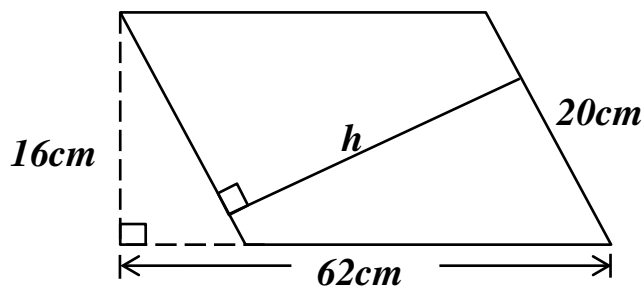
Find length SR in cm

7. Study the figure below carefully.



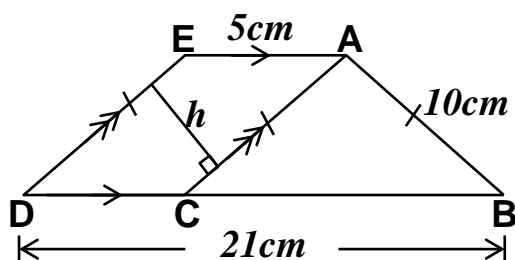
- a) Calculate the perimeter of parallelogram ABCD.
b) Find length DF in centimetres.

8. Study the figure below carefully and use it to answer the question that follows.



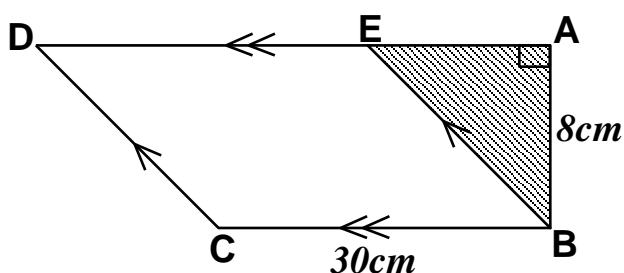
Find the value of h .

9. In the figure below, ABC is an isosceles triangle, ACDE is a parallelogram and diagonal EC is perpendicular to line DC.



- a) Find the value of h .
b) Find the area of triangle ABC.
c) Calculate the area of parallelogram ACDE.
d) Find the area of figure ABDE.

10. In the figure below, BCDE is a parallelogram, diagonal EC is perpendicular to line EB and the area of the shaded part is 24cm^2 .

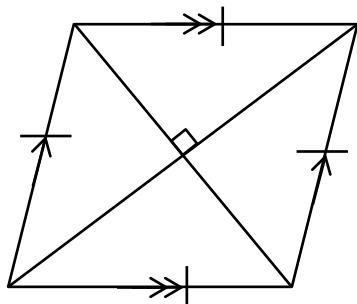


Find in cm, the length of diagonal EC.

TOPIC 10: LENGTH, MASS AND CAPACITY



Area of a rhombus

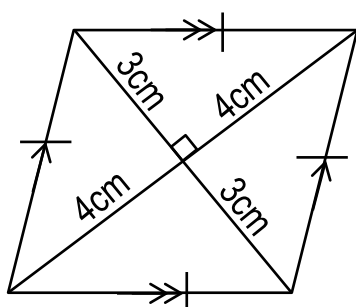


$$\text{Area} = \frac{1}{2} \times \text{base} \times \text{height} \times 4$$

$$\text{Area} = \frac{1}{2} \times \text{diagonal}_1 \times \text{diagonal}_2$$

Example 1

Find the area of the figure below.



Method 1

$$A = \frac{1}{2} \times b \times h \times 4$$

$$A = \frac{1}{2} \times 3\text{cm} \times 4\text{cm} \times 4$$

$$A = 1 \times 3\text{cm} \times 2\text{cm} \times 4$$

$$A = 24\text{cm}^2$$

Method 2

$$d_1 = 3\text{cm} + 3\text{cm} = 6\text{cm}$$

$$d_2 = 4\text{cm} + 4\text{cm} = 8\text{cm}$$

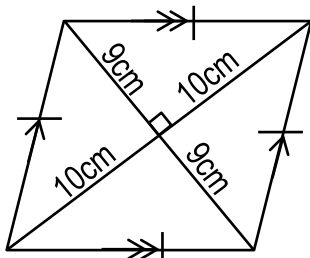
$$A = \frac{1}{2} \times d_1 \times d_2$$

$$A = \frac{1}{2} \times 6\text{cm} \times 8\text{cm}$$

$$A = 24\text{cm}^2$$

Example 2

The diagonals of a rhombus are 18cm and 20cm respectively. Find the area of the rhombus.



$$A = \frac{1}{2} \times d_1 \times d_2$$

$$A = \frac{1}{2} \times 18\text{cm} \times 20\text{cm}$$

$$A = 1 \times 9\text{cm} \times 20\text{cm}$$

$$A = 180\text{cm}^2$$

Example 3

The diagonals of a rhombus are in the ratio of 4:3 respectively. The length of the shorter diagonal is 18cm.

3 parts represent 18cm

1 part represents $18\text{cm} \div 3$

1 part represents 6cm

4 parts represent $4 \times 6\text{cm}$

4 parts represent 24cm

$$A = \frac{1}{2} \times d_1 \times d_2$$

$$A = \frac{1}{2} \times 24\text{cm} \times 18\text{cm}$$

$$A = 1 \times 12\text{cm} \times 18\text{cm}$$

$$A = 216\text{cm}^2$$

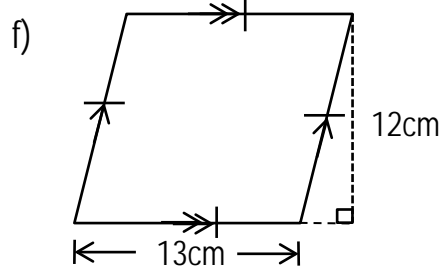
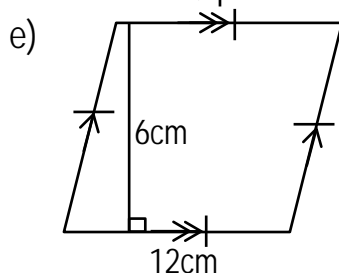
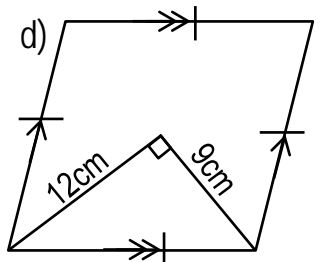
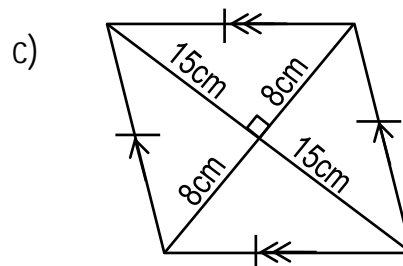
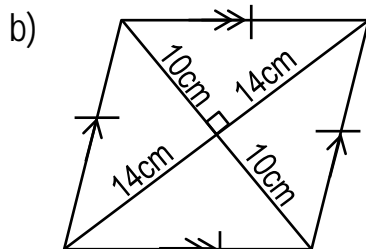
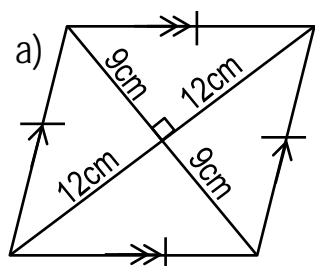
Exercise

- Calculate the area of a rhombus whose diagonals are 18cm and 16cm.
- Find the area of a rhombus whose diagonals are 12cm and 16cm respectively.
- One of the four congruent triangles of a rhombus has a base of 9cm and height 8cm. Find the area of the rhombus.
- The diagonals of a rhombus are in the ratio of 2:3 respectively. The length of the longer diagonal is 15cm. Calculate the area of the rhombus.

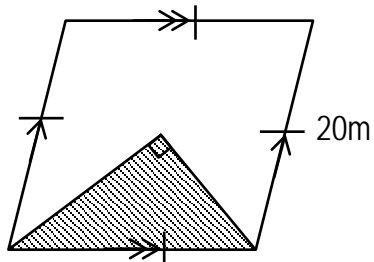
TOPIC 10: LENGTH, MASS AND CAPACITY



5. Find the area of each of the following:



4. The area of the shaded triangle in the rhombus below is 24m^2 .

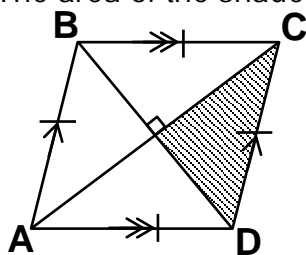


a) Find the area of the rhombus.

b) Calculate its perimeter.

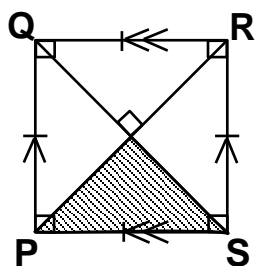
5. The area of a rhombus is 96cm^2 . One of its diagonals is 16cm. Find the length of the other diagonal.

6. The area of the shaded part in the figure below is 42cm^2 and diagonal $BD = 12\text{cm}$.



Find the length of diagonal AC.

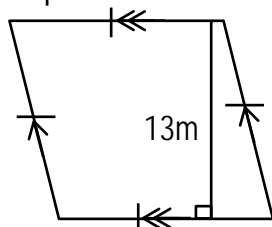
7. Below is a square PQRS. The area of the shaded part is 16m^2 .



a) Find the area of square PQRS.

b) Calculate the perimeter of the square.

8. The perimeter of the rhombus below is 60m.



Calculate its area.

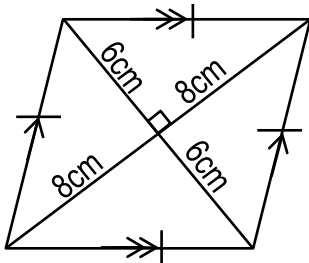
TOPIC 10: LENGTH, MASS AND CAPACITY



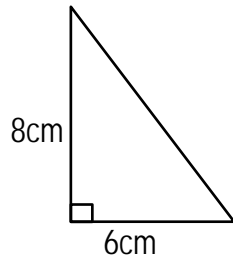
Problems involving applying Pythagoras theorem in a rhombus

Example 1

The length of the diagonals of a rhombus are 16cm and 12cm as shown below.



a) Find the length of each side.



$$\begin{aligned} c^2 &= a^2 + b^2 \\ c^2 &= (6\text{cm})^2 + (8\text{cm})^2 \\ c^2 &= (6\text{cm} \times 6\text{cm}) + (8\text{cm} \times 8\text{cm}) \\ c^2 &= 36\text{cm}^2 + 64\text{cm}^2 \\ c^2 &= 100\text{cm}^2 \\ \sqrt{c^2} &= \sqrt{100\text{cm}^2} \\ c &= 10\text{cm} \end{aligned}$$

The length of each side is 10cm

b) Calculate the perimeter of the rhombus.

Method 1

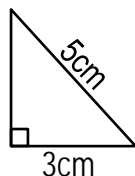
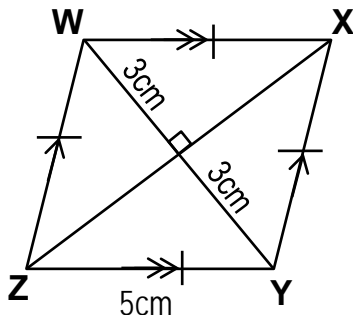
$$\begin{aligned} P &= S + S + S + S \\ P &= 10\text{cm} + 10\text{cm} + 10\text{cm} + 10\text{cm} \\ P &= 40\text{cm} \end{aligned}$$

Method 2

$$\begin{aligned} P &= 4S \\ P &= 4 \times 10\text{cm} \\ P &= 40\text{cm} \end{aligned}$$

Example 2

Study the rhombus WXYZ below. Find the length of diagonal ZX.

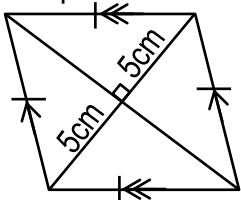


$$\begin{aligned} a^2 + b^2 &= c^2 \\ (3\text{cm})^2 + b^2 &= (5\text{cm})^2 \\ (3\text{cm} \times 3\text{cm}) + b^2 &= 5\text{cm} \times 5\text{cm} \\ 9\text{cm}^2 + b^2 &= 25\text{cm}^2 \\ 9\text{cm}^2 - 9\text{cm}^2 + b^2 &= 25\text{cm}^2 - 9\text{cm}^2 \\ \sqrt{b^2} &= \sqrt{16\text{cm}^2} \\ b &= 4\text{cm} \end{aligned}$$

Diagonal ZX = 4cm + 4cm
Diagonal ZX = 8cm

Example 3

The perimeter of the rhombus below is 52cm. Find its area.

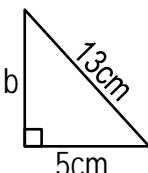


Length of each side

$$4s = P$$

$$\frac{4s}{4} = \frac{52\text{cm}}{4}$$

$$s = 13\text{cm}$$



Value of b

$$\begin{aligned} a^2 + b^2 &= c^2 \\ (5\text{cm})^2 + b^2 &= (13\text{cm})^2 \\ (5\text{cm} \times 5\text{cm}) + b^2 &= 13\text{cm} \times 13\text{cm} \\ 25\text{cm}^2 + b^2 &= 169\text{cm}^2 \\ 25\text{cm}^2 - 25\text{cm}^2 + b^2 &= 169\text{cm}^2 - 25\text{cm}^2 \\ \sqrt{b^2} &= \sqrt{144\text{cm}^2} \\ b &= 12\text{cm} \end{aligned}$$

$$\begin{aligned} 5\text{cm} + 5\text{cm} &= 10\text{cm} \\ 12\text{cm} + 12\text{cm} &= 24\text{cm} \end{aligned}$$

Area

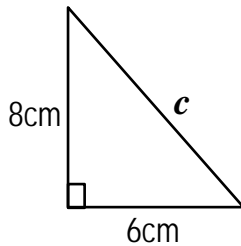
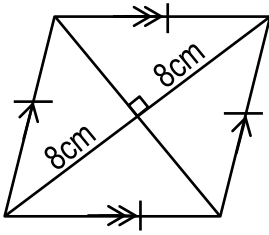
$$\begin{aligned} A &= \frac{1}{2} \times d_1 \times d_2 \\ A &= \frac{1}{2} \times 10\text{cm} \times 24\text{cm} \\ A &= 1 \times 5\text{cm} \times 24\text{cm} \\ A &= 120\text{cm}^2 \end{aligned}$$

TOPIC 10: LENGTH, MASS AND CAPACITY



Example 4

The area of the rhombus below is 96m^2 . Find the perimeter of the rhombus.



$$c^2 = a^2 + b^2$$

$$c^2 = (6\text{m})^2 + (8\text{m})^2$$

$$c^2 = (6\text{m} \times 6\text{m}) + (8\text{m} \times 8\text{m})$$

$$c^2 = 36\text{m}^2 + 64\text{m}^2$$

$$c^2 = 100\text{m}^2$$

$$\sqrt{c^2} = \sqrt{100\text{m}^2}$$

$$c = 10\text{m}$$

The length of each side is 10m

Perimeter

$$P = 4s$$

$$P = 4 \times 10\text{m}$$

$$P = 40\text{m}$$

$$\frac{1}{2} \times d_1 \times d_2 = A$$

$$\frac{1}{2} \times 16\text{m} \times d_2 = 96\text{m}^2$$

$$\frac{8\text{m} \times d_2}{8\text{m}} = \frac{96\text{m} \times \text{m}}{8\text{m}}$$

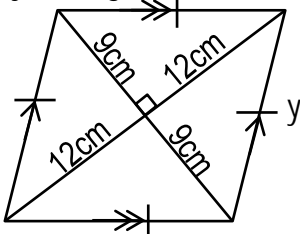
$$d_2 = 12\text{m}$$

Exercise

- The diagonals of a rhombus are 24cm and 10cm .

- Find the length of each side.
- Calculate the perimeter of the rhombus.

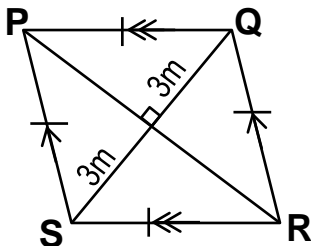
- Study the figure below.



- Find the value of y .

- Calculate the total distance around the figure.

- The area of the rhombus PQRS below is 24m^2 .

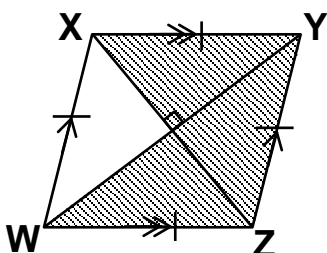


- Find length QR.

- Find the perimeter of PQRS.

- The area of a rhombus is 120cm^2 . If one of its diagonals is 24cm , calculate the total distance around the rhombus.

- In the figure below, WXYZ is a rhombus. Diagonal $XZ = 18\text{cm}$ and the area of the shaded part is 162m^2 .



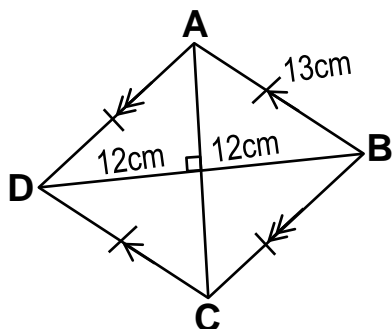
- Find the length of diagonal WY in cm.

- Calculate the perimeter of the figure.

TOPIC 10: LENGTH, MASS AND CAPACITY

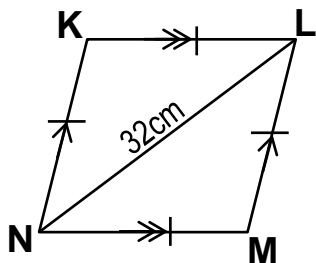


6. In the figure below, ABCD is rhombus. Study it carefully and answer questions that follow.



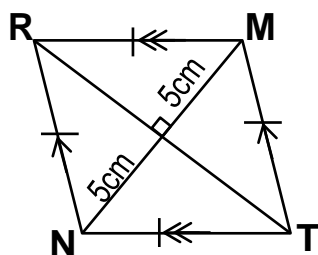
- Find the length of diagonal AC.
- Calculate the area of the rhombus in cm^2 .

7. The side of a rhombus is 15cm. One of its diagonals is 18cm.
- Find the length of the second diagonal.
 - Calculate its;
 - perimeter
 - area
8. The diagonals of a rhombus are in the ratio of 4:3 respectively. The shorter diagonal is 12cm. Calculate its
- area.
 - perimeter.
9. The diagram below is a rhombus KLMN of perimeter 80cm and diagonal NL = 32cm.



- Find the length of diagonal KM.
- Find the area of the rhombus.

10. The perimeter of a rhombus is 40cm. The length of the shorter diagonal is 12cm.
- Find the length of the longer diagonal.
 - Find the area of the rhombus.
11. An insect moved 15 times around the rhombus below and covered 780cm.



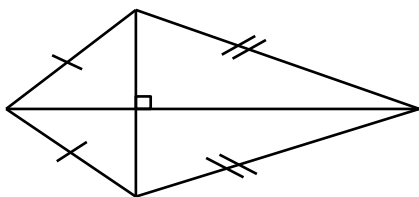
Find the area of the rhombus in cm^2 .

12. The diagonal of a rhombus are in the ratio of 3:4 respectively. Its area is 96cm^2 . Find its perimeter.

TOPIC 10: LENGTH, MASS AND CAPACITY



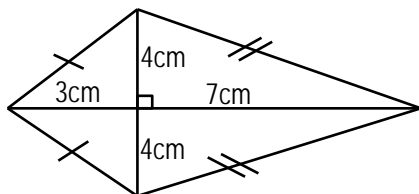
Finding area of a kite



$$A = \frac{1}{2} \times d_1 \times d_2$$

Example

Find the area of the kite below.



Method 1

$$A = \frac{1}{2} \times d_1 \times d_2$$

$$A = \frac{1}{2} \times 10\text{cm} \times 8\text{cm}$$

$$A = \frac{1}{2} \times 5\text{cm} \times 8\text{cm}$$

$$A = 40\text{cm}^2$$

Method 2

$$A = \frac{1}{2} \times b \times h \times 2$$

$$A = \frac{1}{2} \times 10\text{cm} \times 4\text{cm} \times 2$$

$$A = \frac{1}{2} \times 5\text{cm} \times 4\text{cm} \times 2$$

$$A = 40\text{cm}^2$$

Method 3

$$A = \left(\frac{1}{2} \times b \times h\right) + \left(\frac{1}{2} \times b \times h\right)$$

$$A = \left(\frac{1}{2} \times 8\text{cm} \times 3\text{cm}\right) + \left(\frac{1}{2} \times 8\text{cm} \times 7\text{cm}\right)$$

$$A = (4\text{cm} \times 3\text{cm}) + (4\text{cm} \times 7\text{cm})$$

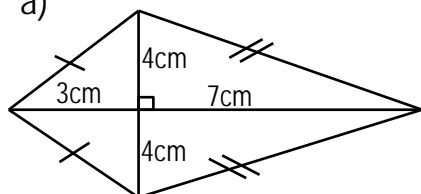
$$A = 12\text{cm}^2 + 28\text{cm}^2$$

$$A = 40\text{cm}^2$$

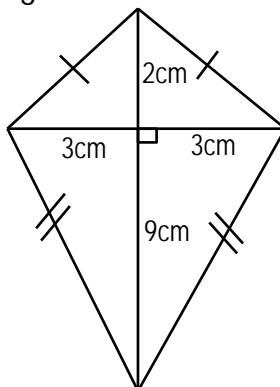
Exercise

- The diagonals of a kite are 18cm and 9cm respectively. Find its area.
- Find the area of a kite whose diagonals are 20cm and 12cm.
- Calculate the area of each of the figure below.

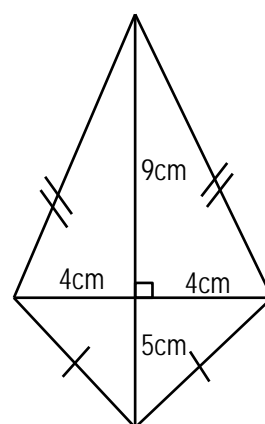
a)



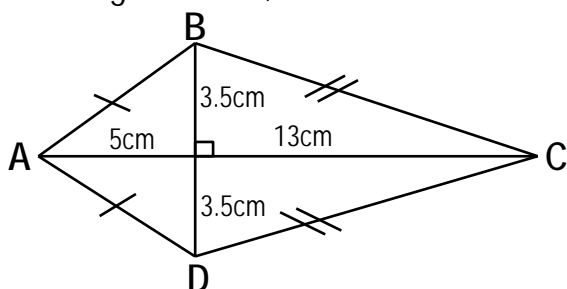
b)



c)



- In the figure below, ABCD is a kite.



a) Find the length of diagonal DB.

b) Calculate the area of the kite ABCD.

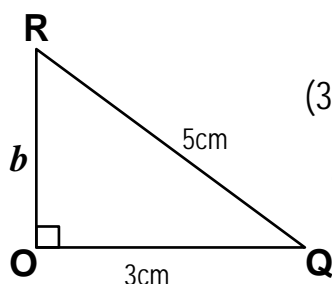
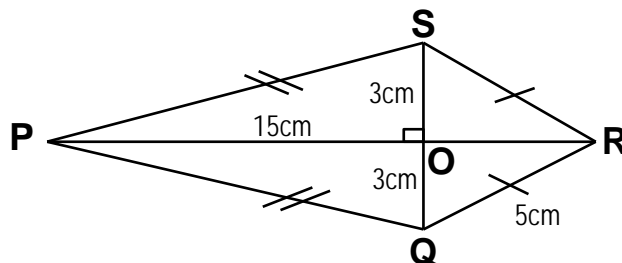
TOPIC 10: LENGTH, MASS AND CAPACITY



Finding the unknown side of a kite

Example 1

The diagram below is a kite. $QR = RS = 5\text{cm}$, $OS = OQ = 3\text{cm}$ and $OP = 15\text{cm}$. Find its area.



Value of b

$$\begin{aligned} a^2 + b^2 &= c^2 \\ (3\text{cm})^2 + b^2 &= (5\text{cm})^2 \\ (3\text{cm} \times 3\text{cm}) + b^2 &= 5\text{cm} \times 5\text{cm} \\ 9\text{cm}^2 + b^2 &= 25\text{cm}^2 \\ 9\text{cm}^2 - 9\text{cm}^2 + b^2 &= 25\text{cm}^2 - 9\text{cm}^2 \\ \sqrt{b^2} &= \sqrt{16\text{cm}^2} \\ b &= 4\text{cm} \\ OR &= 4\text{cm} \end{aligned}$$

Diagonal SQ

$$3\text{cm} + 3\text{cm} = 6\text{cm}$$

Diagonal PR

$$15\text{cm} + 4\text{cm} = 19\text{cm}$$

Area

$$A = \frac{1}{2} \times d_1 \times d_2$$

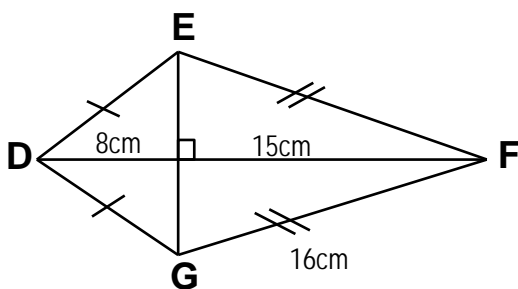
$$A = \frac{1}{2} \times 6\text{cm} \times 19\text{cm}$$

$$A = \frac{1}{2} \times 3\text{cm} \times 19\text{cm}$$

$$A = 57\text{cm}^2$$

Example 2

The area of the kite DEFG below is 138cm^2 . Calculate its perimeter.



$$15\text{cm} + 8\text{cm} = 23\text{cm}$$

Length of diagonal EG

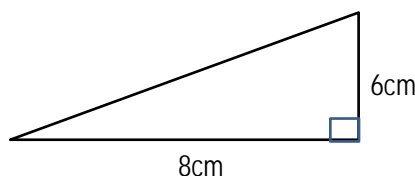
$$\frac{1}{2} \times d_1 \times d_2 = A$$

$$\frac{1}{2} \times 23\text{cm} \times d_2 = 138\text{cm}^2$$

$$2 \times \frac{1}{2} \times 23\text{cm} \times d_2 = 138\text{cm}^2 \times 2$$

$$\frac{23\text{cm} \times d_2}{23\text{cm}} = \frac{276\text{cm} \times \text{cm}}{23\text{cm}}$$

$$d_2 = 12\text{cm}$$



$$c^2 = a^2 + b^2$$

$$c^2 = (6\text{cm})^2 + (8\text{cm})^2$$

$$c^2 = (6\text{cm} \times 6\text{cm}) + (8\text{cm} \times 8\text{cm})$$

$$c^2 = 36\text{cm}^2 + 64\text{cm}^2$$

$$c^2 = 100\text{cm}^2$$

$$\sqrt{c^2} = \sqrt{100\text{cm}^2}$$

$$c = 10\text{cm}$$

$$\text{Length GD} = \text{DE} = 10\text{cm}$$

$$\text{Length GF} = \text{FE} = 16\text{cm}$$

Perimeter

$$P = s + s + s + s$$

$$P = 10\text{cm} + 16\text{cm} + 10\text{cm} + 16\text{cm}$$

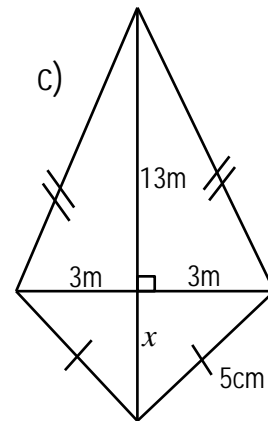
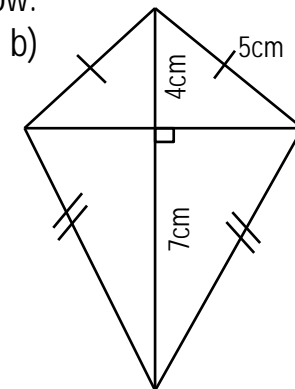
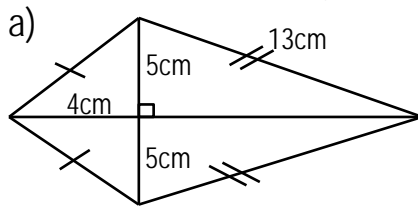
$$P = 52\text{cm}$$

TOPIC 10: LENGTH, MASS AND CAPACITY

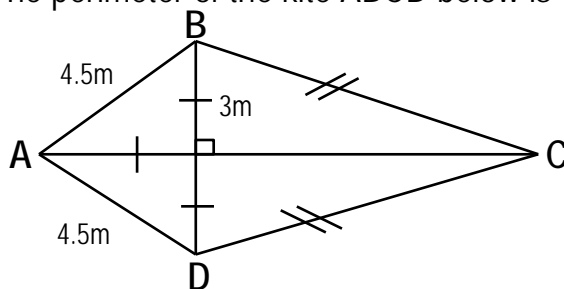


Exercise

1. Find the area of the figures below.

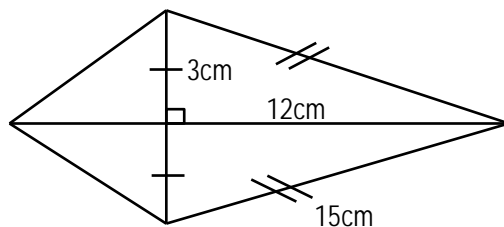


2. The perimeter of the kite ABCD below is 19m.



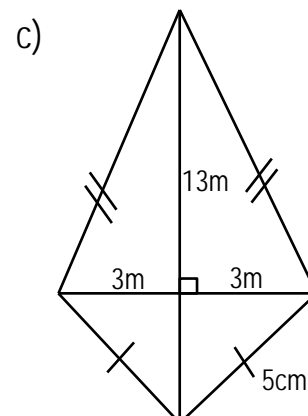
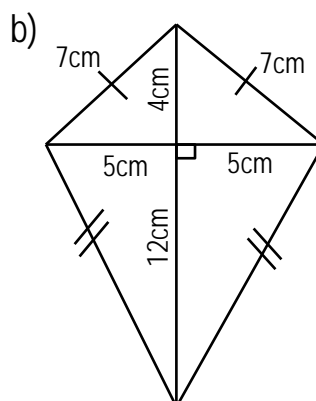
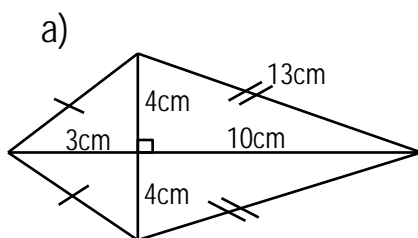
- a) Find length BC
b) Find its area.

3. Below is a kite whose perimeter is 40cm. Study it carefully and use it to answer the question that follows.



Find its area.

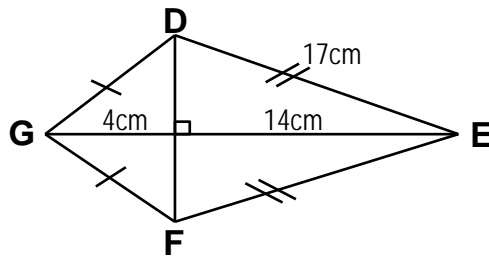
3. The area of a kite is 102cm^2 . If one of its diagonals is 12cm, find the other diagonal.
4. The area of kite is 40cm^2 . The shorter diagonal is 8cm. Find the length of the longer diagonal.
5. Find the perimeter of each of the following.



TOPIC 10: LENGTH, MASS AND CAPACITY

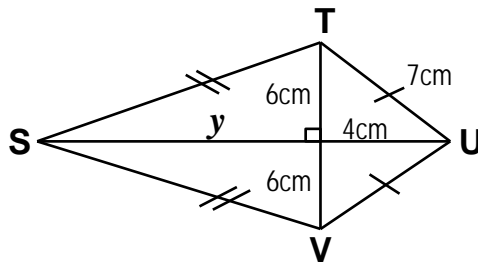


6. The area of the kite below is 54m^2 .



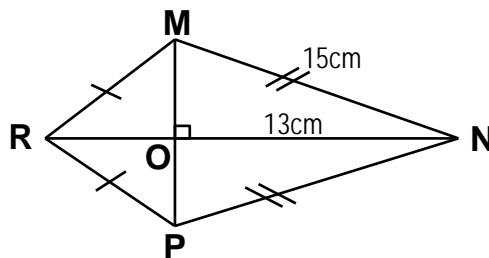
- Find the length of diagonal DF in cm.
- Calculate the perimeter of the kite.

7. The area of the kite below is 72cm^2 .



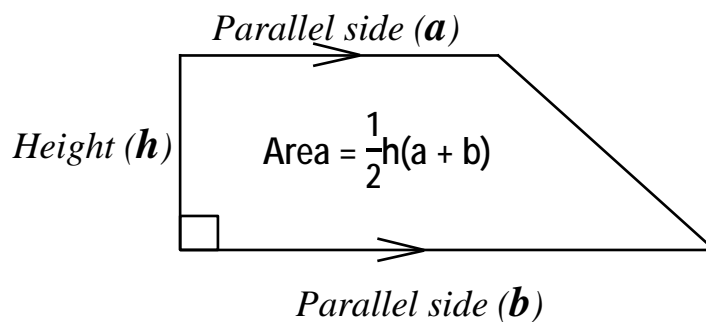
- Find the value of y .
- Find the total distance around the kite.

8. Given that the area of the kite MNPR below is 51cm^2 . Line MP = 6cm, MN = NP = 15cm and ON = 13cm.



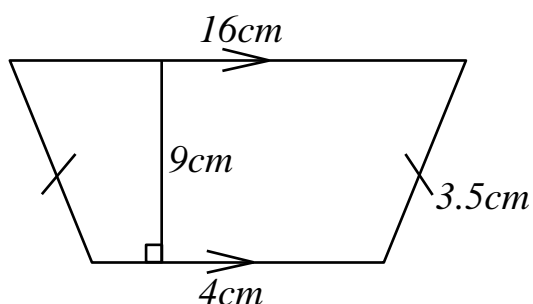
Find in centimeters, the perimeter of kite MNPR.

Area of a trapezium



Example

Find the area of the figures below.



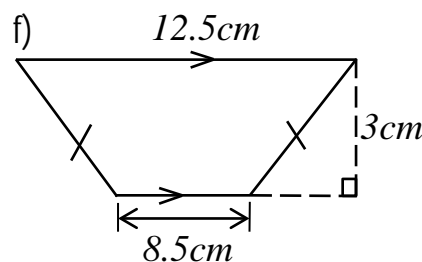
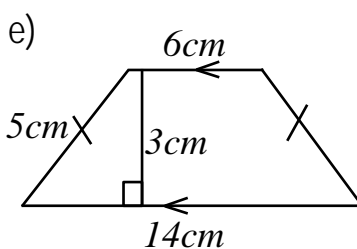
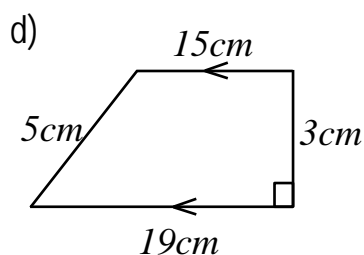
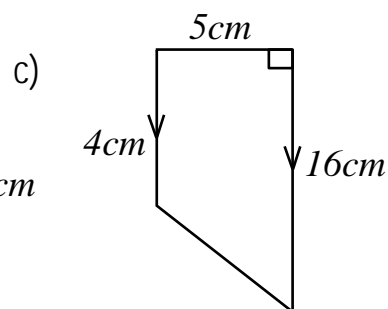
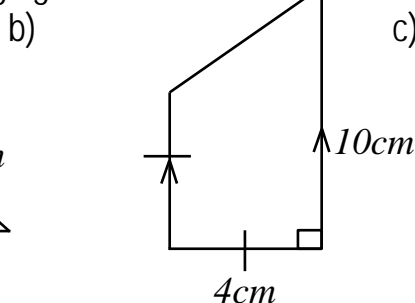
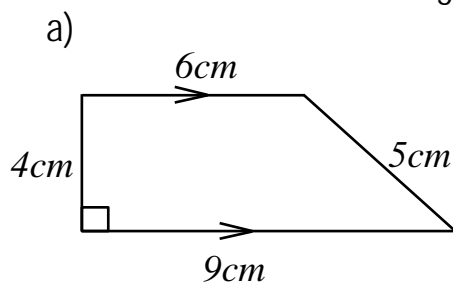
$$\begin{aligned}
 A &= \frac{1}{2}h(a + b) \\
 A &= \frac{1}{2} \times 9\text{cm}(4\text{cm} + 16\text{cm}) \\
 A &= \frac{1}{2} \times 9\text{cm} \times 20\text{cm} \\
 A &= 9\text{cm} \times 10\text{cm} \\
 A &= 90\text{cm}^2
 \end{aligned}$$

TOPIC 10: LENGTH, MASS AND CAPACITY



Exercise

1. Find the area of the following figures.

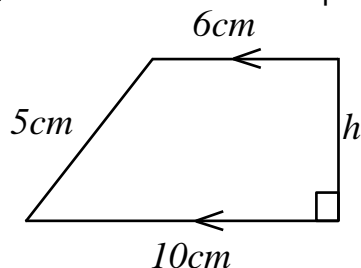


2. Calculate the area of a trapezium whose height is 9cm and the parallel sides are 7cm and 13cm respectively.

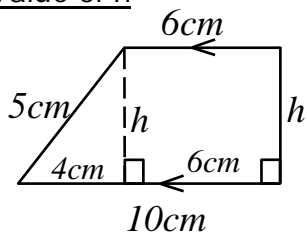
Finding the unknown side of a trapezium

Example 1

Study the figure below, calculate its area and perimeter.



Value of h



$$a^2 + b^2 = c^2$$

$$(4\text{cm})^2 + h^2 = (5\text{cm})^2$$

$$(4\text{cm} \times 4\text{cm}) + h^2 = 5\text{cm} \times 5\text{cm}$$

$$16\text{cm}^2 + h^2 = 25\text{cm}^2$$

$$16\text{cm}^2 - 16\text{cm}^2 + h^2 = 25\text{cm}^2 - 16\text{cm}^2$$

$$\sqrt{h^2} = \sqrt{9\text{cm}^2}$$

$$h = 3\text{cm}$$

Area

$$A = \frac{1}{2}h(a + b)$$

$$A = \frac{1}{2} \times 3\text{cm}(6\text{cm} + 10\text{cm})$$

$$A = \frac{1}{2} \times 3\text{cm} \times 16\text{cm}$$

$$A = 3\text{cm} \times 8\text{cm}$$

$$A = 24\text{cm}^2$$

Perimeter

$$P = S + S + S$$

$$P = 10\text{cm} + 5\text{cm} + 6\text{cm} + 3\text{cm}$$

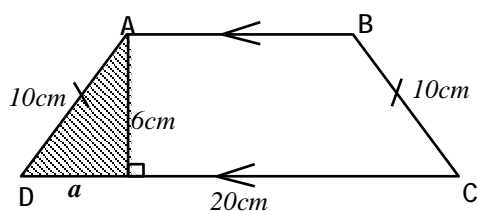
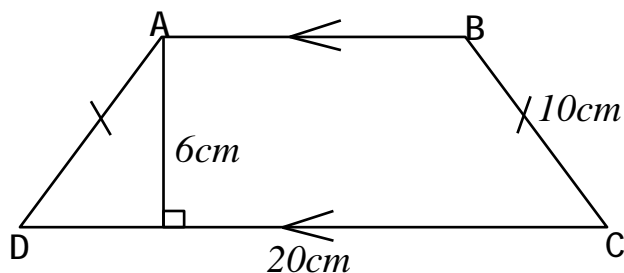
$$P = 24\text{cm}$$

TOPIC 10: LENGTH, MASS AND CAPACITY



Example 2

Find the area of the figure below.



$$\begin{aligned}
 a^2 + b^2 &= c^2 \\
 a^2 + (6\text{cm})^2 &= (10\text{cm})^2 \\
 a^2 + (6\text{cm} \times 6\text{cm}) &= 10\text{cm} \times 10\text{cm} \\
 a^2 + 36\text{cm}^2 &= 100\text{cm}^2 \\
 a^2 + 36\text{cm}^2 - 36\text{cm}^2 &= 100\text{cm}^2 - 36\text{cm}^2 \\
 a^2 &= 64\text{cm}^2 \\
 \sqrt{a^2} &= \sqrt{64\text{cm}^2} \\
 a &= 8\text{cm}
 \end{aligned}$$

Length AB

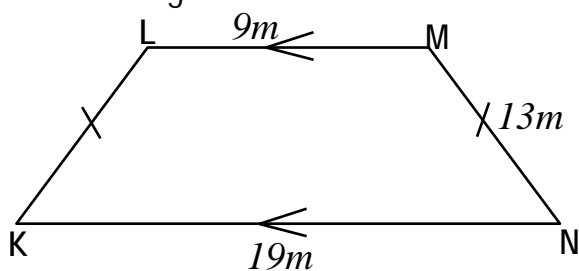
$$\begin{aligned}
 20\text{cm} - (8\text{cm} + 8\text{cm}) \\
 20\text{cm} - 16\text{cm} \\
 4\text{cm}
 \end{aligned}$$

Area

$$\begin{aligned}
 A &= \frac{1}{2}h(a + b) \\
 A &= \frac{1}{2} \times 6\text{cm}(4\text{cm} + 20\text{cm}) \\
 A &= \frac{1}{2} \times 6\text{cm} \times 24\text{cm} \\
 A &= 3\text{cm} \times 24\text{cm} \\
 A &= 72\text{cm}^2
 \end{aligned}$$

Example 3

Calculate the area of the figure below .

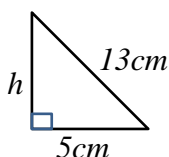


$$19\text{m} - 9\text{m} = 10\text{m}$$

$$10\text{m} \div 2 = 5\text{m}$$

Height

$$\begin{aligned}
 a^2 + b^2 &= c^2 \\
 (5\text{m})^2 + h^2 &= (13\text{m})^2 \\
 (5\text{m} \times 5\text{m}) + h^2 &= 13\text{m} \times 13\text{m} \\
 25\text{m}^2 + h^2 &= 169\text{m}^2 \\
 25\text{m}^2 - 25\text{m}^2 + h^2 &= 169\text{m}^2 - 25\text{m}^2 \\
 \sqrt{h^2} &= \sqrt{144\text{m}^2} \\
 h &= 12\text{m}
 \end{aligned}$$



Area

$$\begin{aligned}
 A &= \frac{1}{2}h(a + b) \\
 A &= \frac{1}{2} \times 12\text{m}(19\text{m} + 9\text{m}) \\
 A &= \frac{1}{2} \times 12\text{m} \times 28\text{m} \\
 A &= 6\text{m} \times 28\text{m} \\
 A &= 168\text{m}^2
 \end{aligned}$$

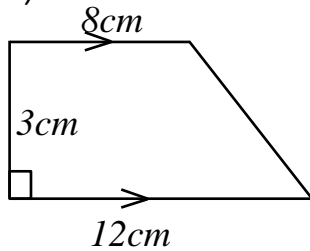
TOPIC 10: LENGTH, MASS AND CAPACITY



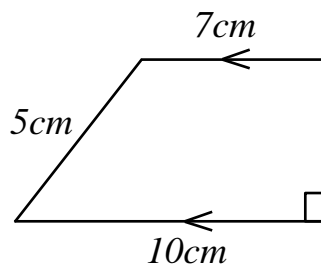
Exercise

1. Find the unknown side, perimeter and area of each of the following figures.

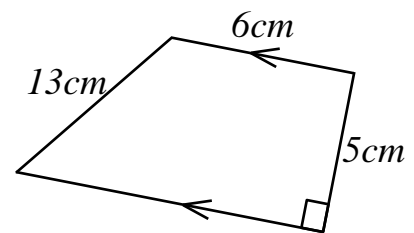
a)



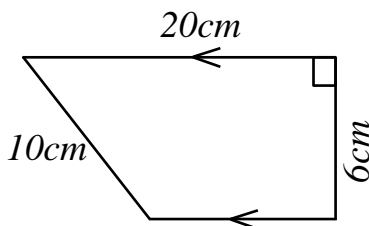
b)



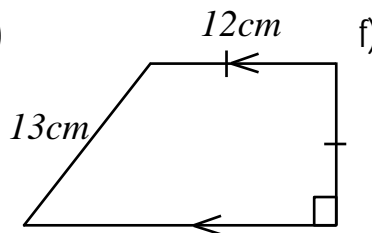
c)



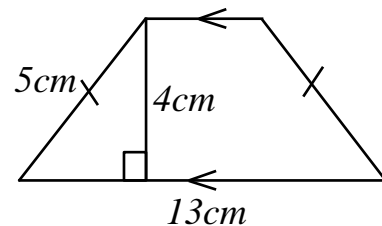
d)



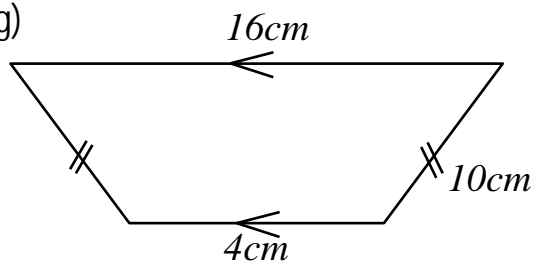
e)



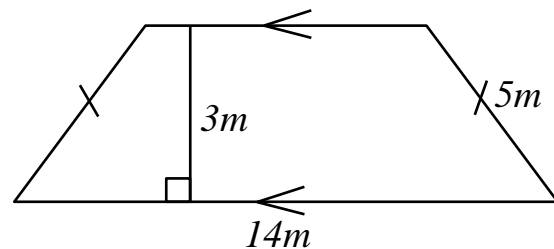
f)



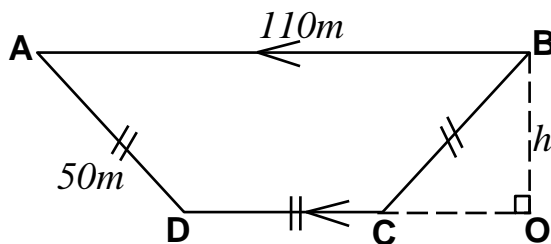
g)



h)



2. The figure below shows Jibu's flower garden. Use it answer questions that follow.

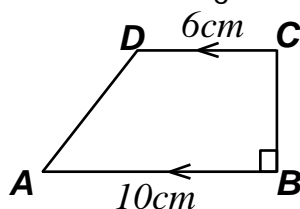


a) Find the value of h .

b) Calculate the total distance around it

c) Find the area of the flower garden.

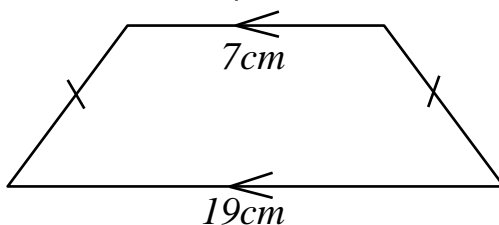
3. The area of the figure below is 24cm^2 .



a) Find length BC

b) Calculate the perimeter of trapezium ABCD.

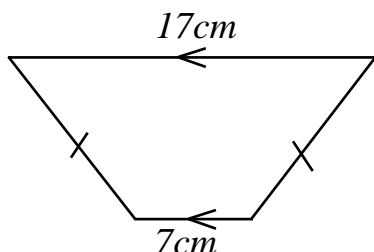
4. The area of trapezium below is 104cm^2 . Find its perimeter.



TOPIC 10: LENGTH, MASS AND CAPACITY

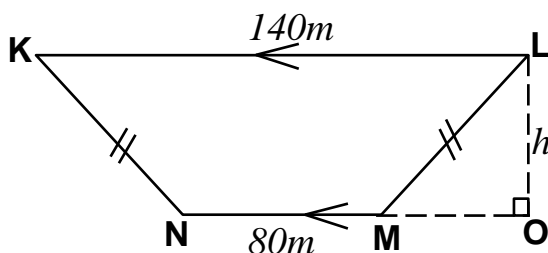


5. The perimeter of the trapezium below is 50cm. Use it to answer questions that follow.



- Find the height of the trapezium.
- Calculate its area.

6. In the figure below, KLMN is a trapezoidal field. By running 15 times around the field, Mr. Misinde covered 4.8 kilometres. Study the figure carefully and use the given information to answer the question that follows.



Calculate in square metres, the area of the field.

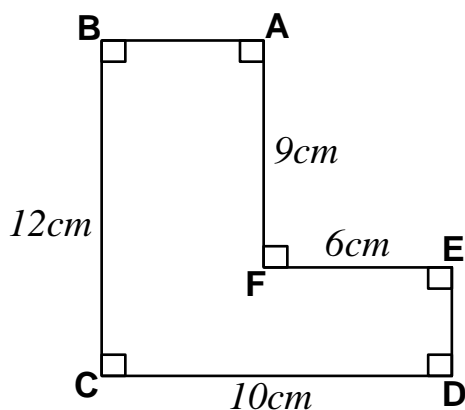
Finding the area of a compound figure

To find the area of compound shapes, we must split the compound shape into basic shapes, then find the area of each of the basic shapes and add them together.

Our final answer must be in square units e.g. square centimetres (cm^2), square metres (m^2), etc.

Example 1

Calculate the area of the figure below.

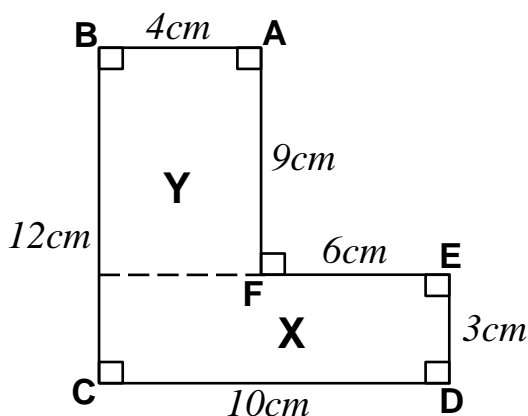


$$AB = 10\text{cm} - 6\text{cm}$$

$$AB = 4\text{cm}$$

$$ED = 12\text{cm} - 9\text{cm}$$

$$ED = 3\text{cm}$$



$$\text{Total area} = \text{Area X} + \text{Area Y}$$

$$(\text{L} \times \text{W}) + (\text{L} \times \text{W})$$

$$(10\text{cm} \times 3\text{cm}) + (9\text{cm} \times 4\text{cm})$$

$$30\text{cm}^2 + 36\text{cm}^2$$

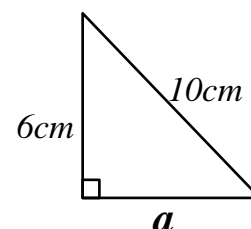
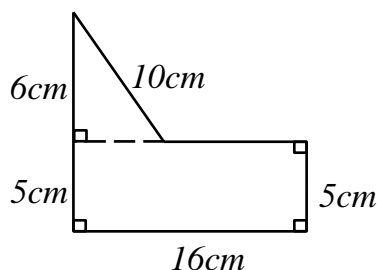
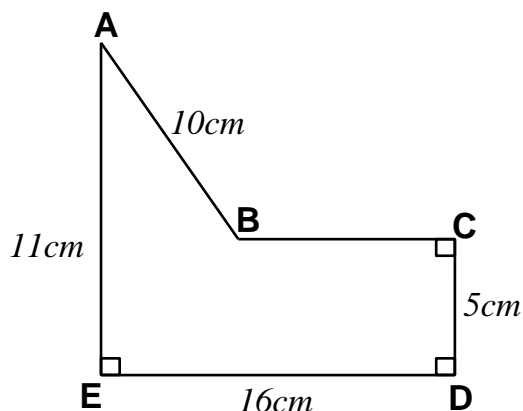
$$66\text{cm}^2$$

TOPIC 10: LENGTH, MASS AND CAPACITY



Example 2

Study the figure below. Calculate its area and perimeter.



$$\begin{aligned} a^2 + b^2 &= c^2 \\ a^2 + (6\text{cm})^2 &= (10\text{cm})^2 \\ a^2 + (6\text{cm} \times 6\text{cm}) &= (10\text{cm} \times 10\text{cm}) \\ a^2 + 36\text{cm}^2 &= 100\text{cm}^2 \\ a^2 + 36\text{cm}^2 - 36\text{cm}^2 &= 100\text{cm}^2 - 36\text{cm}^2 \\ a^2 &= 64\text{cm}^2 \\ \sqrt{a^2} &= \sqrt{64\text{cm}^2} \\ a &= 8\text{cm} \end{aligned}$$

Area of the rectangle

$$A = L \times W$$

$$A = 16\text{cm} \times 5\text{cm}$$

$$A = 80\text{cm}^2$$

Area of the triangle

$$A = \frac{1}{2} \times b \times h$$

$$A = \frac{1}{2} \times 8\text{cm} \times 6\text{cm}$$

$$A = 1 \times 4\text{cm} \times 6\text{cm}$$

$$A = 24\text{cm}^2$$

Area of the figure

$$80\text{cm}^2 + 24\text{cm}^2 = 104\text{cm}^2$$

Perimeter

$$16\text{cm} - 8\text{cm} = 8\text{cm}$$

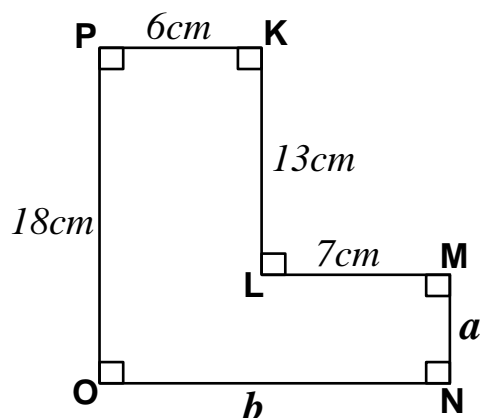
$$P = S + S + S + S$$

$$P = 16\text{cm} + 5\text{cm} + 8\text{cm} + 10\text{cm} + 11\text{cm}$$

$$P = 50\text{cm}$$

Activity

1. Study the figure below.



a) Find the value of

i) a

ii) b

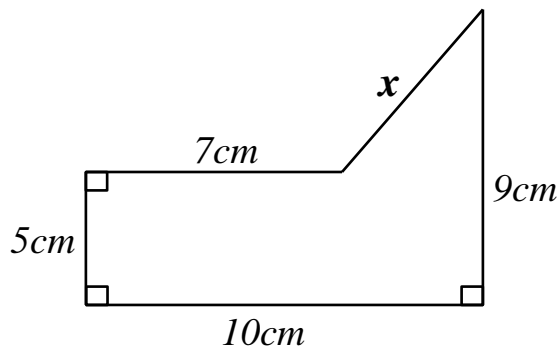
b) Find the perimeter of the figure.

c) Calculate the area of the figure

TOPIC 10: LENGTH, MASS AND CAPACITY

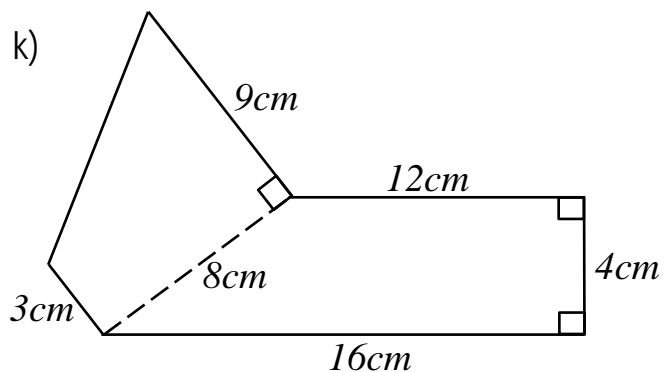
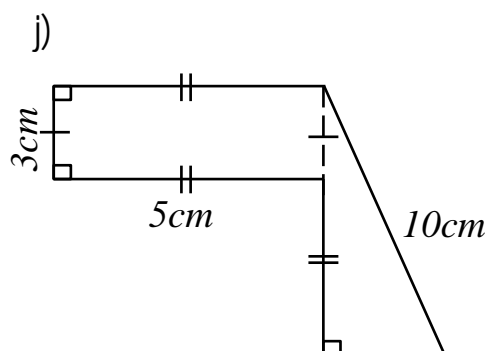
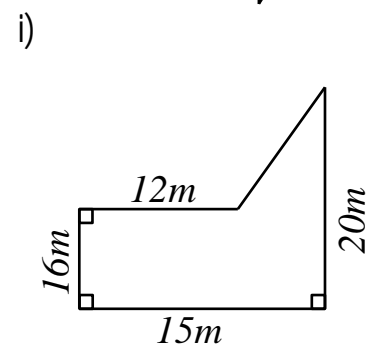
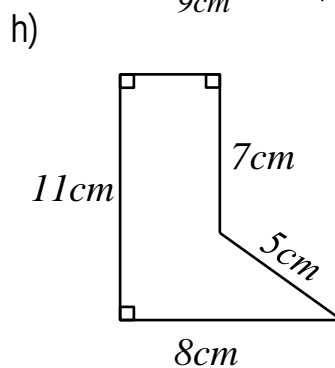
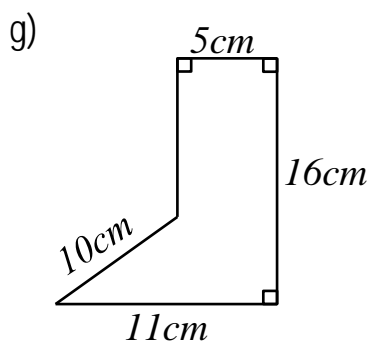
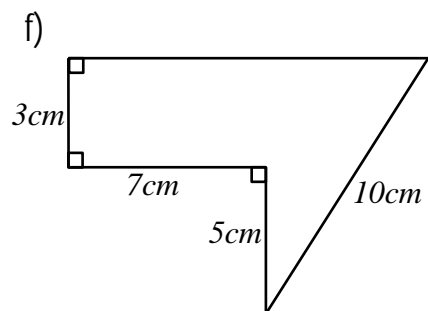
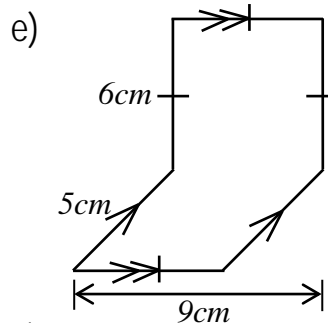
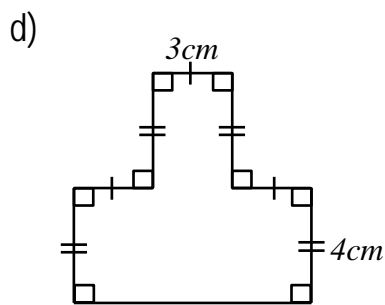
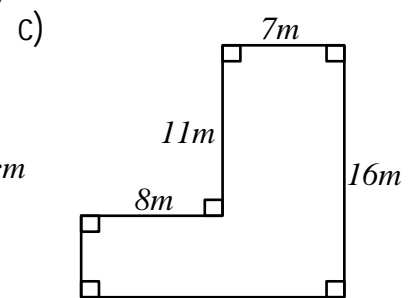
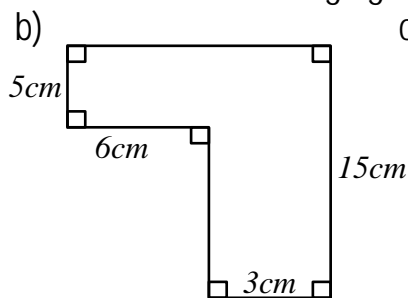
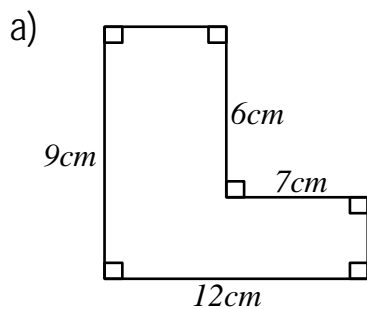


2. Study the figure below and use it to answer the questions that follow.



- Find the value of x .
- Find the perimeter of the figure.
- find the area of the figure.

3. Calculate the area and the perimeter of the following figures.

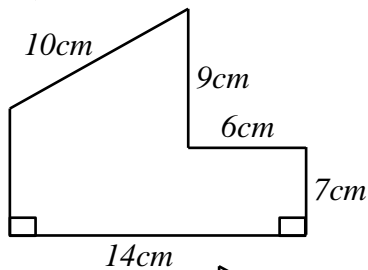


TOPIC 10: LENGTH, MASS AND CAPACITY

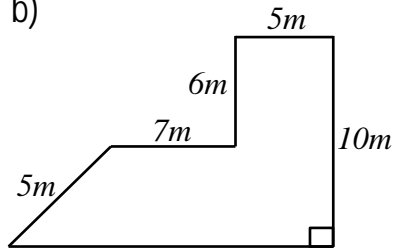


4. Below are combined shapes. Find the area and perimeter of each of the given shapes.

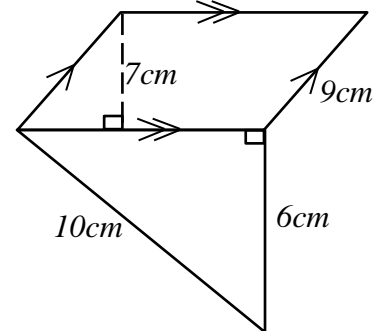
a)



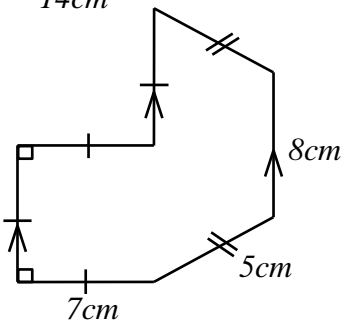
b)



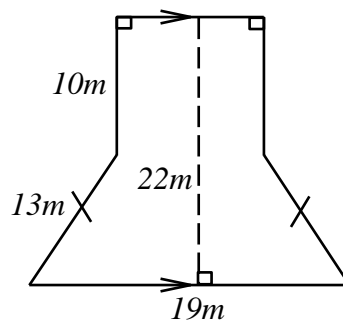
c)



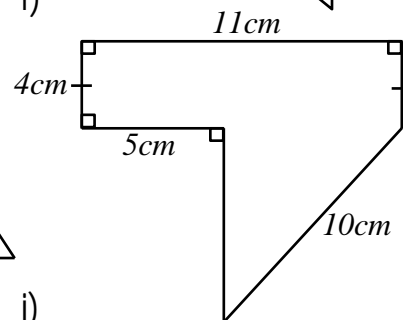
d)



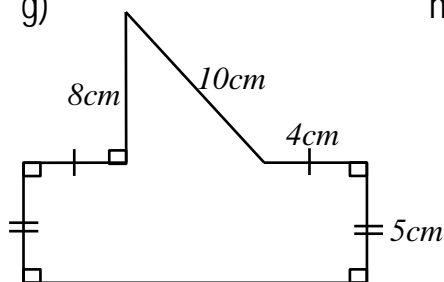
e)



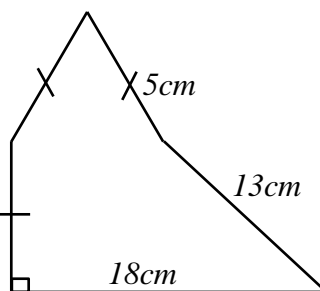
f)



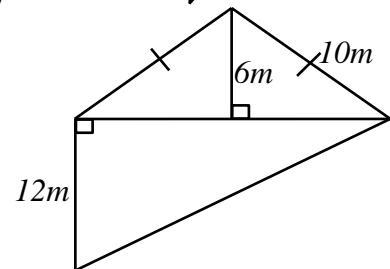
g)



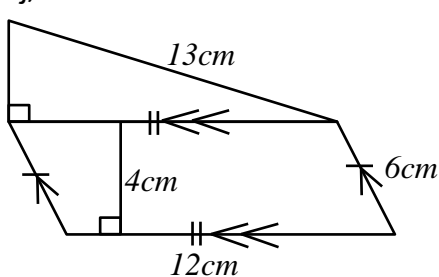
h)



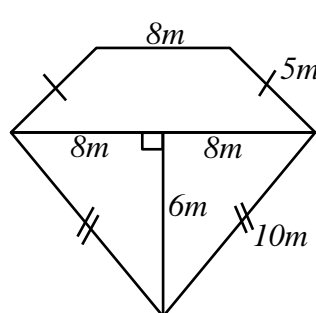
i)



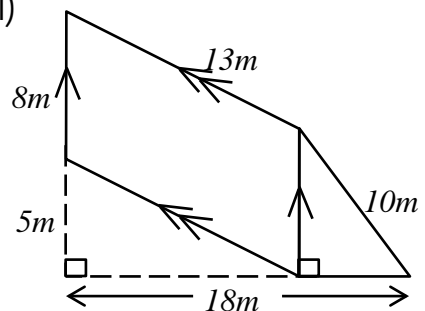
j)



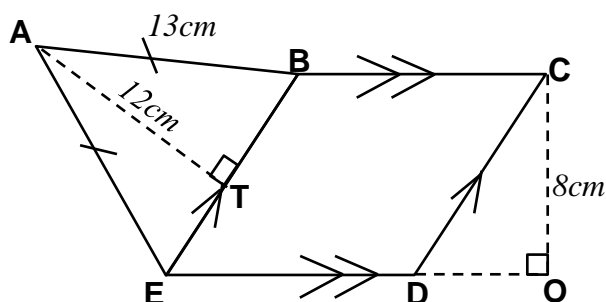
k)



l)



5. In the figure ABCDE below, $OC = 8\text{cm}$, $AB = 13\text{cm}$, $AT = 12\text{cm}$ and line $BC =$ line CD . Use it to answer questions that follow.



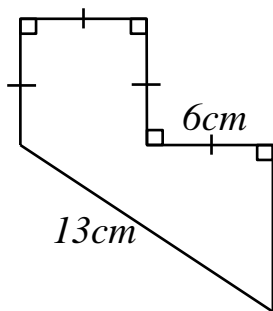
a) Find length DC in cm.

b) Calculate the area of rhombus BCDF.

c) Find the
i) perimeter of the figure.
ii) area of ABCDE.

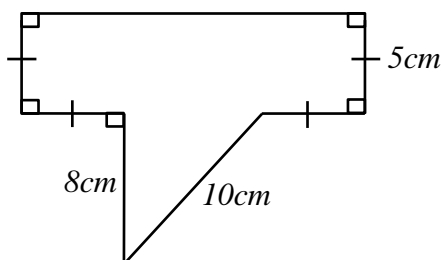


6. Study the figure below.



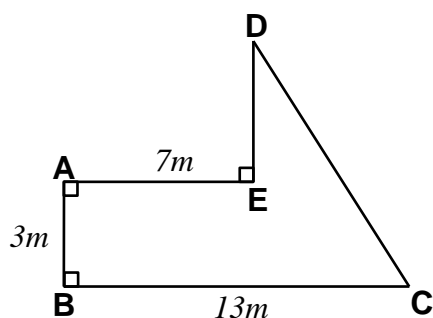
- Find the total distance around the shape.
- Calculate the area of the figure above.

7. The figure below shows a school garden.



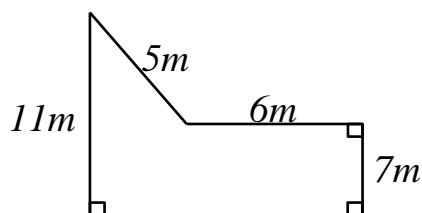
- Find the distance round the garden.
- Calculate the area covered by the garden above.

8. The area of the figure below is 45m^2 .



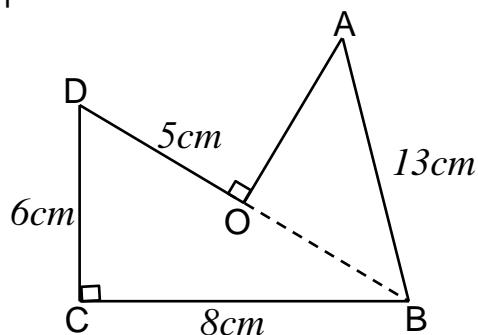
- Find length DE.
- Calculate the total distance around the shape.

9. Study the figure below carefully and use it to answer questions that follow.



Calculate the area of the figure in square metres.

10. In the figure below, $OD = OB = 5\text{cm}$. Study the figure carefully and use it to answer questions that follow.



- Find length OA.
- Find the perimeter of the shape.
- Calculate its area.

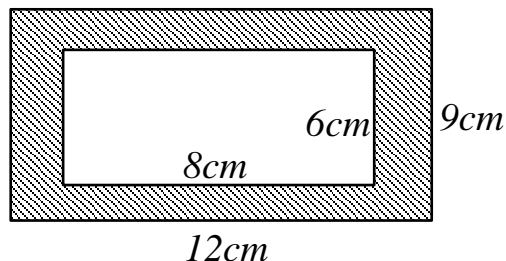
TOPIC 10: LENGTH, MASS AND CAPACITY



More problems involving area

Example 1

Study the figure below.



a) Calculate the area of the outer rectangle

$$A = L \times W$$

$$A = 12\text{cm} \times 9\text{cm}$$

$$A = 108\text{cm}^2$$

c) Calculate the area of the shaded part.

Area of the inner rectangle

$$A = L \times W$$

$$A = 8\text{cm} \times 6\text{cm}$$

$$A = 48\text{cm}^2$$

Area of the shaded part

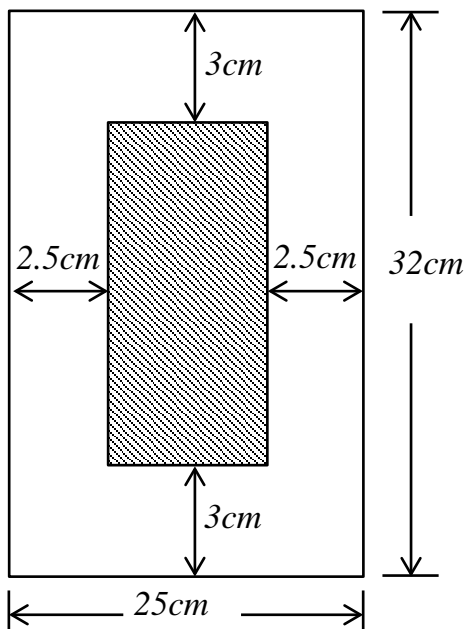
$$108\text{cm}^2 - 48\text{cm}^2$$

$$60\text{cm}^2$$

The area of the shaded part is 60cm^2

Example 2

The figure below represents a photograph enclosed in a photo frame. The area of the photograph is shaded. Study the figure and use it to answer the questions that follow.



a) Find the length and width of the photograph.

Length

$$32\text{cm} - (3\text{cm} + 3\text{cm})$$

$$32\text{cm} - 6\text{cm}$$

$$26\text{cm}$$

Width

$$25\text{cm} - (2.5\text{cm} + 2.5\text{cm})$$

$$25\text{cm} - 5\text{cm}$$

$$20\text{cm}$$

b) Calculate the area of the frame not covered by the photograph.

Area of the photograph

$$A = L \times W$$

$$A = 26\text{cm} \times 20\text{cm}$$

$$A = 520\text{cm}^2$$

Area of the frame

$$A = L \times W$$

$$A = 32\text{cm} \times 25\text{cm}$$

$$A = 800\text{cm}^2$$

Area not covered by the photograph

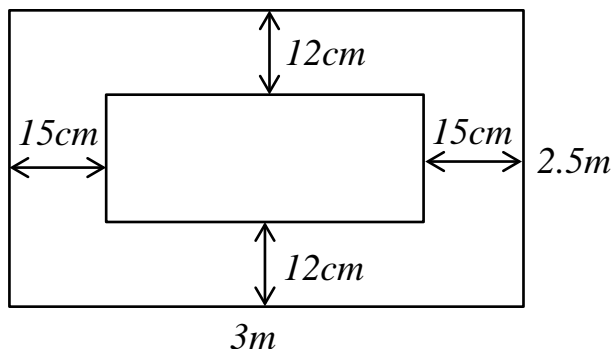
$$800\text{cm}^2 - 520\text{cm}^2 = 280\text{cm}^2$$

TOPIC 10: LENGTH, MASS AND CAPACITY



Example 3

A rectangular carpet was laid centrally on a rectangular floor 3m by 2.5m as shown in the figure below. Calculate in square centimetres, the area of the floor not covered by the carpet.



Length of the carpet

$$(3 \times 100\text{cm}) - (15\text{cm} + 15\text{cm})$$

$$300\text{cm} - 30\text{cm}$$

$$270\text{cm}$$

Length of the carpet

$$(2.5 \times 100\text{cm}) - (12\text{cm} + 12\text{cm})$$

$$250\text{cm} - 24\text{cm}$$

$$226\text{cm}$$

Area of the carpet

$$A = L \times W$$

$$A = 270\text{cm} \times 226\text{cm}$$

$$A = 61020\text{cm}^2$$

Area of the floor

$$A = L \times W$$

$$A = 300\text{cm} \times 250\text{cm}$$

$$A = 75000\text{cm}^2$$

Area not covered by the carpet

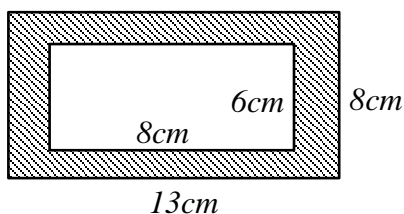
$$75000\text{cm}^2 - 61020\text{cm}^2$$

$$13980\text{cm}^2$$

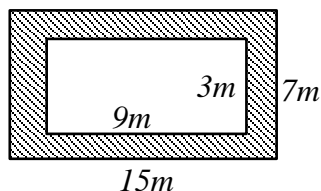
Exercise

1. In the figures below, calculate the area of the shaded part.

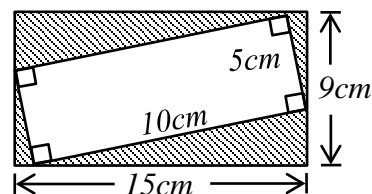
a)



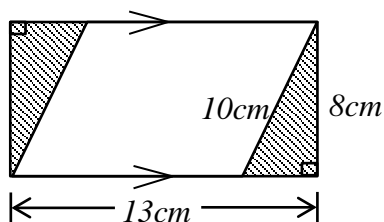
b)



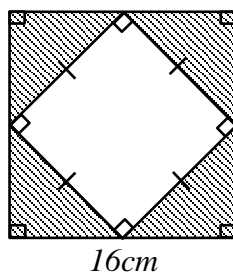
c)



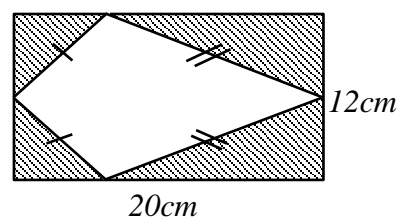
d)



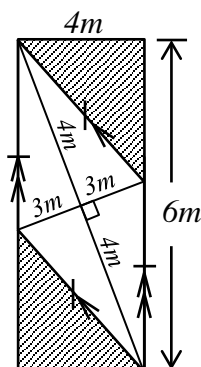
e)



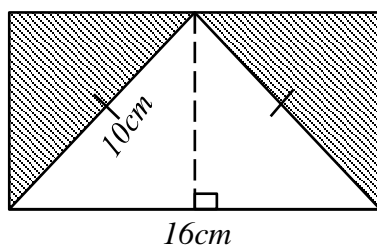
f)



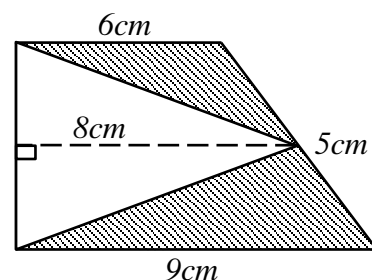
g)



i)



h)

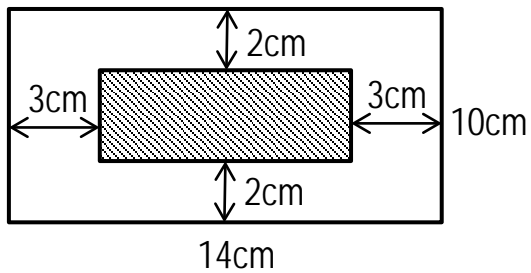


TOPIC 10: LENGTH, MASS AND CAPACITY

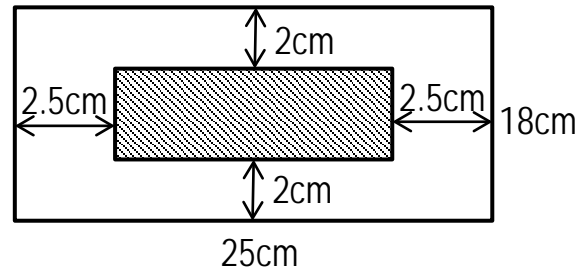


2. Find the area of the un shaded part.

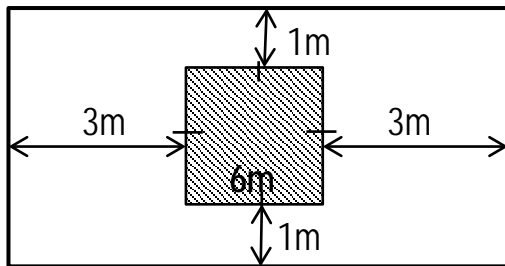
a)



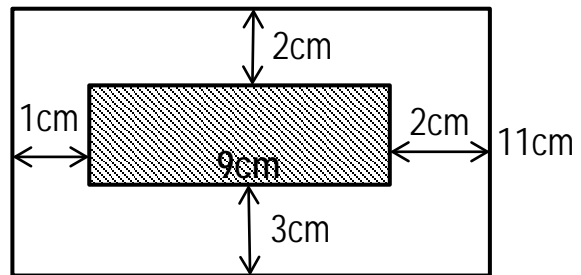
b)



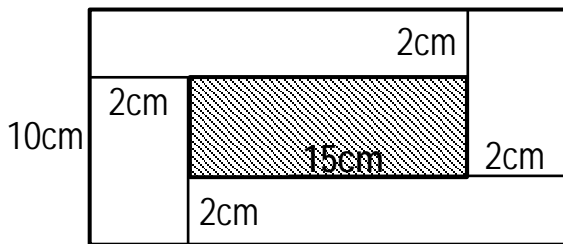
c)



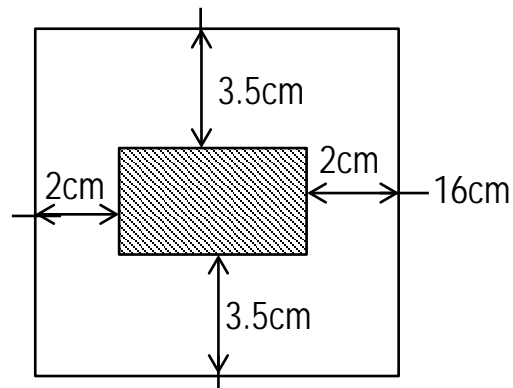
d)



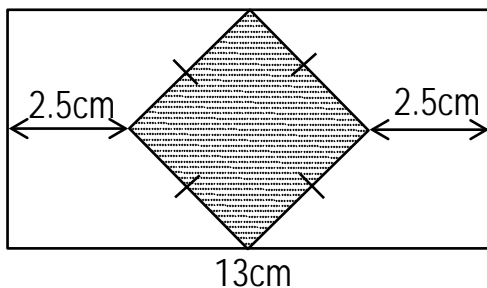
e)



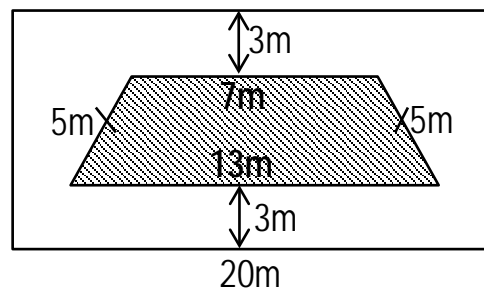
f)



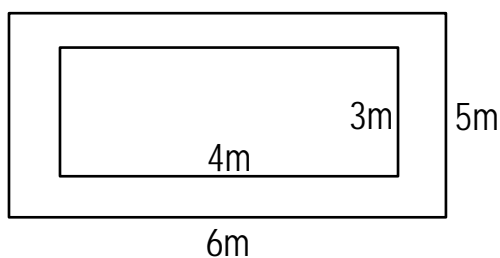
g)



h)



3. A mat was laid on ground 6m by 4m as shown below.



a) Calculate the area of the rectangular mat.

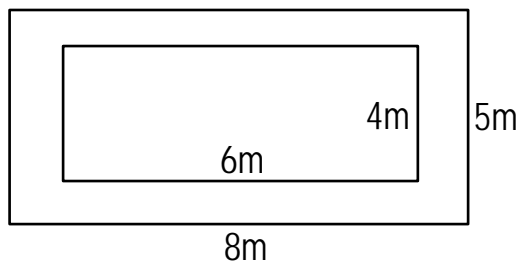
b) Find the area of the rectangular ground.

c) Calculate the area of the ground not covered by the mat.

TOPIC 10: LENGTH, MASS AND CAPACITY

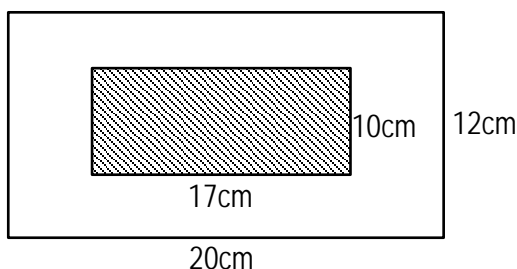


4. A rectangular carpet was laid on a rectangular floor as shown below.



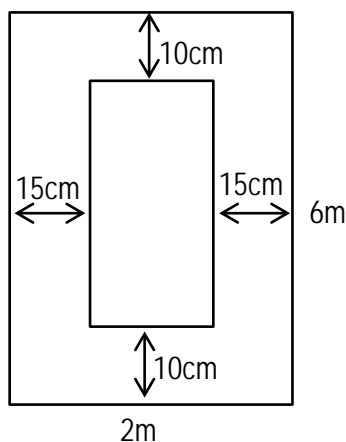
- Calculate the area of the rectangular floor.
- Find the area of carpet not covered by the carpet.

5. The figure below represents a photograph which was enclosed in the photo frame. The shaded part is the area of the photograph. Use it to answer questions that follow.



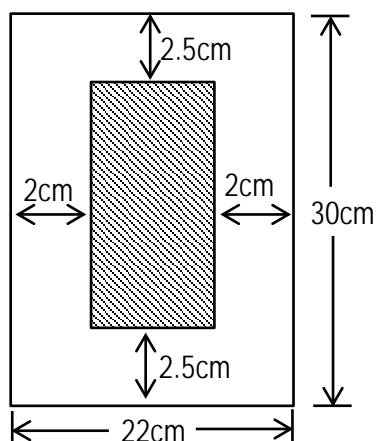
Calculate the area of the photo frame not covered by the photograph.

6. The figure below represents a rectangular carpet which was laid on a rectangular floor. Study it carefully and answer the questions that follow.



- Find the actual length of the carpet.
- Calculate the area of the rectangular floor not covered by the carpet.

7. The figure below represents a photograph enclosed in a rectangular photo frame. The area of the photograph is shaded. Use it to answer questions that follow.

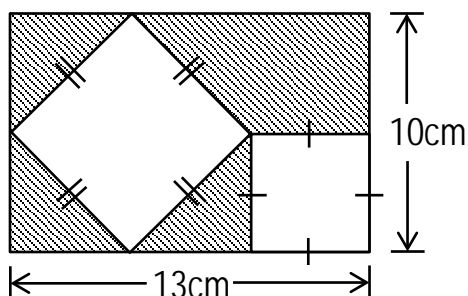


- Find the area of the photograph.
- Calculate the area of the photo frame not covered by the photograph.

TOPIC 10: LENGTH, MASS AND CAPACITY



8. Below are two squares of different sizes are enclosed in a rectangle. Study the figure carefully and use it to answer the question that follows.

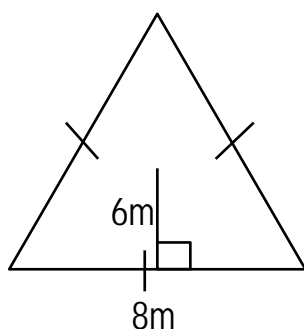


Calculate the area of the shaded part.

Finding area of simple regular polygons

Examples

1. Calculate the area of the figure below.



Perimeter

$$P = 3S$$

$$P = 3 \times 8m$$

$$P = 24m$$

Area

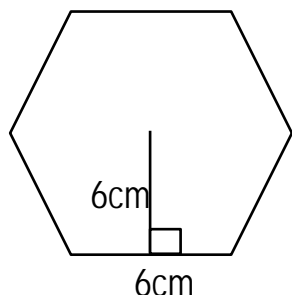
$$A = \frac{1}{2} \times \text{apothem} \times \text{perimeter}$$

$$A = \frac{1}{2} \times 6m \times 24m$$

$$A = 3m \times 24m$$

$$A = 72m^2$$

2. Below is a regular hexagon. Calculate its area.



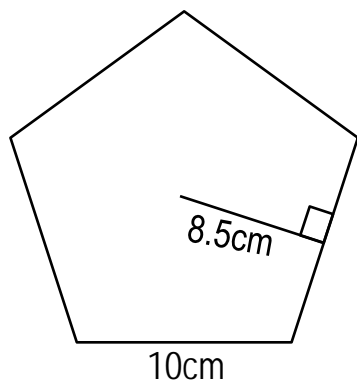
$$A = \frac{1}{2} \times \text{apothem} \times \text{perimeter}$$

$$A = \frac{1}{2} \times 6cm \times (6 \times 6cm)$$

$$A = 3cm \times 36m$$

$$A = 108cm^2$$

3. Below is a regular pentagon.



Calculate its;

a) perimeter

$$P = 5S$$

$$P = 5 \times 10cm$$

$$P = 50cm$$

b) area

$$A = \frac{1}{2} \times \text{apothem} \times \text{perimeter}$$

$$A = \frac{1}{2} \times 8.5cm \times 50cm$$

$$A = \frac{85cm}{10} \times 25cm$$

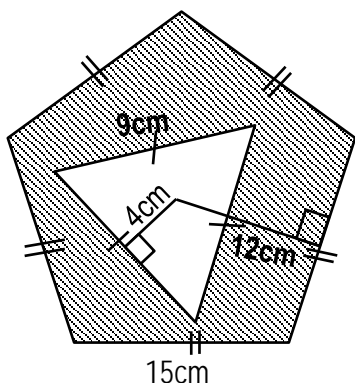
$$A = \frac{2125}{10}cm^2$$

$$A = 212.5cm^2$$

TOPIC 10: LENGTH, MASS AND CAPACITY



4. Calculate the area of the shaded part below.



Area of a triangle

$$A = \frac{1}{2} \times \text{apothem} \times \text{perimeter}$$

$$A = \frac{1}{2} \times 4\text{cm} \times (3 \times 9\text{cm})$$

$$A = 2\text{cm} \times 27\text{cm}$$

$$A = 54\text{cm}^2$$

Area of the shaded part

$$450\text{cm}^2 - 54\text{cm}^2 = 396\text{cm}^2$$

Area of a pentagon

$$A = \frac{1}{2} \times \text{apothem} \times \text{perimeter}$$

$$A = \frac{1}{2} \times 12\text{cm} \times (5 \times 15\text{cm})$$

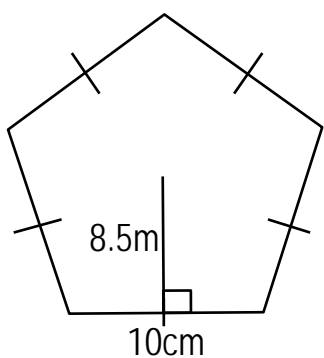
$$A = 6\text{cm} \times 75\text{cm}$$

$$A = 450\text{cm}^2$$

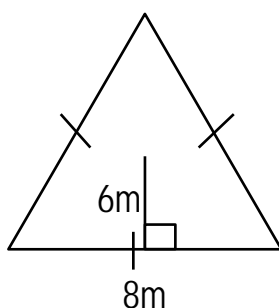
Exercise

1. Find the area of each of the following regular polygons.

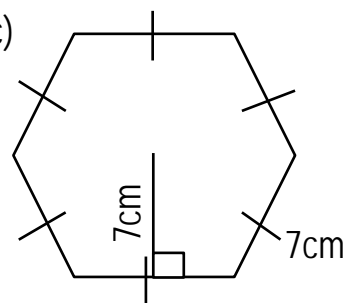
a)



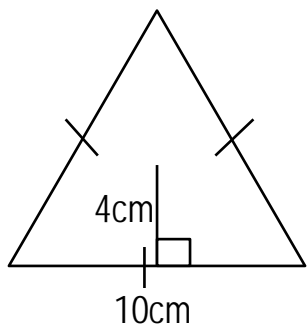
b)



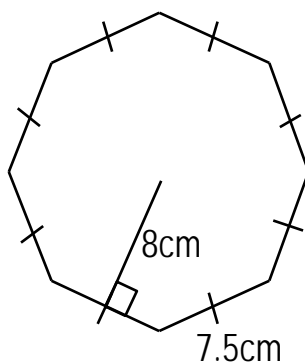
c)



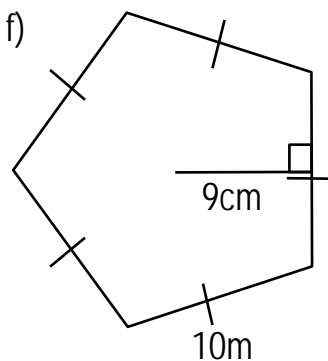
d)



e)

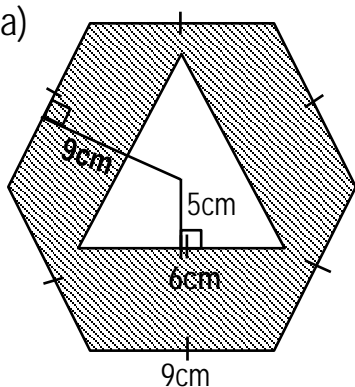


f)

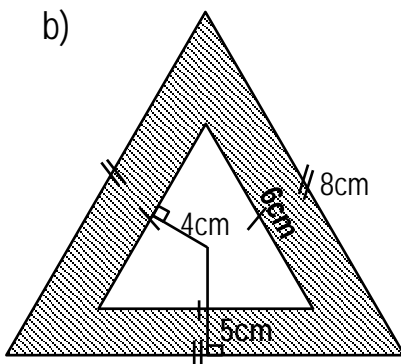


2. Calculate the area of the shaded part.

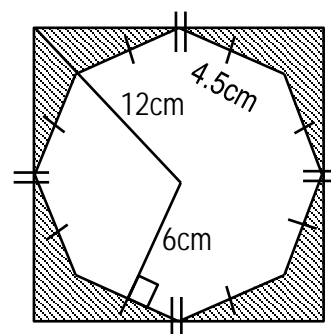
a)



b)



c)

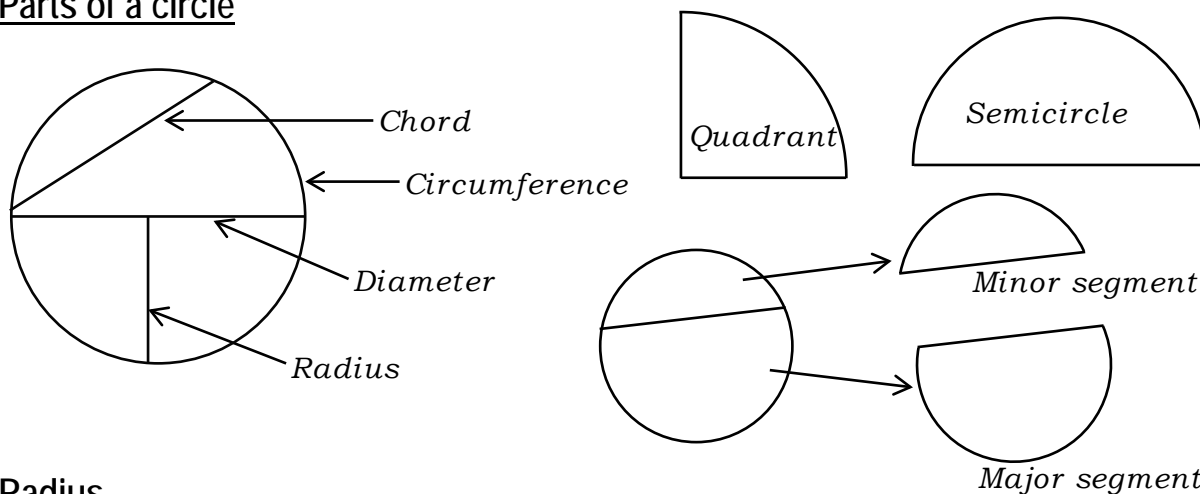


TOPIC 10: LENGTH, MASS AND CAPACITY



CIRCLES

Parts of a circle



Radius

The length of the straight line drawn from the centre of a circle to any point on its boundary.

$$\text{Radius} = \text{Diameter} \div 2$$

$$\text{Radius} = \frac{\text{diameter}}{2}$$

Example

Find the radius of a circle whose diameter is 8cm.

$$\begin{aligned} \text{Radius} &= \text{Diameter} \div 2 \\ \text{Radius} &= 8\text{cm} \div 2 \\ &= 4\text{cm} \end{aligned}$$

$$\begin{aligned} \text{Radius} &= \frac{\text{diameter}}{2} \\ \text{Radius} &= \frac{8\text{cm}}{2} \\ &= 4\text{cm} \end{aligned}$$

Diameter

A line segment joining two points on a circle passing through the centre.

$$\text{Diameter} = \text{radius} + \text{radius}$$

$$\text{Diameter} = 2r$$

Example

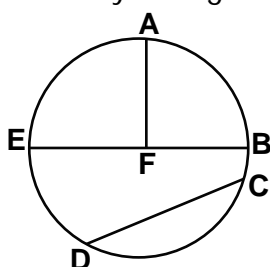
Calculate the diameter of a circle with radius 6cm.

$$\begin{aligned} \text{Diameter} &= r + r \\ \text{Diameter} &= 6\text{cm} + 6\text{cm} \\ &= 12\text{cm} \end{aligned}$$

$$\begin{aligned} \text{Diameter} &= 2r \\ \text{Diameter} &= 2 \times 6\text{cm} \\ &= 12\text{cm} \end{aligned}$$

Exercise

1. Study the figure below.



a) Name the following.

i) CD

iii) EF

v) AF

ii) BE

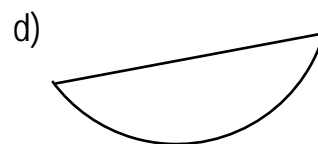
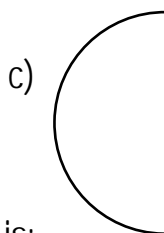
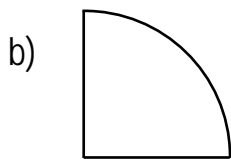
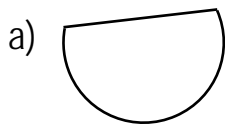
iv) ABCDEA

b) If AF = 5cm, find length EB.

TOPIC 10: LENGTH, MASS AND CAPACITY



2. Name the parts of the circle below.



3. Find the diameter of a circle whose radius is:

a) 4cm

d) 9cm

g) 12cm

b) 2cm

e) 15cm

h) 25cm

c) 7cm

f) 10dm

i) 38m

4. Find the radius of a circle whose diameter.

a) 10 cm

d) 18cm

g) 7km

b) 8cm

e) 14 cm

h) 13m

c) 12cm

f) 24cm

i) 9cm

5. Construct a circle of radius:

a) 2.5cm

b) 4cm

c) 3.5 cm

d) 4.5 cm

6. Construct a circle of diameter:

a) 6cm

b) 8cm

c) 5cm

d) 7cm

Finding circumference using diameter.

Circumference = Pi times diameter (πd)

Example 1

Calculate the circumference of a circle whose diameter is 21cm. (Take $\pi = \frac{22}{7}$)

$$C = \pi d$$

$$C = \frac{22}{7} \times 21\text{cm}$$

$$C = 22 \times 3\text{cm}$$

$$C = 66\text{cm}$$

Example 2

Find the circumference of circle whose diameter is 15m. (Take $\pi = 3.14$)

$$C = \pi d$$

$$C = 3.14 \times 15\text{cm}$$

$$C = \frac{314}{100} \times 15\text{cm}$$

$$C = \frac{4710\text{cm}}{100}$$

$$C = 47.1\text{cm}$$

Exercise

1. Find the circumference of a circle whose diameter is; (Take $\pi = \frac{22}{7}$)

a) 7cm

e) 70cm

i) 63m

b) 28cm

f) 1.4cm

j) 49m

c) 3.5cm

g) $3\frac{1}{2}$ cm

k) 8.4 cm

d) 14cm

h) 4.2cm

l) 0.07m

TOPIC 10: LENGTH, MASS AND CAPACITY



- Calculate the circumference of a circle whose diameter is; (Use $\pi = 3.14$)

a) 2cm	e) 30cm	i) 45
b) 8cm	f) 20 cm	j) 36m
c) 5cm	g) 30 cm	k) 12m
d) 6cm	h) 25 cm	l) 22 m
- The diameter of a circular garden is 56m. Calculate its circumference. (Use $\pi = 3\frac{1}{7}$)
- A circular garden of diameter 35 metres was fenced with barbed wires. Find in metres, the length of barbed wires used.
- The diameter of a roundabout is 21 metres. Muyindi moved around it once. What distance did he cover in metres?
- A wheel of bicycle is 70cm in diameter. What distance does it cover in 1 complete revolution?
- A wire was wound round a tin to make one complete turn. The diameter of the tin was 70cm. Find the length of the wire.
- Kokrachi rolled a drum of 49cm once. Find the distance it covered.

Finding circumference using radius - Circumference = 2 times pi times radius ($2\pi r$)

Example 1

Calculate the circumference of a circle whose radius is 20cm. (Take $\pi = 3.14$)

$$C = 2\pi r$$

$$C = 2 \times 3.14 \times 20\text{cm}$$

$$C = 2 \times \frac{314}{100} \times 20\text{cm}$$

$$C = \frac{12560\text{cm}}{100}$$

$$C = 125.6\text{cm}$$

Example 2

The length of a minute hand is 14cm. Find the distance it covers in one hour. (Use $\pi = \frac{22}{7}$)

$$C = 2\pi r$$

$$C = 2 \times \frac{22}{7} \times 14\text{cm}$$

$$C = 2 \times 22 \times 2\text{cm}$$

$$C = 88\text{cm}$$

Exercise

- Find the circumference of a circle whose radius is (Use $\pi = \frac{22}{7}$)

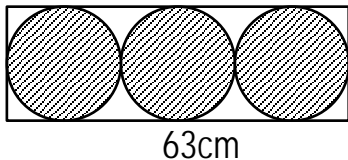
a) 7cm	f) 70m	k) 3.5m
b) 35cm	g) $22\frac{1}{2}\text{m}$	l) $17\frac{1}{2}\text{cm}$
b) 14cm	h) 84m	m) 10.5 cm
c) 21cm	i) 11.5m	n) 4.9 cm
- Calculate the circumference of a circle whose radius is; (Use $\pi = 3.14$)

a) 10cm	f) 40cm	k) 8cm
b) 20cm	g) 32 cm	J) 6cm
c) 15 cm	h) 22cm	m) 5 cm
d) 30cm	i) 25 cm	n) 4cm
e) 50cm	j) 16cm	o) $22\frac{1}{2}\text{cm}$

TOPIC 10: LENGTH, MASS AND CAPACITY



- Calculate the circumference of a circle whose radius is 56cm. (Use $\pi = 3\frac{1}{7}$)
- The radius of the circle is 1 metre. Calculate its circumference. (Use $\pi = 3.14$)
- A minute hand is 21cm long. What distance does its tip cover in one hour?
- A boy walked around a circular park of radius 126 metres and completed one round. Calculate the distance covered by the boy.
- The radius of a circular garden is 105 metres. Calculate its circumference.
- The diagram below shows three circles enclosed in a rectangle.

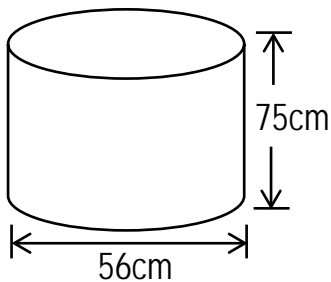


Calculate the circumference of one circle. (Use $\pi = \frac{22}{7}$)

Problems involving finding circumference in real life situation

Example 1

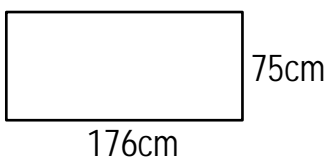
The diagram below shows a metallic drum which was cut open to form a door sheet. Use it to answer questions that follow.



- a) Calculate the length of the door which was made out of the door sheet. (Use $\pi = \frac{22}{7}$)

$$\begin{aligned} C &= \pi d \\ C &= \frac{22}{7} \times 56\text{cm} \\ C &= 22 \times 8\text{cm} \\ C &= 176\text{cm} \end{aligned}$$

- b) Calculate the area of the door in square metres.



Area in cm^2

$$\begin{aligned} A &= L \times W \\ A &= 176\text{cm} \times 75\text{cm} \\ A &= 13200\text{cm}^2 \end{aligned}$$

Area in m^2

$$\begin{aligned} 100\text{cm} \times 100\text{cm} &= 1\text{m} \times 1\text{m} \\ 10000\text{cm}^2 &= 1\text{m}^2 \\ 13200\text{cm}^2 &= \frac{13200\text{m}^2}{10000} \\ &= 1.32\text{m}^2 \end{aligned}$$

Example 2

Opeta rides a distance of 3.96km from his home to the market on a bicycle. The wheel of the bicycle has a diameter of 84cm. How many revolutions does the wheel make to cover the distance?

Circumference

$$\begin{aligned} C &= \pi d \\ C &= \frac{22}{7} \times 84\text{cm} \\ C &= 22 \times 12\text{cm} \\ C &= 264\text{cm} \end{aligned}$$

Distance in cm

$$\begin{aligned} 1\text{km} &= 100000\text{cm} \\ 3.96\text{km} &= \frac{396}{100} \times 100000\text{cm} \\ &= 396000\text{cm} \end{aligned}$$

Number of revolutions

$$\begin{aligned} &\left(\frac{396000\text{cm}}{264\text{cm}} \right) \text{ revolutions} \\ &1500 \text{ revolutions} \end{aligned}$$

TOPIC 10: LENGTH, MASS AND CAPACITY



Example 3

A farmer wants to fence his circular 21 metres using poles placed at intervals of 60cm.

a) How many poles are needed to fence the flower garden?

Circumference

$$C = \pi d$$

$$C = \frac{22}{7} \times 21\text{m}$$

$$C = 22 \times 3\text{m}$$

$$C = 66\text{m}$$

Circumference in cm

$$1\text{m} = 100\text{cm}$$

$$66\text{m} = 66 \times 100\text{cm}$$

$$= 6600\text{cm}$$

Number of poles

Circumference

Interval

$$\left(\frac{6600\text{cm}}{60\text{cm}}\right) \text{ poles}$$

$$= 110 \text{ poles}$$

b) If each pole costs sh.5500, how much money will the farmer spend on poles?

$$110 \times \text{sh. } 5500 = \text{sh. } 605,000$$

He will spend sh. 605,000 on poles

Example 4

A boy wants to make a square from a circular wire of radius 21cm. Find the area of the resulting square. (Use $\pi = \frac{22}{7}$)

Circumference

$$C = 2\pi r$$

$$C = 2 \times \frac{22}{7} \times 21\text{cm}$$

$$C = 2 \times 22 \times 3\text{cm}$$

$$C = 132\text{cm}$$

Length of each side

$$4s = \text{Perimeter}$$

$$4s = 132\text{cm}$$

$$\frac{4s}{4} = \frac{132\text{cm}}{4}$$

$$s = 33\text{cm}$$

Area of the square

$$A = s \times s$$

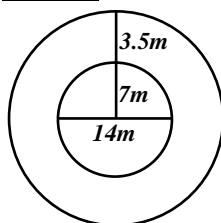
$$A = 33\text{cm} \times 33\text{cm}$$

$$A = 1089\text{cm}^2$$

Example 5

A 3.5 metre wide road runs around a circular garden whose diameter is 14metres. Find the cost fencing the boundary of the road at a rate of sh. 35000 per meter. (Use $\pi = \frac{22}{7}$)

Sketch



Circumference of the road

$$C = 2\pi r$$

$$C = 2 \times \frac{22}{7} \times (7\text{m} + 3.5\text{m})$$

$$C = 2 \times \frac{22}{7} \times 10.5\text{m}$$

$$C = 2 \times 22 \times 1.5\text{m}$$

$$C = 66\text{m}$$

Cost of fencing

$$\text{sh. } 35000 \times 66 = \text{sh. } 231,000$$

Fencing will cost sh. sh. 231,000

Example 6

Chebet rode from Kasambya to Kafunda on a bicycle. The wheel of the bicycle had radius of 42cm. The wheel made 625 revolutions to cover the distance . How far is Kafunda from Kasambya in kilometers?

$$C = 2\pi r$$

$$C = 2 \times \frac{22}{7} \times 42\text{cm}$$

$$C = 264\text{cm}$$

Distance = Revolutions x Circumference

$$= 625 \times 264\text{cm}$$

$$= 165000\text{cm}$$

$$100000\text{cm} = 1\text{km}$$

$$165000\text{cm} = \left(\frac{165000}{100000}\right)\text{km}$$

$$= 1.65\text{km}$$

By Sseggayi Benjamin Kasuka

TOPIC 10: LENGTH, MASS AND CAPACITY



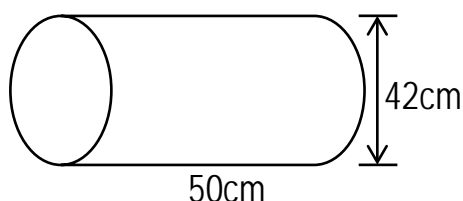
Exercise

1. The rectangular sheet of paper below forms a cylinder of diameter 14cm when folded.



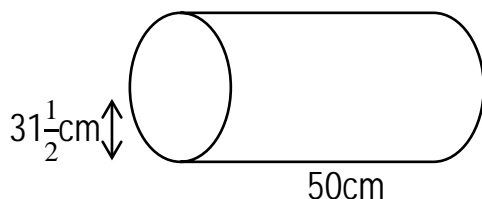
- a) Find the length of the rectangular sheet of paper. (Use $\pi = \frac{22}{7}$)
 b) Find its:
 i) area ii) perimeter

2. The diagram below shows a drum which was cut open to form a rectangular sheet of metal.



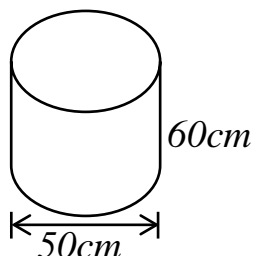
- a) Find the length of the rectangular sheet of metal formed. (Use $\pi = \frac{22}{7}$)
 b) Calculate the area of the rectangular sheet of metal formed.

3. By cutting open the rectangular drum below, it forms a rectangular door sheet.



Find the area of the door sheet in square metres. (Use $\pi = \frac{22}{7}$)

4. Mutimbi wrapped the cylindrical tin below using a rectangular paper.



Calculate the area of the paper used.
 (Use $\pi = 3.14$)

5. George has a 1 meter red ribbon. He wants to wrap it around a tree trunk with diameter 42cm. Find in meters the length of the tree trunk which is not covered by the ribbon.
6. A goat is tied on a wooden stake with a rope 7 metres long. It runs around in circles pulling the rope as far as it can go. Find the farthest distance it covers in one rotation.
7. A storm is expected to hit 7km in every direction from Munaku village. What is the total distance around the area that the storm will affect?
8. A man wants to make square shaped figure from a circular wire of diameter 28cm.
- a) Find the length of each side of the square.
- b) Calculate the;
- i) perimeter of the square
- ii) area of the square

TOPIC 10: LENGTH, MASS AND CAPACITY



9. Below is a rectangular sheet of manila.



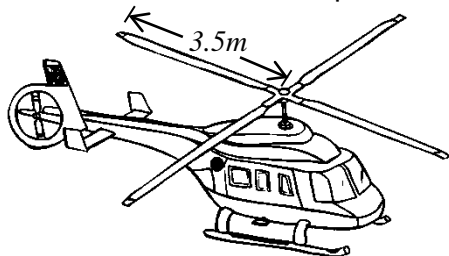
Find the circumference of the largest circular sheet that can be cut from the given sheet of manila.

10. Obed wrapped the curved surface of a cylindrical tin of diameter $24\frac{1}{2}$ cm and height 30cm with a rectangular piece of cloth 30cm wide. Calculate the area of the piece of cloth used.
11. The radius of a wheel barrow tyre is 7cm.
- What distance does it cover in one revolution?
 - How many revolutions can it make to complete a distance of 88 metres?
12. A bicycle wheel has a radius of 28cm.
- What distance does it cover in 1 revolution?
 - What distance can it cover in 15 complete revolutions?
13. The distance from the Main road to Rufula wa covered by a wheel of diameter 42cm making 50 revolutions.
Find the distance from the Main road to Rufula in;
- centimetres.
 - metres.
14. A thread has been wound 15 times around a cylindrical tin whose radius is 14dm. Find the length of the thread.
15. Find the number of revolutions a wheel of diameter 70cm can make to cover a distance of 44 kilometres
16. The length of a minute hand is 14cm. What distance will its tip cover
- in 1 hour?
 - in 45 minutes?
 - in 5 hours 15 minutes?
 - from 9:45a.m to 3:30p.m?
17. Henry drove from his home to church which is 3.3 kilometres away. His car has a tyre of radius $17\frac{1}{2}$ cm.
- How many revolutions did the car tyre make?
 - If the car tyre made 250 revolutions per minute, how long was the journey?
18. Otieno rides a distance of 2.64 kilometres from home to school on a bicycle. The wheel of the bicycle has a diameter of 70cm. If he makes 50 revolutions in one minute,
- How long does he take to reach school?
 - Calculate his speed in kilometres per hour.
19. Wafula takes 30 minutes to ride from town A to town B on a bicycle. The wheel of the bicycle has a diameter of 63cm. He makes 50 revolutions per minute.
Find in kilometres, the distance from town A to town B.

TOPIC 10: LENGTH, MASS AND CAPACITY



20. A school wants to fence a circular flower garden of diameter 28 metres using poles placed at intervals of 80cm.
- How many poles are needed to fence the garden?
 - If each pole costs sh. 5000, how much money will the school spend on poles?
21. A rotor blade of a helicopter is 3.5 metres long.



Find in centimeters the distance the rotor blade covers in one rotation.

22. Kisa used 88 poles to fence his circular flower garden of diameter 7m. Find in centimeters, the distance from one pole to another.
23. A farmer fenced his circular garden using poles placed at the same interval. The radius of the garden is 70 metres. The farmer spent sh 1,320,000 on poles. If the cost of each pole was sh. 1500,
- How many poles were used?
 - Find the distance between poles.
24. A 7 metre wide road runs around a roundabout of diameter 14 meters. The road is fenced using poles placed at interval of 80cm. Calculate the number of poles used.
25. A 3.5 metres wide road runs around a circular garden of diameter 49 meters. Find the cost of fencing the boundary of the road at a rate of sh. 5000 per meter.
26. An electric pole 14 metres tall was fixed at one end of a circular garden when it rained, it fell into the centre of garden. Calculate the total distance around the circular garden.
27. A metallic cylindrical drum of radius 42cm and height 65cm was cut open forming a rectangular door sheet. Calculate the area of the door sheet. (Use $\pi = \frac{22}{7}$)

Finding diameter of a circle when circumference is given.

Example 1

Find the diameter of a circle whose circumference is 88cm. (Use $\pi = \frac{22}{7}$)

$$\begin{aligned}\pi d &= \text{Circumference} \\ \frac{22}{7} \times d &= 88\text{cm} \\ 7 \times \frac{22}{7} \times d &= 88\text{cm} \times 7 \\ 22d &= 88\text{cm} \times 7 \\ \frac{22d}{22} &= \frac{88\text{cm} \times 7}{22} \\ d &= 28\text{cm}\end{aligned}$$

Example 2

The circumference of a circular garden is 13.2m. Find its diameter. (Use $\pi = \frac{22}{7}$)

$$\begin{aligned}\pi d &= \text{Circumference} \\ \frac{22}{7} \times d &= 13.2\text{m} \\ 70 \times \frac{22}{7} \times d &= \frac{132\text{m}}{10} \times 70 \\ 220d &= 132\text{m} \times 7 \\ \frac{220d}{220} &= \frac{132\text{m} \times 7}{220} \\ d &= 4.2\text{m}\end{aligned}$$

TOPIC 10: LENGTH, MASS AND CAPACITY



Exercise

- Find the diameter of a circle whose circumference is; (Use $\pi = \frac{22}{7}$)

a) 44cm	d) 132 cm	g) 55cm	j) 330 cm
b) 66cm	e) 110cm	h) 154cm	k) 2.2m
c) 22cm	f) 77cm	i) 220cm	l) 0.66m
- The circumference of a circular garden is 3300 metres. Find its diameter.
- The circumference of a circular tank is 1980cm. Find its diameter.
- A wheel of a bicycle covers 1540cm in one complete revolution. Find its diameter.
- Find the diameter of a basin whose circumference is 1386cm.

Finding radius of a circle whose circumference is given .

Example 1

Find the radius of a circle whose circumference is 110cm. (Use $\pi = \frac{22}{7}$)

$$\begin{aligned}
 2\pi r &= \text{Circumference} \\
 2 \times \frac{22}{7} r &= 110\text{cm} \\
 7 \times \frac{44}{7} r &= 110\text{cm} \times 7 \\
 44r &= 110\text{cm} \times 7 \\
 \frac{44r}{44} &= \frac{110\text{cm} \times 7}{44} \\
 r &= 17\frac{1}{2}\text{cm}
 \end{aligned}$$

Example 2

In one hour, the minute hand of a clock covers 44cm. Calculate the length of the minute hand. (Use $\pi = \frac{22}{7}$)

$$\begin{aligned}
 2\pi r &= \text{Circumference} \\
 2 \times \frac{22}{7} r &= 44\text{cm} \\
 7 \times \frac{44}{7} r &= 44\text{cm} \times 7 \\
 44r &= 44\text{cm} \times 7 \\
 \frac{44r}{44} &= \frac{44\text{cm} \times 7}{44} \\
 r &= 7\text{cm}
 \end{aligned}$$

Exercise

- Find the radius of a circle whose circumference is; (Use $\pi = \frac{22}{7}$)

a) 88cm	f) 286cm	k) 440cm
b) 110cm	g) 264cm	l) 3.3m
c) 22cm	h) 198cm	m) 5.5m
d) 11cm	i) 154cm	n) 39.6m
e) 132cm	j) 308cm	o) 5.28cm
- In one hour, a minute hand of a clock covers 88cm. Calculate the length of the minutes hand.
- In one revolution a wheel covers 110cm. Find its radius. (Use $\pi = \frac{22}{7}$)
- The distance covered by a rotor blade of a helicopter in one rotation is 22 metres. Find the length of the rotor blade.
- A rectangular sheet of metal of length 660cm was folded to form a cylindrical tank. Find the radius of tank formed.

TOPIC 10: LENGTH, MASS AND CAPACITY



6. The circumference of a cup is 44cm. Find its radius.
7. The distance around a circular pound is 66 metres. Find its radius.
8. A red ribbon 220cm long was wrapped around a tree trunk. Find the radius of the tree trunk.
9. By running around a circular field, Kotich covered 1.1 kilometers. Find in metres, the radius of the field.
10. A drum rolled once on the ground covers 132cm. Find the radius of the drum.
11. The distance around a pipe is 55cm. Calculate its radius.
12. The circumference of a chapatti is 0.44 metres. Find the radius of the chapatti in cm.
13. The circumference of a wheel of a bicycle is 110cm. Find the length of each spoke.

Difference between circumference and diameter or radius of a circle

Example 1

The circumference of a circle is 105cm more than its diameter. Find the diameter of the circle. (Use $\pi = \frac{22}{7}$)

Circumference – Diameter = Difference

$$\pi d - d = 105\text{cm}$$

$$\left(\frac{22}{7} \times d\right) - d = 105\text{cm}$$

$$\left(7 \times \frac{22d}{7}\right) - (7 \times d) = (7 \times 105\text{cm})$$

$$22d - 7d = 735\text{cm}$$

$$\frac{15d}{15} = \frac{735\text{cm}}{15}$$

$$d = 49\text{cm}$$

The diameter of the circle is 49cm

Example 2

The tip of a minute hand of a city clock is 111cm less than the distance it covers in one hour. Find the length of the minute hand. (Use $\pi = \frac{22}{7}$)

Circumference – Radius = Difference

$$2\pi r - r = 111\text{cm}$$

$$\left(2 \times \frac{22}{7} \times r\right) - r = 111\text{cm}$$

$$\left(7 \times \frac{44r}{7}\right) - (7 \times r) = (7 \times 111\text{cm})$$

$$44r - 7r = 777\text{cm}$$

$$\frac{37r}{37} = \frac{777\text{cm}}{37}$$

$$r = 21\text{cm}$$

The minute hand is 21cm long

Exercise

1. The difference between the circumference and the diameter of a circle is given. Find the diameter of the circle. (Use $\pi = \frac{22}{7}$)

a) 30cm	d) 15cm	g) 75cm
b) 90cm	e) 135cm	h) 4.5m
c) 60cm	f) 120cm	i) $37\frac{1}{2}\text{m}$
2. The straight distance through the centre of a circular garden is 150 metres less than the distance round the same garden. The garden was fenced using poles fixed 88cm apart.
 - a) Find the diameter of the circular garden. (Use $\pi = \frac{22}{7}$)
 - b) How many poles were used?

TOPIC 10: LENGTH, MASS AND CAPACITY



3. The difference between the circumference and the radius of a circle is given below. Find the radius then the actual circumference.

a) 74cm	d) 148cm	g) 11.1m
b) 37cm	e) 185cm	h) 92.5mm
c) 222cm	f) 296cm	i) $55\frac{1}{2}$ m
4. The distance around a circular field is 370 metres more than the straight distance from the centre to one point on its outermost edge.
 - a) Find the radius of the field.
 - b) Calculate the circumference of the field.
5. The distance covered by a bicycle wheel is 222cm more than the length of its spoke. How many revolutions will it make to cover a distance of 3.96 kilometres?
6. A goat is tied on a tree with a rope. It runs around in circles pulling the rope as far as it can go. The farthest distance it covers in one rotation is 37 metres more than the length of the rope. Find in centimetres, the length of the rope.

More problems involving application of circumference real life situation

Example 1

110 poles placed at intervals of 80cm were used to fence a circular garden. Find in metres, the radius of the garden (Use $\pi = \frac{22}{7}$)

Circumference

$$110 \times 80\text{cm}$$

$$8800\text{cm}$$

Circumference in metres

$$100\text{cm} = 1\text{m}$$

$$8800\text{cm} = \left(\frac{8800}{100}\right)\text{m}$$

$$= 88\text{m}$$

Radius in metres

$$2\pi r = \text{Circumference}$$

$$2 \times \frac{22}{7} \times r = 88\text{m}$$

$$7 \times \frac{44}{7} \times r = 88\text{m} \times 7$$

$$44r = 88\text{m} \times 7$$

$$\frac{44r}{44} = \frac{88\text{m} \times 7}{44}$$

$$r = 14\text{m}$$

Example 2

A wire in form of a square of side 33cm was carefully folded to form a circular wire. Find the radius of the circular wire formed.

Length of the wire

Length = Perimeter

Length = 4s

$$= 4 \times 33\text{cm}$$

$$= 132\text{cm}$$

$$2\pi r = \text{Circumference}$$

$$2 \times \frac{22}{7} \times r = 132\text{cm}$$

$$7 \times \frac{44}{7} \times r = 132\text{cm} \times 7$$

$$44r = 132\text{cm} \times 7$$

$$\frac{44r}{44} = \frac{132\text{cm} \times 7}{44}$$

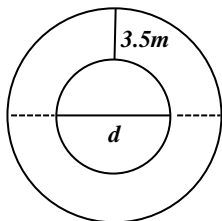
$$r = 21\text{cm}$$

TOPIC 10: LENGTH, MASS AND CAPACITY



Example 3

A 3.5 metre wide road runs around a circular field whose circumference is 44 metres. Find the circumference of the road.



Diameter of the field

$$\begin{aligned}\pi d &= \text{Circumference} \\ \frac{22}{7} \times d &= 44\text{m} \\ 7 \times \frac{22}{7} \times d &= 44\text{m} \times 7 \\ \frac{22d}{22} &= \frac{44\text{m} \times 7}{22} \\ d &= 14\text{cm}\end{aligned}$$

Diameter of the road

$$3.5\text{m} + 14\text{m} + 3.5\text{m} = 21\text{m}$$

Circumference of the road

$$\begin{aligned}C &= \pi d \\ &= \frac{22}{7} \times 21\text{m} \\ &= 22 \times 3\text{m} \\ &= 66\text{m}\end{aligned}$$

Example 4

A wire of length 330 metres was wound 500 times around a cylindrical tin. Find in centimetres, the diameter of the tin. (Use $\pi = \frac{22}{7}$)

Length in centimetres

$$\begin{aligned}330 \times 100\text{cm} \\ 33000\text{cm}\end{aligned}$$

Circumference

$$\frac{33000\text{cm}}{500} = 66\text{cm}$$

Diameter of the tin

$$\begin{aligned}\pi d &= \text{Circumference} \\ \frac{22}{7} \times d &= 66\text{cm} \\ 7 \times \frac{22}{7} \times d &= 66\text{cm} \times 7 \\ \frac{22d}{22} &= \frac{66\text{cm} \times 7}{22} \\ d &= 21\text{cm}\end{aligned}$$

The diameter of the tin is 21cm

Example 5

Njoroge takes half an hour to ride a distance of 2.97 kilometers from her home to school on a bicycle. If she makes 50 revolutions per minute, Find the diameter of the wheel of her bicycle in centimetres. (Use $\pi = \frac{22}{7}$)

Distance in cm

$$\begin{aligned}1\text{km} &= 100,000\text{cm} \\ 2.97\text{km} &= \frac{297}{100} \times 100000\text{cm} \\ &= 297000\text{cm}\end{aligned}$$

Number of revolutions

$$\begin{aligned}50 \times \left(\frac{1}{2} \times 60\right) \\ 50 \times 30 \\ 1500 \text{ revolutions}\end{aligned}$$

Circumference of the wheel

$$\frac{297000\text{cm}}{1500} = 198\text{cm}$$

Diameter of the wheel

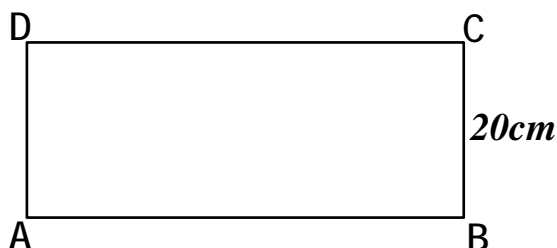
$$\begin{aligned}\pi d &= \text{Circumference} \\ \frac{22}{7} \times d &= 198\text{cm} \\ 7 \times \frac{22}{7} \times d &= 198\text{cm} \times 7 \\ \frac{22d}{22} &= \frac{198\text{cm} \times 7}{22} \\ d &= 63\text{cm}\end{aligned}$$

TOPIC 10: LENGTH, MASS AND CAPACITY



Example 6

In the figure below, ABCD is a rectangular paper whose area is 880cm^2 and width 20cm . It was folded to form a hollow cylinder 20cm high.



Find the radius of the cylinder formed.

(Use $\pi = \frac{22}{7}$)

Length of the paper

$$L \times W = A$$

$$l \times 20\text{cm} = 880\text{cm}^2$$

$$\frac{l \times 20\text{cm}}{20\text{cm}} = \frac{880\text{cm} \times \text{cm}}{20\text{cm}}$$

$$l = 44\text{cm}$$

Circumference = Length

$$\text{Circumference} = 44\text{cm}$$

Radius (r) of the cylinder

$$2\pi r = \text{Circumference}$$

$$2 \times \frac{22}{7} \times r = 44\text{cm}$$

$$7 \times \frac{44}{7} \times r = 44\text{cm} \times 7$$

$$44r = 44\text{cm} \times 7$$

$$\frac{44r}{44} = \frac{44\text{cm} \times 7}{44}$$

$$r = 7\text{cm}$$

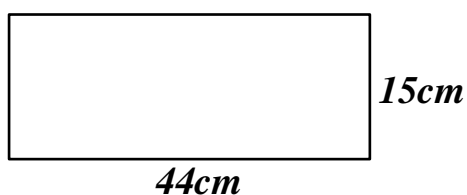
Exercise

- Twenty two holes were made 4cm apart around the edge of a bucket.
 - Find the circumference of the bucket.
 - Calculate the radius of the bucket. (Use $\pi = \frac{22}{7}$)
- Thirty-three poles were placed 40cm apart around a circular pond.
 - Find the distance around the pond.
 - Calculate the diameter of the pond. (Use $\pi = \frac{22}{7}$)
- A farmer fenced his circular nursery bed with forty four poles placed at intervals of 1.2 metres.
 - Calculate the circumference of the farm in metres.
 - Find in centimetres, the radius of the farm. (Use $\pi = \frac{22}{7}$)
- Jane bought a circular necklace with 11 beads placed 6cm apart. Calculate the diameter of a necklace. (Use $\pi = \frac{22}{7}$)
- A school fenced its circular garden with 400 poles placed at intervals of 55cm . Calculate the diameter of the garden.
- Chebet needs sh.1155,000 to buy poles to fence his circular fish pond such that the poles are placed 80cm apart. Given that the cost of each pole is 3500. Find in metres, the radius of the fish pond.
- A wire of length 132m was wound round a circular log 200 times. Find the diameter of the log.
- A thread 8800cm long has been around 40 times around a cylindrical tin. Calculate the radius of the tin.

TOPIC 10: LENGTH, MASS AND CAPACITY

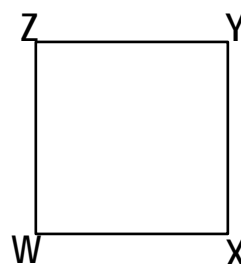
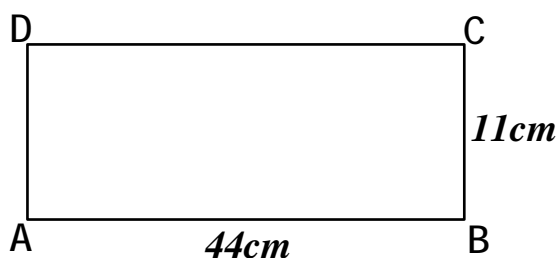


9. A wire of length 704m is wound round a tin 800 turns. Find the diameter of the tin.
10. The distance from town A to town B is 7.7km. A wheel makes 3500 revolutions to cover that distance.
 - a) Find in metres, the distance between town A and town B
 - b) Calculate the circumference of the wheel in centimetres.
 - c) Find the diameter of the wheel.
11. A wheel of a wheel barrow makes 20 revolutions to cover a distance of 8.8m.
 - a) Find in centimetres, the circumference of the wheel..
 - b) Find the radius of the wheel.
12. A wheel made 40,000 revolutions to cover a distance of 88km from Town X to Town Y. Find the radius of the wheel. (Use $\pi = \frac{22}{7}$)
13. Kabode pushed a wheel barrow through a distance of 0.792 kilometres. Its wheel made 800 revolutions. Find the diameter of the wheel of the wheel barrow. (Use $\pi = \frac{22}{7}$)
14. Bosco took 40 minutes to cover a distance of 6.6 kilometres from Nkenge to Bunjuzi on a motorcycle. The wheel of his motorcycle made 125 revolutions per minute. Find the diameter of the wheel.
15. A 3.5m in wide road runs around a circular garden. The road was fenced with 80 poles placed at intervals of 110cm. Find the circumference of the garden.
16. A $1\frac{3}{4}$ metre wide road runs around a circular field whose circumference is 110 metres. Find the diameter of the road. (Use $\pi = \frac{22}{7}$)
17. A rectangular sheet 220cm long was folded to form a cylindrical tank. Find the radius of the circular sheet needed sheet to cover its bottom.
18. The rectangular sheet below was folded to form a cylindrical tin.



Find the diameter of the cylindrical tin formed.

19. Wires ABCD and WXYZ have the same area. The square wire WXYZ was reshaped to form a circular wire.



- a) Find the total distance around the square wire WXYZ.
- b) Find the radius of the circular wire formed. (Use $\pi = \frac{22}{7}$)

TOPIC 10: LENGTH, MASS AND CAPACITY

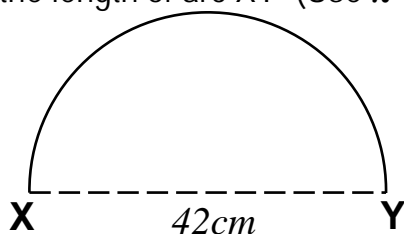


20. A rectangular sheet whose area is 264cm^2 was folded to form a cylindrical tin of height 8cm . Find the diameter of the tin. (Use $\pi = \frac{22}{7}$)
21. A wheel of a bicycle has 32 spokes placed 4.125cm apart. Find the length of each spoke. (Use $\pi = \frac{22}{7}$)
22. Town A is 11km away from Town B. It took Gerald 40 minutes to travel from Town B to Town A using a bicycle of wheel of diameter 70cm . Find the number of revolutions, the wheel of his bicycle made per minute.

Finding the length of arcs

Example 1

Find the length of arc XY (Use $\pi = \frac{22}{7}$)



Length XY = $\frac{1}{2}$ of circumference

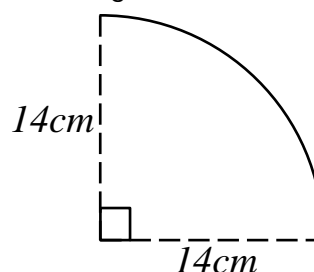
$$\text{Length XY} = \frac{1}{2} \times \pi d$$

$$\text{Length XY} = \frac{1}{2} \times \frac{22}{7} \times 42\text{cm}$$

$$\text{Length XY} = 66\text{cm}$$

Example 2

Find the length of arc AB. (Use $\pi = \frac{22}{7}$)



Length AB = $\frac{1}{4}$ of circumference

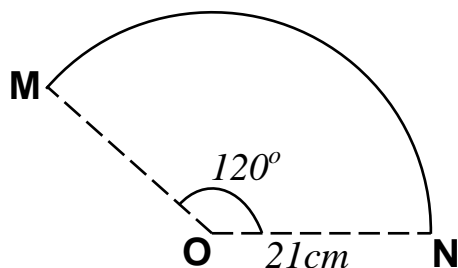
$$\text{Length AB} = \frac{1}{4} \times 2\pi r$$

$$\text{Length AB} = \frac{1}{4} \times 2 \times \frac{22}{7} \times 14\text{cm}$$

$$\text{Length AB} = 22\text{cm}$$

Example 3

Find the length of arc MN. (Use $\pi = \frac{22}{7}$)



$$120^\circ = \frac{120}{360}$$

$$= \frac{1}{3}$$

Length MN = $\frac{1}{3}$ of circumference

$$\text{Length MN} = \frac{1}{3} \times 2\pi r$$

$$\text{Length MN} = \frac{1}{3} \times 2 \times \frac{22}{7} \times 21\text{cm}$$

$$\text{Length MN} = 44\text{cm}$$

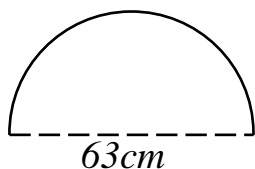
TOPIC 10: LENGTH, MASS AND CAPACITY



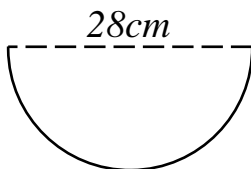
Exercise

1. Find the length of the given arcs. (Use $\pi = \frac{22}{7}$)

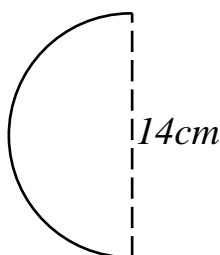
a)



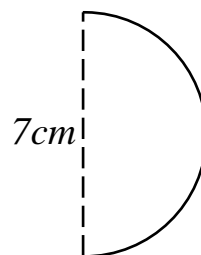
b)



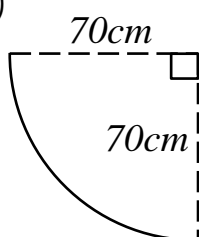
c)



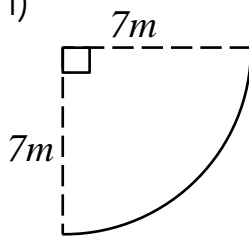
d)



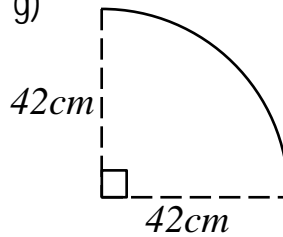
e)



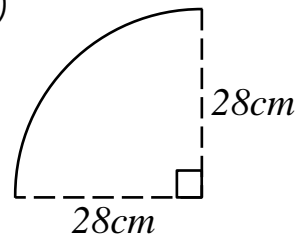
f)



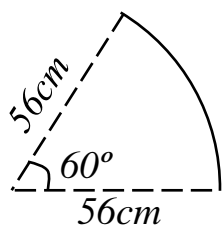
g)



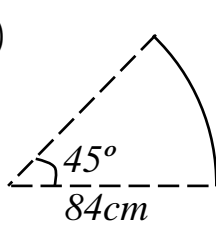
h)



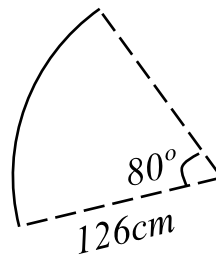
i)



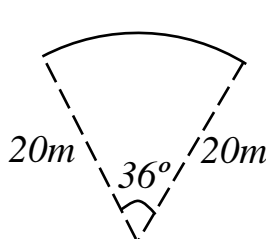
j)



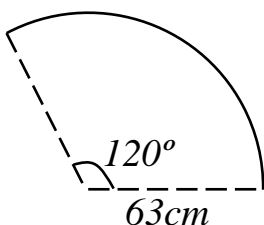
k)



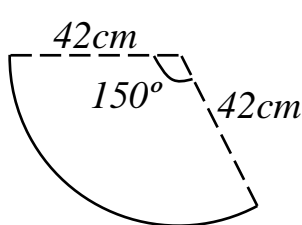
l)



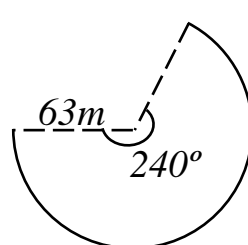
m)



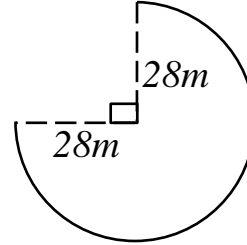
n)



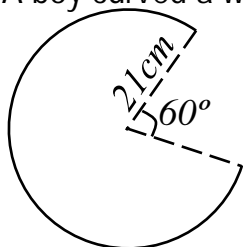
o)



p)

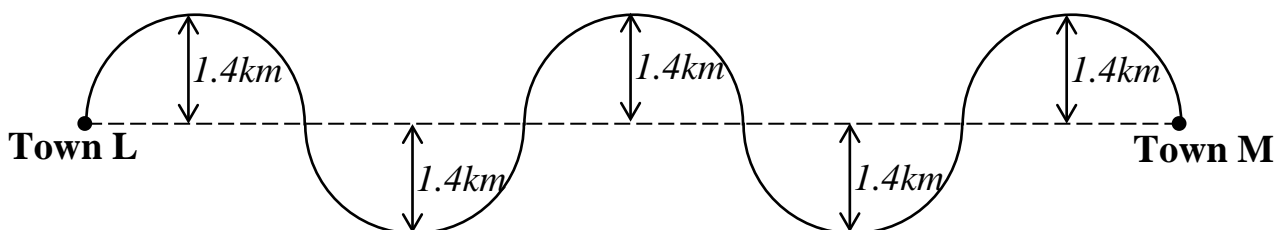


2. A boy curved a wire as shown in the figure below.



Find the length of the wire. (Use $\pi = \frac{22}{7}$)

3. Below is a curved road from Town L to Town M.



A man covered that distance using a bicycle whose wheel has a diameter of 56cm. Find the number of revolutions which the wheel of his bicycle made.

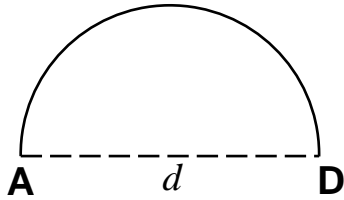
TOPIC 10: LENGTH, MASS AND CAPACITY



Finding the diameter or radius of arcs

Example 1

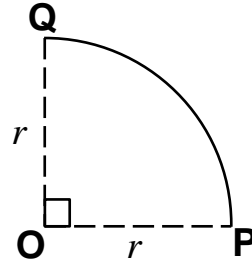
The length of arc AD in the figure below is 99m. Find its diameter. (Use $\pi = \frac{22}{7}$)



$$\begin{aligned}\frac{1}{2}\pi d &= \text{Length of arc AD} \\ \frac{1}{2} \times \frac{22}{7} \times d &= 99\text{cm} \\ 7 \times \frac{11}{7} \times d &= 99\text{cm} \times 7 \\ \frac{11d}{11} &= \frac{99\text{cm} \times 7}{11} \\ d &= 63\text{cm}\end{aligned}$$

Example 2

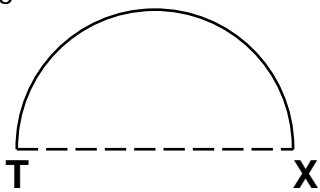
The length arc PQ is 44cm. Find its radius. (Use $\pi = \frac{22}{7}$)



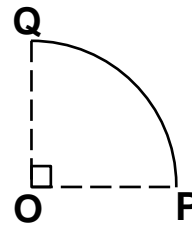
$$\begin{aligned}\frac{1}{4} \times 2\pi r &= \text{Length of arc PQ} \\ \frac{1}{4} \times 2 \times \frac{22}{7} \times r &= 44\text{cm} \\ 7 \times \frac{11}{7} \times r &= 44\text{cm} \times 7 \\ \frac{11r}{11} &= \frac{44\text{cm} \times 7}{11} \\ r &= 28\text{cm}\end{aligned}$$

Exercise

- Find the diameter of a semicircular arc of length; (Use $\pi = \frac{22}{7}$)
 - 11 cm
 - 55cm
 - 77 cm
 - 22 cm
 - 110cm
 - 132cm
- Find length of the arc TX in the figure below is 33cm.
- In the figure below, arc AP is 11m.

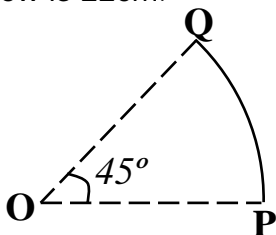


Find its diameter. (Use $\pi = \frac{22}{7}$)



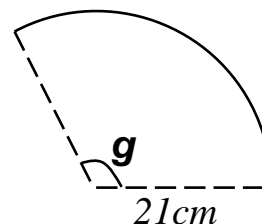
Find length OP. (Use $\pi = \frac{22}{7}$)

- The length of arc PQ in the figure below is 22cm.



Find its radius. (Use $\pi = \frac{22}{7}$)

- The length of the arc drawn below is 44cm



Find the size of angle g. (Use $\pi = \frac{22}{7}$)

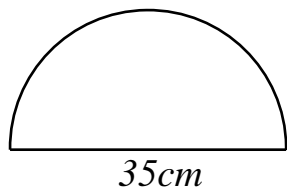
TOPIC 10: LENGTH, MASS AND CAPACITY



Finding perimeter of shapes with curved lengths

Example 1

Find the perimeter of the semicircle below.



Curved length

$$\frac{1}{2} \times \pi d$$

$$\frac{1}{2} \times \frac{22}{7} \times 35\text{cm}$$

$$55\text{cm}$$

Perimeter

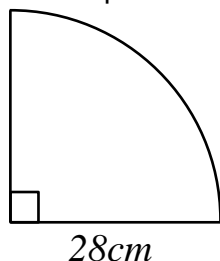
$$35\text{cm} + 55\text{cm}$$

$$90\text{cm}$$

The perimeter is 90cm

Example 2

Find the perimeter of the figure below. (Use $\pi = \frac{22}{7}$)



Curved length

$$\frac{1}{4} \times 2\pi r$$

$$\frac{1}{4} \times 2 \times \frac{22}{7} \times 28\text{cm}$$

$$44\text{cm}$$

Perimeter

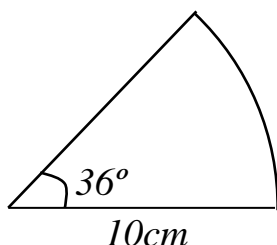
$$28\text{cm} + 28\text{cm} + 44\text{cm}$$

$$100\text{cm}$$

The perimeter is 100cm

Example 3

Find the perimeter of the figure below. (Use $\pi = 3.14$)



Curved length

$$\frac{36}{360} \times 2\pi r$$

$$\frac{1}{10} \times 2 \times 3.14 \times 10\text{cm}$$

$$\frac{1}{10} \times 2 \times \frac{314}{100} \times 10\text{cm}$$

$$\frac{628\text{cm}}{100}$$

$$6.28\text{cm}$$

Perimeter

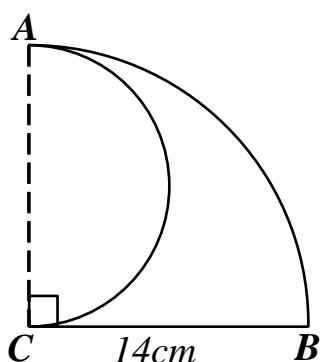
$$6.28\text{cm} + 10\text{cm} + 10\text{cm}$$

$$26.28\text{cm}$$

The perimeter is 26.28cm

Example 4

Calculate the total distance around the figure below. (Use $\pi = \frac{22}{7}$)



Curved length AB

$$\frac{1}{4} \times 2\pi r$$

$$\frac{1}{4} \times 2 \times \frac{22}{7} \times 14\text{cm}$$

$$22\text{cm}$$

Curved length AC

$$\frac{1}{2} \times \pi d$$

$$\frac{1}{2} \times \frac{22}{7} \times 14\text{cm}$$

$$22\text{cm}$$

Perimeter

$$22\text{cm} + 22\text{cm} + 14\text{cm}$$

$$58\text{cm}$$

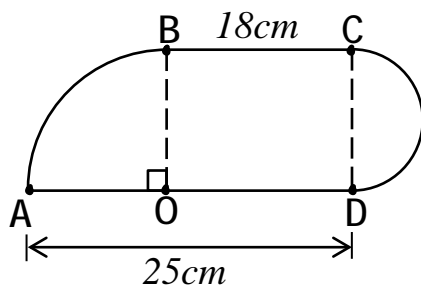
Perimeter = 58cm

TOPIC 10: LENGTH, MASS AND CAPACITY



Example 5

In the figure below, length $AD = 25\text{cm}$ and $BC = 18\text{cm}$. Find the perimeter of figure ABCDA.



$$\begin{aligned}\text{Line } AO &= 25\text{cm} - 18\text{cm} \\ &= 7\text{cm}\end{aligned}$$

$$\text{Line } AO = OB = CD = 7\text{cm}$$

Curved length AB

$$\begin{aligned}\frac{1}{4} \times 2\pi r \\ \frac{1}{4} \times 2 \times \frac{22}{7} \times 7\text{cm}\end{aligned}$$

$$11\text{cm}$$

Curved length AC

$$\begin{aligned}\frac{1}{2} \times \pi d \\ \frac{1}{2} \times \frac{22}{7} \times 14\text{cm}\end{aligned}$$

$$11\text{cm}$$

Perimeter

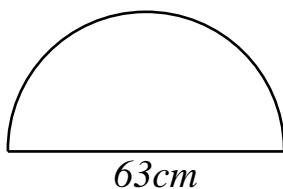
$$25\text{cm} + 11\text{cm} + 18\text{cm} + 11\text{cm}$$

$$65\text{cm}$$

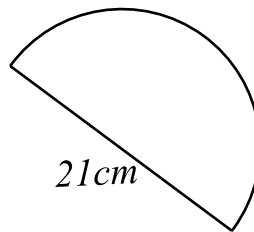
Exercise

1. Find the perimeter of the figures below.

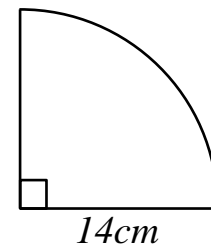
a)



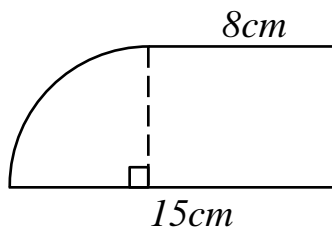
b)



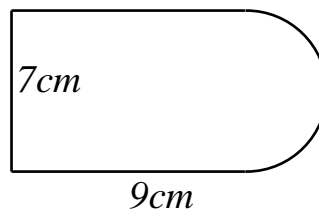
c)



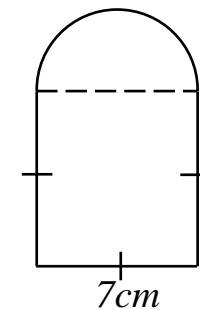
d)



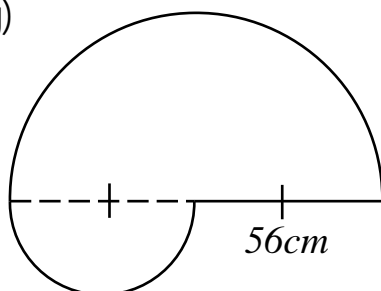
e)



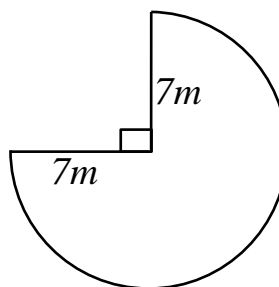
f)



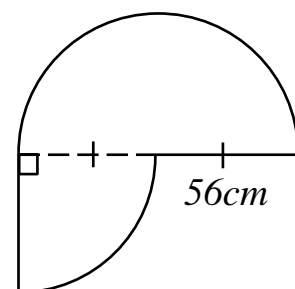
g)



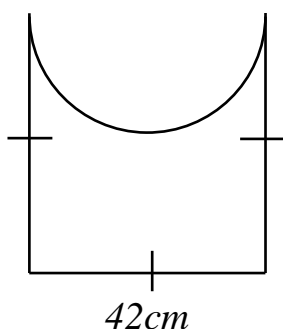
h)



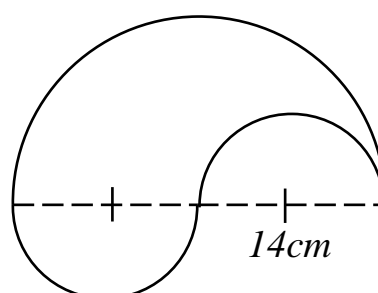
i)



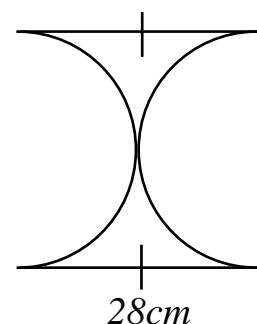
j)



k)



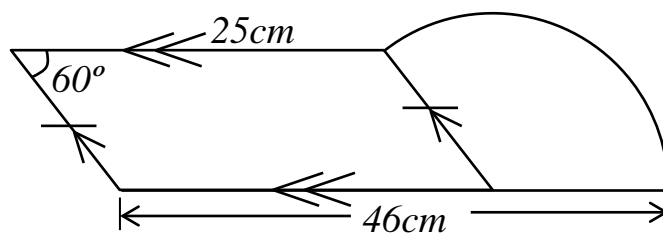
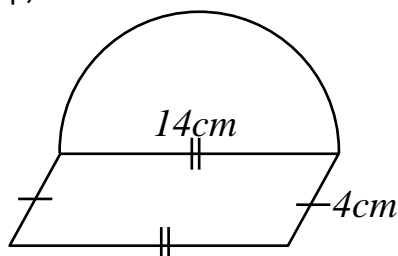
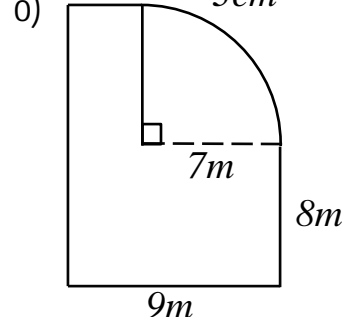
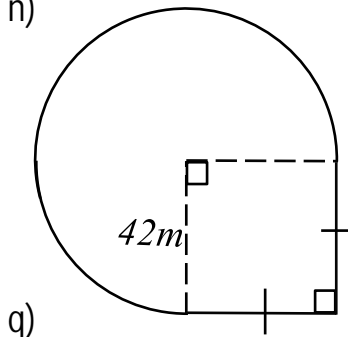
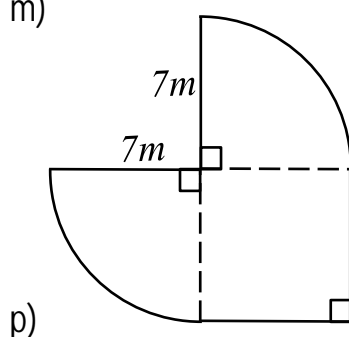
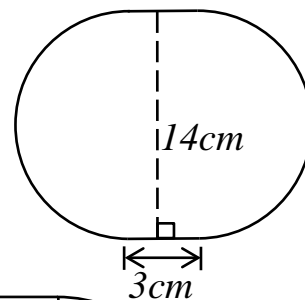
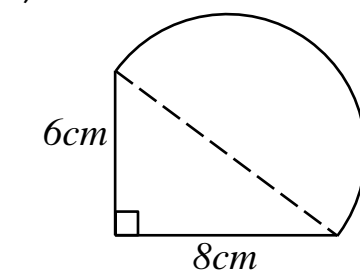
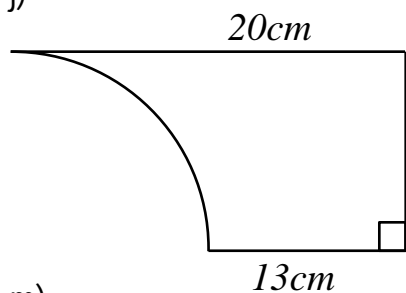
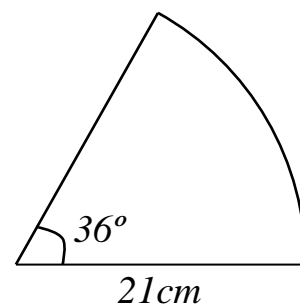
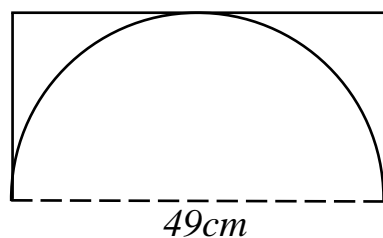
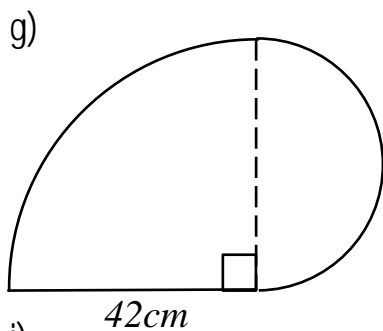
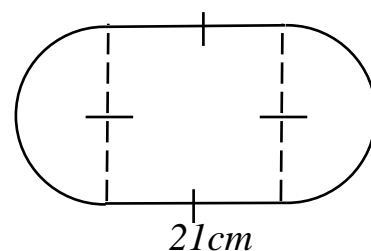
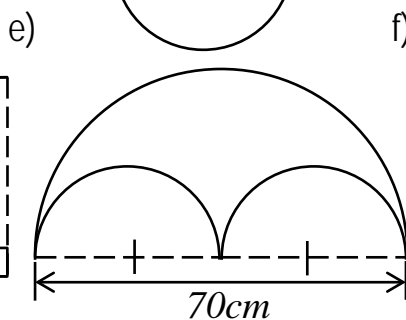
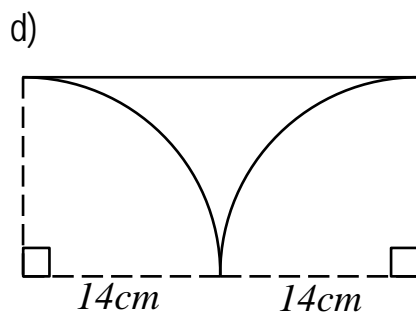
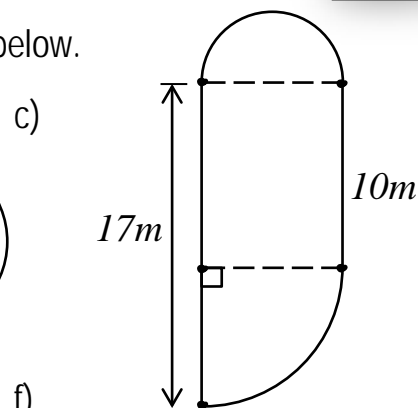
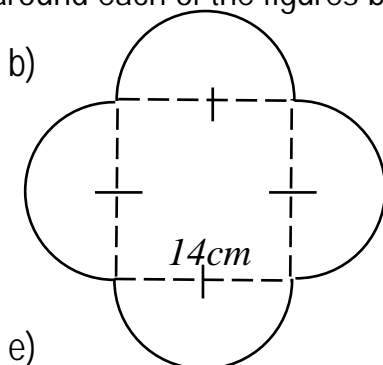
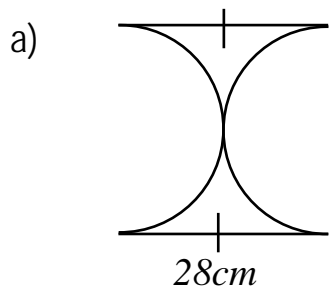
l)



TOPIC 10: LENGTH, MASS AND CAPACITY



2. Calculate the total distance around each of the figures below.



TOPIC 10: LENGTH, MASS AND CAPACITY

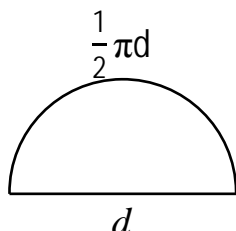


Finding the diameter or radius when perimeter is given

Example 1

The perimeter of a semicircle is 162cm.

Find its diameter. (Use $\pi = \frac{22}{7}$)

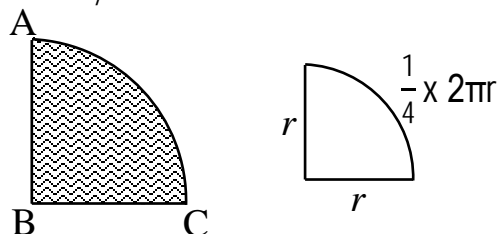


$$\begin{aligned}\frac{1}{2}\pi d + d &= \text{Perimeter} \\ \left(\frac{1}{2} \times \frac{22}{7} \times d\right) + d &= 162\text{cm} \\ \frac{11d}{7} + d &= 162\text{cm} \\ \left(7 \times \frac{11d}{7}\right) + (7 \times d) &= 162\text{cm} \times 7 \\ 11d + 7d &= 1134\text{cm} \\ \frac{18d}{18} &= \frac{1134\text{cm}}{18} \\ d &= 63\text{cm}\end{aligned}$$

Example 2

The total distance around the flower garden below is 150m. Find length BC.

(Use $\pi = \frac{22}{7}$)

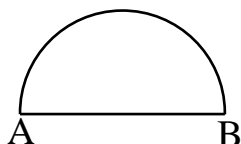


$$\begin{aligned}\left(\frac{1}{4} \times 2\pi r\right) + r + r &= \text{Perimeter} \\ \left(\frac{1}{4} \times 2 \times \frac{22}{7} \times r\right) + 2r &= 150\text{m} \\ \frac{11r}{7} + 2r &= 150\text{m} \\ \left(7 \times \frac{11r}{7}\right) + (7 \times 2r) &= 150\text{m} \times 7 \\ 11r + 14r &= 1050\text{m} \\ \frac{25r}{25} &= \frac{1050\text{m}}{25} \\ r &= 42\text{m}\end{aligned}$$

Exercise

- Find the diameter of a semi-circle whose perimeter is; (Use $\pi = \frac{22}{7}$)

a) 18cm	c) 90cm	e) 270cm	g) 54cm
b) 72cm	d) 36cm	f) 108cm	h) 45cm
- 180 poles were used to fence a semicircular garden. The poles were placed at intervals of 40cm. Find in metres, the diameter of the garden. (Use $\pi = \frac{22}{7}$)
- The total distance around the figure below is 126cm.



Find the length of arc AB in centimeters. (Use $\pi = \frac{22}{7}$)

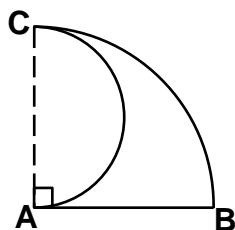
- Find the radius of a quadrant whose perimeter is; (Use $\pi = \frac{22}{7}$)

a) 25cm	e) 150cm	h) 125cm
b) 75cm	f) 100cm	i) 375cm
c) 50cm	g) 225cm	j) 250cm

TOPIC 10: LENGTH, MASS AND CAPACITY



5. The total distance around the figure below is 116cm.



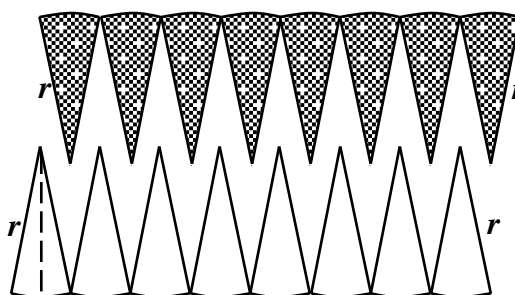
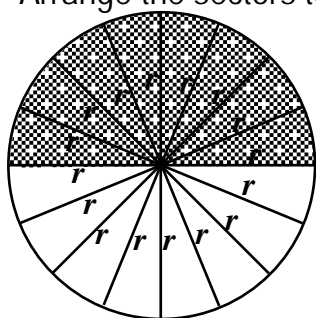
Find length (Use $\pi = \frac{22}{7}$)

- AB
- CBA

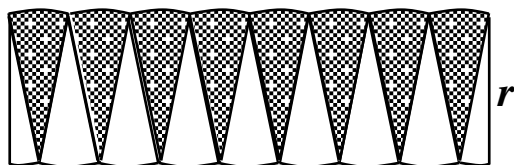
AREA OF A CIRCLE

Group activity

- Get a circular piece of paper and cut it into 16 congruent sectors.
- Arrange the sectors to form a rectangle.

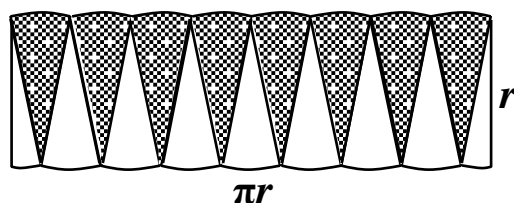


The length of the rectangle is half of the circumference of the circle. But the circumference of a circle is $2\pi r$ therefore half $2\pi r$ is πr



$$\begin{aligned}\text{Area of a rectangle} &= L \times W \\ &= \pi r \times r \\ &= \pi r^2\end{aligned}$$

So, area of a circle = πr^2



$$= \pi r^2$$

Calculating area of a circle when radius is given

Example 1

Calculate the area of a circle whose radius is 21cm. (Use $\pi = \frac{22}{7}$)

$$A = \pi r^2$$

$$A = \frac{22}{7} \times 21\text{cm} \times 21\text{cm}$$

$$A = 22 \times 3\text{cm} \times 21\text{cm}$$

$$A = 1386\text{cm}^2$$

Example 2

Find the area of a circle whose radius is 10cm. (Use $\pi = 3.14$)

$$A = \pi r^2$$

$$A = 3.14 \times 10\text{cm} \times 10\text{cm}$$

$$A = \frac{314}{100} \times 10\text{cm} \times 10\text{cm}$$

$$A = 314\text{cm}^2$$

TOPIC 10: LENGTH, MASS AND CAPACITY



Exercise

- Find the area of the circle whose radius is; (Use $\pi = \frac{22}{7}$)

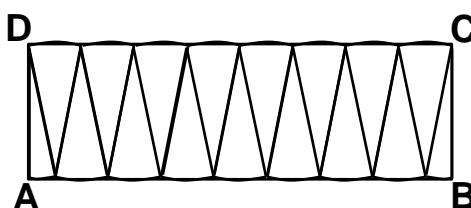
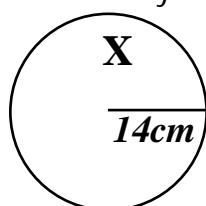
a) 7cm	f) $3\frac{1}{2}$ cm	k) 84cm
b) 28cm	g) 42cm	l) 1.4cm
c) 14cm	h) 49cm	m) 4.2cm
d) 35cm	i) 56cm	n) 2.8m
e) 70 cm	j) 21cm	o) 3.5cm
- Calculate the area of a circle whose radius; (Use $\pi = 3.14$)

a) 20cm	e) 80cm	j) 45 cm
b) 30cm	f) 50 cm	j) 16cm
c) 40 cm	g) 15 cm	k) 18cm
d) 10cm .	h) 25 cm	l) 3.2 cm
- A circular garden has a radius of 35 metres. Calculate its area.
- Calculate the area of the circular sheet of manila whose radius is 10.5cm. (Use $\pi = \frac{22}{7}$)
- A goat is tied on a stump. The length of the rope is 7 metres. Calculate the area of the area of the grazing ground.
- A circular floor has a radius of 8.4m. Calculate its area.
- Find the area of a circular pond whose radius is 9.1 metres.
- Calculate the area of the circular field whose radius is 18 metres. (Use $\pi = \frac{22}{7}$)

Group activity

(Use $\pi = \frac{22}{7}$)

- Figure X is a circle which was cut into small sectors and arranged to form rectangle ABCD. Study it carefully and use it to answer questions than follow.



- Find length AB.
 - Find the area of the rectangle ABCD.
- Small sectors of a circle were arranged to form a rectangle PQRS whose length is 44cm.

a) Find width QR in centimeters.	
b) Find the area of the rectangle.	
c) Calculate the perimeter of the rectangle PQRS.	
 - A circular sheet of manila was cut into small sectors which were arranged to form a rectangular shape whose perimeter is 58cm.
 - Find the length of the rectangular shape formed.
 - Calculate the area of the circular sheet manila used.

TOPIC 10: LENGTH, MASS AND CAPACITY



Finding area of a circle when diameter is given

Example 1

Calculate the area of a circle whose diameter is 32cm. (Use $\pi = 3.14$)

$$\begin{aligned}\text{Radius} &= 32\text{cm} \div 2 \\ &= 16\text{cm}\end{aligned}$$

$$A = \pi r^2$$

$$A = 3.14 \times 16\text{cm} \times 16\text{cm}$$

$$A = \frac{314}{100} \times 16\text{cm} \times 16\text{cm}$$

$$A = \frac{80384\text{cm}^2}{100}$$

$$A = 803.84\text{cm}^2$$

Example 2

Find the area of a circle whose diameter is 70 cm. (Use $\pi = \frac{22}{7}$)

$$\begin{aligned}\text{Radius} &= 70\text{cm} \div 2 \\ &= 35\text{cm}\end{aligned}$$

$$A = \pi r^2$$

$$A = \frac{22}{7} \times 35\text{cm} \times 35\text{cm}$$

$$A = 22 \times 5\text{cm} \times 35\text{cm}$$

$$A = 3850\text{cm}^2$$

Exercise

- Calculate the area of a circle whose diameter is; (Use $\pi = \frac{22}{7}$)
 - 14cm
 - 42 cm
 - 28cm
 - 7cm
 - 21 cm
 - 63 cm
 - 35 cm
 - $3\frac{1}{2}\text{cm}$
 - $10\frac{1}{2}\text{cm}$
 - 56 cm
 - 2.1 cm
 - 2.8cm
- Find the area of a circle whose diameter is; (Use $\pi = 3.14$)
 - 10cm
 - 20cm
 - 30cm
 - 50cm
 - 407 cm
 - 80cm
 - 60 cm
 - 15cm
 - 45 cm
 - 25 cm
 - 18cm
 - 1.2 cm
- The diameter of a circular swimming pool is 480cm. Calculate its area.
- Calculate the area of a circular playground whose diameter is 49 meters.

Finding area of a circle when circumference is given

Example 1

Calculate the area of a circle whose circumference is 132cm. (Use $\pi = \frac{22}{7}$)

Radius (r) of the circle

$$2\pi r = \text{Circumference}$$

$$2 \times \frac{22}{7} \times r = 132\text{cm}$$

$$7 \times \frac{44}{7} \times r = 132\text{cm} \times 7$$

$$44r = 132\text{cm} \times 7$$

$$\frac{44r}{44} = \frac{132\text{cm} \times 7}{44}$$

$$r = 21\text{cm}$$

Area of the circle

$$A = \pi r^2$$

$$A = \frac{22}{7} \times 21\text{cm} \times 21\text{cm}$$

$$A = 22 \times 3\text{cm} \times 21\text{cm}$$

$$A = 1386\text{cm}^2$$

TOPIC 10: LENGTH, MASS AND CAPACITY



Example 2

110 poles were used to fence a circular garden. The poles were placed at intervals of 80cm. Find the area of the garden in square metres. (Use $\pi = \frac{22}{7}$)

Poles = Spaces

110poles = 110spaces

Circumference the garden

Spaces x Interval

110 x 80cm

8800cm

Circumference in metres

$(8800 \div 100)m = 88m$

Radius (r) of the garden

$2\pi r = \text{Circumference}$

$$2 \times \frac{22}{7} \times r = 88m$$

$$7 \times \frac{44}{7} \times r = 88m \times 7$$

$$44r = 88m \times 7$$

$$\frac{44r}{44} = \frac{88m \times 7}{44}$$

$$r = 14m$$

Area of the garden

$$A = \pi r^2$$

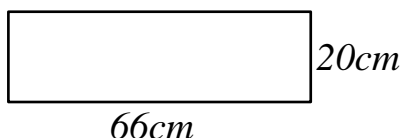
$$A = \frac{22}{7} \times 14m \times 14m$$

$$A = 22 \times 2m \times 14m$$

$$A = 616m^2$$

Example 3

The rectangular sheet below was folded to form a wholly cylinder 20cm high.



Find the area of the circular sheet needed to cover its base. (Use $\pi = \frac{22}{7}$)

Radius (r) of the cylinder

Length = Circumference

$2\pi r = \text{Circumference}$

$$2 \times \frac{22}{7} \times r = 66cm$$

$$7 \times \frac{44}{7} \times r = 66cm \times 7$$

$$44r = 66cm \times 7$$

$$\frac{44r}{44} = \frac{66cm \times 7}{44}$$

$$r = 10\frac{1}{2}cm$$

Area of the garden

$$A = \pi r^2$$

$$A = \frac{22}{7} \times 10\frac{1}{2}cm \times 10\frac{1}{2}cm$$

$$A = \frac{22}{7} \times \frac{21}{2}cm \times \frac{21}{2}cm$$

$$A = \frac{11 \times 3cm \times 21cm}{2}$$

$$A = 346\frac{1}{2}cm^2$$

Exercise

- Find the area of a circle whose circumference is; (Use $\pi = \frac{22}{7}$)
 - 88cm
 - 132cm
 - 44cm
 - 110cm
 - 11cm
 - 66cm
 - 176cm
 - 220cm
 - 308 cm
 - 2.8 cm
 - 35.2cm
 - 17.6cm
- The circumference of a circle is 440cm.
 - Find the radius of the circle.
 - Find its area.
- The distance round a circular plate is 88cm. What is its area?

TOPIC 10: LENGTH, MASS AND CAPACITY



4. A goat tied on a stump such that the farthest distance around the grazing ground is 66 metres.
 - a) Find the length of the rope.
 - b) Calculate the area of the possible grazing ground.
5. In one hour, a minute hand of a clock covers 88cm.
 - a) Find the length of the minute hand.
 - b) Calculate the area through which the minutes hand covered that distance.
6. A school used 440 poles to fence its circular compound. The poles were placed 50cm apart.
 - a) Find the diameter of the compound in meters.
 - b) Calculate the area of the compound in cubic meters.
7. A farmer fenced her circular garden using 160 poles placed 55cm apart. Calculate the area of the garden.
8. The rectangular sheet of metal below was folded to form a cylindrical tin whose height is 65cm.



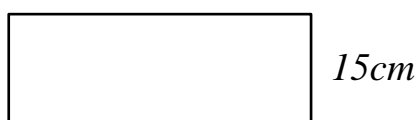
- a) Find the radius of the tin formed.
- b) Calculate the area of the circular sheet need to cover the bottom of the tin.

9. Below is a rectangular sheet of metal whose perimeter is 20 metres is was folded to form a cylindrical tank 1.2 metres high.



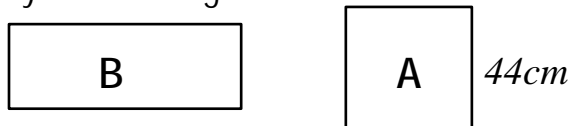
- a) Find in centimetres, the diameter of the tank form.
- b) Calculate the base area of the tank formed.

10. Below is a rectangular paper whose area is 660cm^2 . It was folded make a cylinder whose height is 15cm.



Find the base area of the cylinder formed.

11. A wheel made 500 revolutions to cover a distance of 1.1km.
 - a) Find in centimetres, the radius of the wheel.
 - b) Calculate the area of the wheel.
12. A wire of length 330 metres was wound 500 times round a cylindrical tin. Find in square centimetres, the base area of the tin.
13. Rectangle A and square B have the same area. Rectangle A was folded to form a cylinder of height 11cm.



Calculate the base area of the cylinder formed.

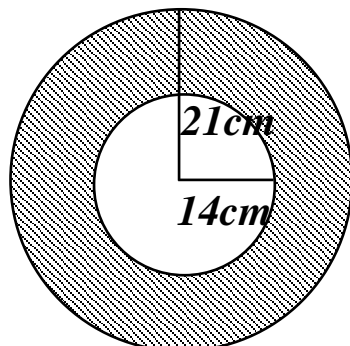
TOPIC 10: LENGTH, MASS AND CAPACITY



Finding the difference between area of two circles

Example 1

Find the area of the shaded part.



Method 1

$$A = \pi(R^2 - r^2)$$

$$A = \frac{22}{7} \times (21\text{cm} \times 21\text{cm} - 14\text{cm} \times 14\text{cm})$$

$$A = \frac{22}{7} \times (441\text{cm}^2 - 196\text{cm}^2)$$

$$A = \frac{22}{7} \times 245\text{cm}^2$$

$$A = 22 \times 35\text{cm}^2$$

$$A = 770\text{cm}^2$$

Method 2

Area of the outer circle

$$A = \pi r^2$$

$$A = \frac{22}{7} \times 21\text{cm} \times 21\text{cm}$$

$$A = 22 \times 3\text{cm} \times 21\text{cm}$$

$$A = 1386\text{cm}^2$$

Area of the inner circle

$$A = \pi r^2$$

$$A = \frac{22}{7} \times 14\text{cm} \times 14\text{cm}$$

$$A = 22 \times 2\text{cm} \times 14\text{cm}$$

$$A = 616\text{cm}^2$$

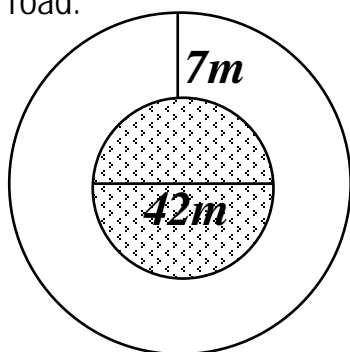
Area of the shaded part

$$1386\text{cm}^2 - 616\text{cm}^2$$

$$770\text{cm}^2$$

Example 2

A 7m wide road runs around a circular garden whose diameter is 42m. Find the area of the road.



Radius of the road

$$21\text{m} + 7\text{m} = 28\text{m}$$

Area of the road + garden

$$A = \pi r^2$$

$$A = \frac{22}{7} \times 28\text{m} \times 28\text{m}$$

$$A = 22 \times 4\text{m} \times 28\text{m}$$

$$A = 2464\text{m}^2$$

Area of the garden

$$A = \pi r^2$$

$$A = \frac{22}{7} \times 21\text{m} \times 21\text{m}$$

$$A = 22 \times 3\text{m} \times 21\text{m}$$

$$A = 1386\text{m}^2$$

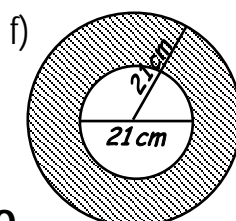
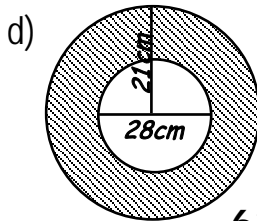
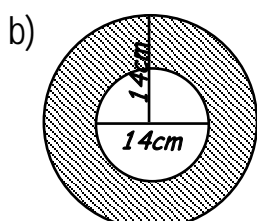
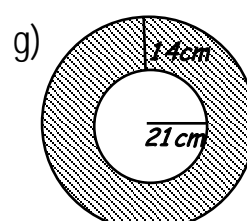
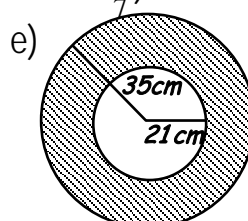
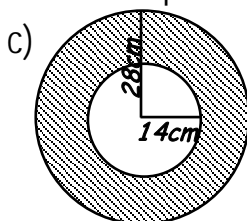
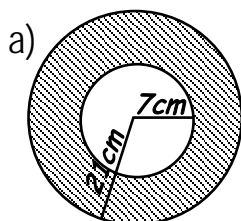
Area of the road

$$2464\text{m}^2 - 1386\text{m}^2$$

$$1078\text{m}^2$$

Exercise

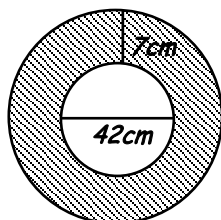
1. Calculate the area of the shaded parts. (Use $\pi = \frac{22}{7}$)



TOPIC 10: LENGTH, MASS AND CAPACITY

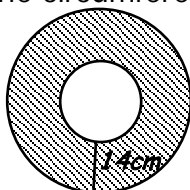


- A circular carpet of diameter 21cm is placed on a circular floor of radius 14cm. Find the area of floor not covered by the carpet. (Use $\pi = \frac{22}{7}$)
- A circular compound 28m is surrounded by a flower bed of thickness 7m. Find the area flower bed. (Use $\pi = \frac{22}{7}$)
- A 3.5 metre wide road runs around a circular pond whose radius is 7 metres.
 - Calculate the area of the area of the pond .
 - Calculate the area of the road .
- A 7 metre wide road runs around a circular farm whose diameter is 70 metres. Calculate the area of the road .
- A circular disc was cut from the centre of a circular manila whose radius is 42cm as shown below.



- Calculate the area of the circular disc. (Use $\pi = \frac{22}{7}$)
- Find the area of the remaining part of the manila.

- The circumference of the inner circle in the figure below is 44cm.



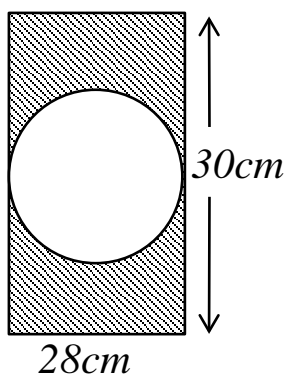
Find the area of the shaded part.

- A seven metre road runs around a circular garden. The distance round the road is 110 metres.
 - Find the radius of the circular garden.
 - Calculate the area of the road.
- A chef prepares doughnuts of diameter 14cm. Each doughnut has a circular hole in its centre whose circumference is 22cm. Calculate the area of each doughnut. (Use $\pi = \frac{22}{7}$)

Finding the difference between area of a circle and area of other shapes

Example 1

Calculate the area of the shaded part in the figure below.



Radius of the circle

$$\begin{aligned}\text{Radius} &= 28\text{cm} \div 2 \\ &= 14\text{cm}\end{aligned}$$

Area of the circle

$$\begin{aligned}A &= \pi r^2 \\ A &= \frac{22}{7} \times 14\text{cm} \times 14\text{cm} \\ A &= 22 \times 2\text{cm} \times 14\text{cm} \\ A &= 616\text{cm}^2\end{aligned}$$

Area of the rectangle

$$\begin{aligned}A &= L \times W \\ A &= 30\text{cm} \times 28\text{cm} \\ A &= 840\text{cm}^2\end{aligned}$$

Area of the shaded part

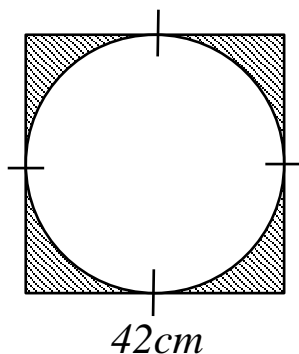
$$\begin{aligned}840\text{cm}^2 &- 616\text{cm}^2 \\ 224\text{cm}^2\end{aligned}$$

TOPIC 10: LENGTH, MASS AND CAPACITY



Example 2

Find the area of the shaded part.



Radius of the circle

$$\text{Radius} = 42\text{cm} \div 2 \\ = 21\text{cm}$$

Area of the circle

$$A = \pi r^2$$

$$A = \frac{22}{7} \times 21\text{cm} \times 21\text{cm}$$

$$A = 22 \times 3\text{cm} \times 21\text{cm}$$

$$A = 1386\text{cm}^2$$

Area of the square

$$A = S \times S$$

$$A = 42\text{cm} \times 42\text{cm}$$

$$A = 1764\text{cm}^2$$

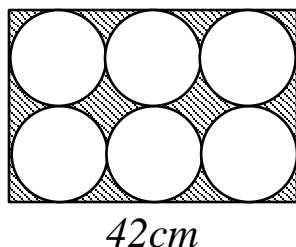
Area of the shaded part

$$1764\text{cm}^2 - 1386\text{cm}^2$$

$$378\text{cm}^2$$

Example 3

Calculate the area of the shaded part in the figure below.



Diameter

$$\frac{42\text{cm}}{3} = 14\text{cm}$$

Width of the rectangle

$$14\text{cm} \times 2 = 28\text{cm}$$

Area of the rectangle

$$A = L \times W$$

$$A = 42\text{cm} \times 28\text{cm}$$

$$A = 1176\text{cm}^2$$

Area of one circle

$$A = \pi r^2$$

$$A = \frac{22}{7} \times 7\text{cm} \times 7\text{cm}$$

$$A = 22 \times 1\text{cm} \times 7\text{cm}$$

$$A = 154\text{cm}^2$$

Area of 6 circles

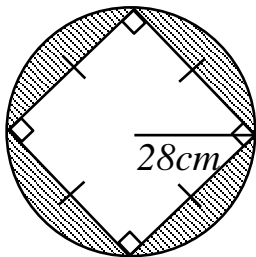
$$154\text{cm}^2 \times 6 = 924\text{cm}^2$$

Area of the shaded part

$$1176\text{cm}^2 - 924\text{cm}^2 = 252\text{cm}^2$$

Example 4

Find the area of the shaded part.



Area of the circle

$$A = \pi r^2$$

$$A = \frac{22}{7} \times 28\text{cm} \times 28\text{cm}$$

$$A = 22 \times 4\text{cm} \times 28\text{cm}$$

$$A = 2464\text{cm}^2$$

Area of the square

$$A = \frac{1}{2} \times d_1 \times d_2$$

$$A = \frac{1}{2} \times 56\text{cm} \times 56\text{cm}$$

$$A = 28\text{cm} \times 56\text{cm}$$

$$A = 1568\text{cm}^2$$

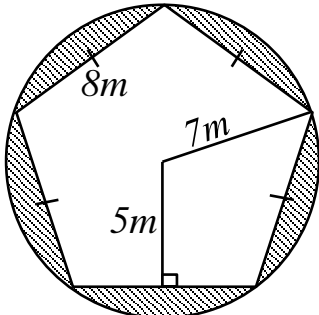
Shaded part

$$2464\text{cm}^2 - 1568\text{cm}^2$$

$$896\text{cm}^2$$

Example 5

Find the area of the shaded part.



Area of the circle

$$A = \pi r^2$$

$$A = \frac{22}{7} \times 7\text{m} \times 7\text{m}$$

$$A = 22 \times 1\text{m} \times 7\text{m}$$

$$A = 154\text{m}^2$$

Area of the pentagon

$$A = \frac{1}{2} \times \text{apothem} \times \text{perimeter}$$

$$A = \frac{1}{2} \times 5\text{m} \times (8\text{m} \times 5)$$

$$A = \frac{1}{2} \times 5\text{m} \times 40\text{m}$$

$$A = 100\text{m}^2$$

Shaded part

$$154\text{m}^2 - 100\text{m}^2$$

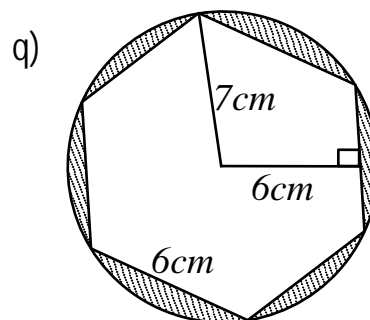
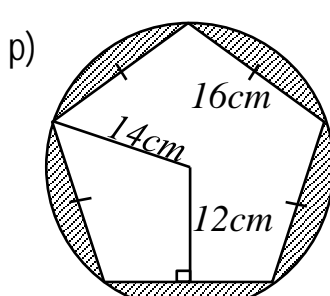
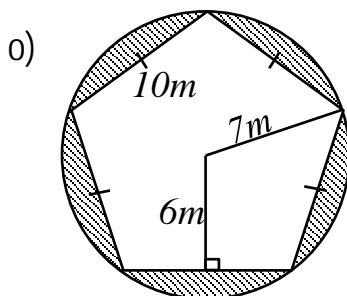
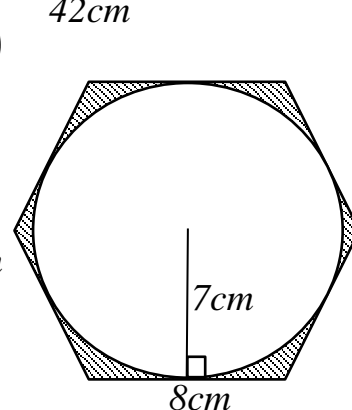
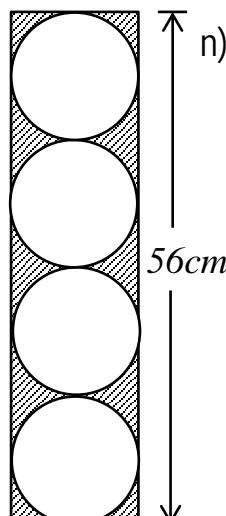
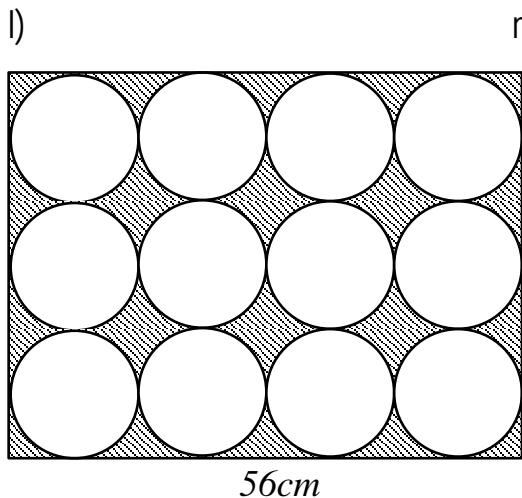
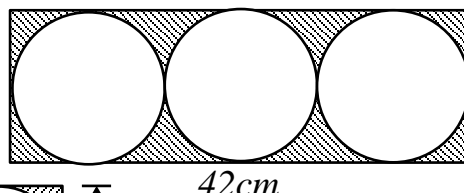
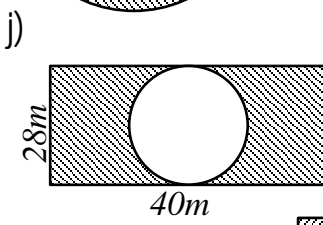
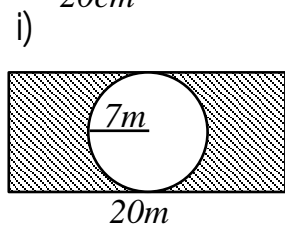
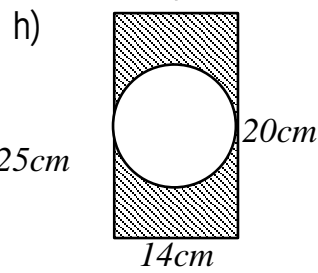
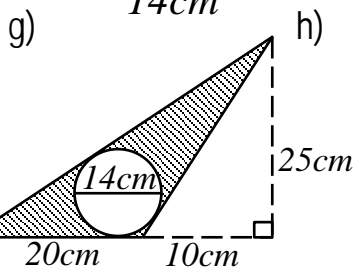
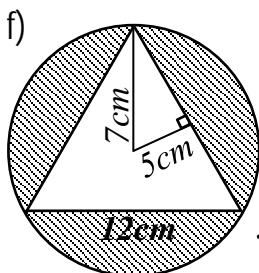
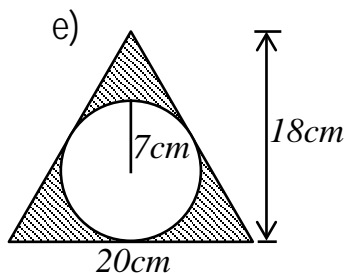
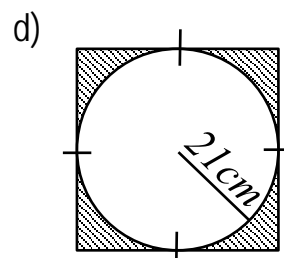
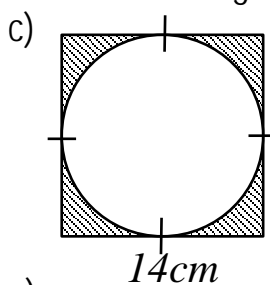
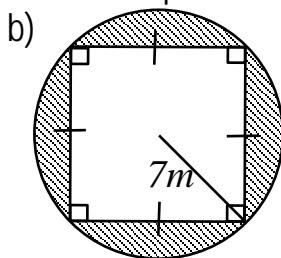
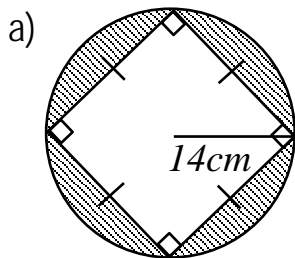
$$54\text{m}^2$$

TOPIC 10: LENGTH, MASS AND CAPACITY



Exercise

1. Calculate the area of the shaded part in each of the drawing below.



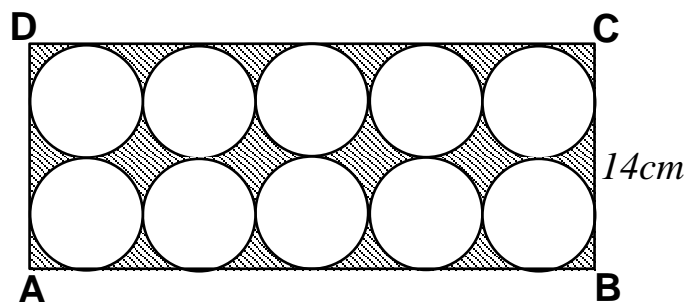
2. Deborah has a rectangular sheet of manila 35cm by 32cm. She wants to cut out a circular card of radius 14cm.

Find the area of the remaining part of manila. (Use $\pi = \frac{22}{7}$)

TOPIC 10: LENGTH, MASS AND CAPACITY

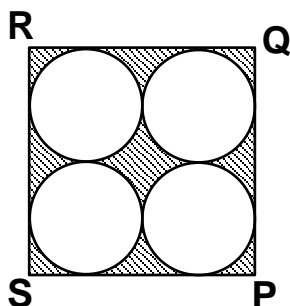


3. Study the figure below and use it to answer questions that follow.



- Find length AB.
- Calculate the area of ABCD.
- Find the area of the shaded part.
(Use $\pi = \frac{22}{7}$)

4. The circumference of each circle in the drawing below is 44cm.

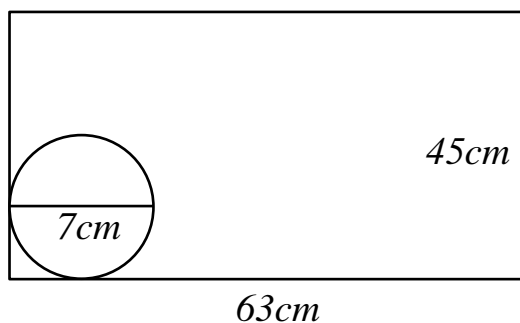


- Find the perimeter of PQRS.
- Calculate the area of the shaded part. (Use $\pi = \frac{22}{7}$)

More problems about area of a circle in real life situation

Example 1

A rectangular sheet of metal is 63cm by 45cm. Circular disc of diameter 7cm are cut out from the sheet of metal.



- Find the total number of discs cut out of the sheet of metal.

$$\text{Along length} \rightarrow \frac{63\text{cm}}{7\text{cm}} = 9 \text{ discs}$$

$$\text{Along width} \rightarrow \frac{45\text{cm}}{7\text{cm}} = 6 \text{ discs}$$

Total number of discs

$$9 \times 6 = 54 \text{ discs}$$

- Find the area of the sheet of metal wasted.

Area of 54 circular discs

$$A = \pi r^2 \times 54$$

$$A = \frac{22}{7} \times \frac{7\text{cm}}{2} \times \frac{7\text{cm}}{2} \times 54$$

$$A = 11 \times 1\text{cm} \times 7\text{cm} \times 27$$

$$A = 2079\text{cm}^2$$

Area of the rectangular sheet

$$A = L \times W$$

$$A = 63\text{cm} \times 45\text{cm}$$

$$A = 2835\text{cm}^2$$

Area of sheet of metal wasted

$$2835\text{cm}^2 - 2079\text{cm}^2$$

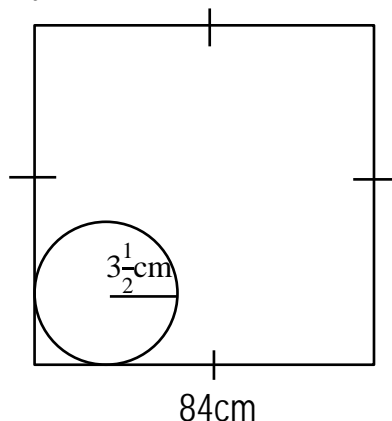
$$756\text{cm}^2$$

TOPIC 10: LENGTH, MASS AND CAPACITY



Example 2

Kabaata prepared square dough of 84cm and cut circular pancakes of radius $3\frac{1}{2}$ cm out of it.



a) How many pancakes did he make?

$$\begin{aligned}\text{Diameter} &= 3\frac{1}{2}\text{cm} + 3\frac{1}{2}\text{cm} \\ &= 7\text{cm}\end{aligned}$$

$$\text{Along length} \rightarrow \frac{84\text{cm}}{7\text{cm}} = 12 \text{ pancakes}$$

$$\begin{aligned}\text{Total number of pancakes} \\ 12 \times 12 &= 144 \text{ pancakes}\end{aligned}$$

b) What is the area of the remaining dough?

Area of 144 circular pancakes

$$A = \pi r^2 \times 144$$

$$A = \frac{22}{7} \times \frac{7\text{cm}}{2} \times \frac{7\text{cm}}{2} \times 144$$

$$A = 11 \times 1\text{cm} \times 7\text{cm} \times 72$$

$$A = 5544\text{cm}^2$$

Area of the dough

$$A = S \times S$$

$$A = 84\text{cm} \times 84\text{cm}$$

$$A = 7056\text{cm}^2$$

Area of the remaining dough

$$7056\text{cm}^2 - 5544\text{cm}^2$$

$$1512\text{cm}^2$$

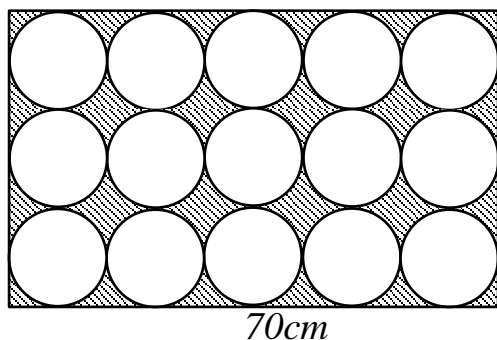
Exercise

- Circular cards of diameter 7cm were cut from a rectangular manila 35cm by 28cm.
 - Find the number of cards cut along the;
 - length
 - width
 - How many cards were cut from the manila?
 - Calculate the area of the rectangular manila.
 - Find the area of manila wasted.
- Kazibwe had a rectangular mat 56cm by 42cm. He later cut out circular table mats of radius 7cm.
 - Find the number of circular table mats he got.
 - Find the area of the rectangular mat wasted.
- A pancake maker prepared a rectangular dough 70cm by 50cm and cut pancakes of radius $3\frac{1}{2}$ cm out of it.
 - How many pancakes did she make?
 - Find the area of the remaining dough.
- Find the number of circular cards of radius 3.5cm that can be cut from a square piece of paper of side 56cm.
 - Calculate the area of the paper wasted

TOPIC 10: LENGTH, MASS AND CAPACITY



5. Makalu has rectangular soft board 80cm by 63cm. If he cuts out circular discs of radius 7cm, find the area of the remaining board. (Use $\pi = \frac{22}{7}$)
6. A rectangular wall 3.5 m by 2m is designed with circular paintings each of radius 7cm.
 - a) How many circles were in the design?
 - b) What is the area of the wall without circles? (Use $\pi = \frac{22}{7}$)
7. Twenty circular cards of diameter 7cm were cut from a rectangular manila of length 40cm and width 28cm.
 - a) How many circular cards were cut along the length?
 - b) Calculate the area of the wasted manila. (Use $\pi = \frac{22}{7}$)
8. Circular discs of diameter 28cm are cut from a rectangular sheet of metal 142 cm by 85cm. The area of the un used metal is 2830cm².
Find the number of circular discs cut from the rectangular sheet of metal. (Use $\pi = \frac{22}{7}$)
9. Twelve circular cards are cut from a rectangular paper whose length is 28cm. The diameter of each card is 7cm and the area of the wasted paper is 238cm².
Calculate the total distance around the rectangular paper. (Use $\pi = \frac{22}{7}$)
10. Pancakes were cut from a rectangular dough 70cm long as shown in the figure below.



- a) Find the width of the dough.
- b) Calculate the area of the remaining dough. (Use $\pi = \frac{22}{7}$)

Finding radius of a circle when area is given

Example 1

The area of a circle is 2464cm².

Find its radius. (Use $\pi = \frac{22}{7}$)

$$\begin{aligned}
 \pi r^2 &= A \\
 \frac{22}{7} \times r^2 &= 2464\text{cm}^2 \\
 7 \times \frac{22}{7} r^2 &= 2464\text{cm}^2 \times 7 \\
 \frac{22r^2}{22} &= \frac{2464\text{cm}^2 \times 7}{22} \\
 r^2 &= 112\text{cm}^2 \times 7 \\
 r^2 &= 784\text{cm}^2 \\
 \sqrt{r^2} &= \sqrt{784\text{cm}^2} \\
 r &= 28\text{cm}
 \end{aligned}$$

Example 2

Find the radius of a circle whose

area is 616m². (Use $\pi = \frac{22}{7}$)

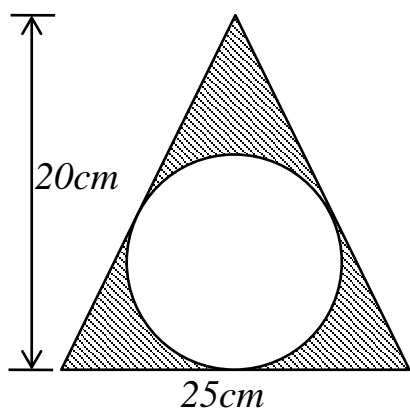
$$\begin{aligned}
 \pi r^2 &= A \\
 \frac{22}{7} \times r^2 &= 616\text{m}^2 \\
 7 \times \frac{22}{7} r^2 &= 616\text{m}^2 \times 7 \\
 \frac{22r^2}{22} &= \frac{616\text{m}^2 \times 7}{22} \\
 r^2 &= 28\text{m}^2 \times 7 \\
 r^2 &= 196\text{m}^2 \\
 \sqrt{r^2} &= \sqrt{196\text{m}^2} \\
 r &= 14\text{m}
 \end{aligned}$$

TOPIC 10: LENGTH, MASS AND CAPACITY



Example 3

The area of the shaded part in the figure below is 96cm^2 .



Find the radius of the circle. (Use $\pi = \frac{22}{7}$)

Area of the triangle

$$A = \frac{1}{2} \times b \times h$$

$$A = \frac{1}{2} \times 25\text{cm} \times 20\text{cm}$$

$$A = 250\text{cm}^2$$

Area of the circle

$$250\text{cm}^2 - 96\text{cm}^2$$

$$154\text{cm}^2$$

Radius of the circle

$$\pi r^2 = A$$

$$\frac{22}{7} \times r^2 = 154\text{cm}^2$$

$$7 \times \frac{22}{7} r^2 = 154\text{cm}^2 \times 7$$

$$\frac{22r^2}{22} = \frac{154\text{cm}^2 \times 7}{22}$$

$$r^2 = 7\text{cm}^2 \times 7$$

$$r^2 = 49\text{cm}^2$$

$$\sqrt{r^2} = \sqrt{49\text{cm}^2}$$

$$r = 7\text{cm}$$

Exercise

- Calculate the radius of a circle whose area is given below. (Use $\pi = \frac{22}{7}$)

a) 154cm^2

e) 15400cm^2

i) 1.54cm^2

b) 1386cm^2

f) 5544cm^2

j) 6.16cm^2

c) 616cm^2

g) $38\frac{1}{2}\text{cm}^2$

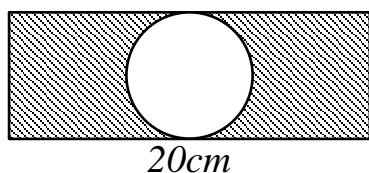
k) 13.86cm^2

d) 3850cm^2

h) $9\frac{5}{8}\text{cm}^2$

l) 38.5cm^2

- The area of a square is 24.64cm^2 . Find its radius. (Use $\pi = \frac{22}{7}$)
- A circular garden has an area of 616m^2 . Find the radius of the garden.
- The area of the un shaded part in the figure below is 154cm^2 .

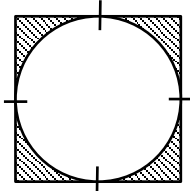


a) Find the radius of the circle. (Use $\pi = \frac{22}{7}$)

b) Find the width of the rectangle.

c) Calculate the area of the shaded part.

- The area of the circle in the figure below is 616cm^2 .

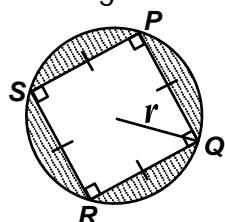


a) Find the length of each side of the square. (Use $\pi = \frac{22}{7}$)

b) Calculate the area of the shaded part.

c) Find the perimeter of the square.

- The diagram below shows a square PQRS enclosed in a circle with area 616cm^2 .



a) Find the value of r . (Use $\pi = \frac{22}{7}$)

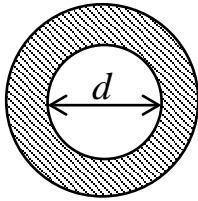
b) Calculate the area of square PQRS.

c) Find the area of the shaded part.

TOPIC 10: LENGTH, MASS AND CAPACITY

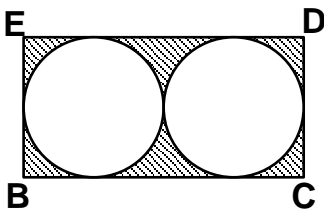


7. In the figure below, the area of the inner circle is 154cm^2 . The radius of the outer circle is 3 times the radius of the inner circle.



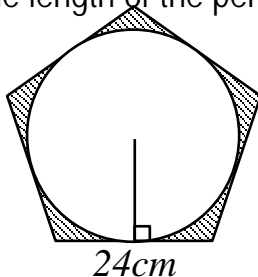
- Find the value of d . (Use $\pi = \frac{22}{7}$)
- Calculate the area of the shaded part.

8. Below are two circles enclosed in a rectangle BCDE. The area of the unshaded part is 308m^2 .



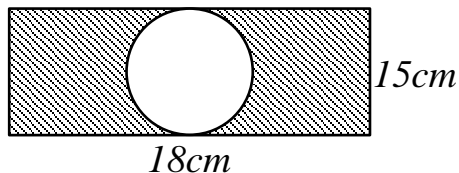
- Find length BC in metres. (Use $\pi = \frac{22}{7}$)
- Calculate the area of the unshaded part.

9. The area of the circle enclosed in a regular pentagon in the figure below is 616cm^2 . The length of the pentagon is 24cm .



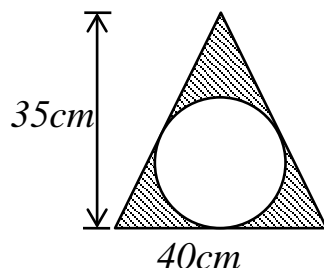
- Calculate the perimeter of the pentagon.
- Find the area of the shaded part. (Use $\pi = \frac{22}{7}$)

10. The area of the shaded part in the figure below is 116cm^2 .



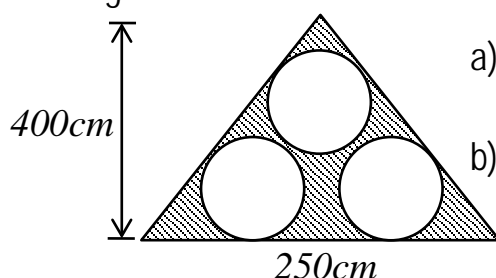
- Find the area of the rectangle.
- Find the radius of the circle. (Use $\pi = \frac{22}{7}$)

11. The area of the shaded part in the figure below is 84cm^2 .



- Find the area of the triangle.
- Find the radius of the circle. (Use $\pi = \frac{22}{7}$)

12. In the figure below, three circles of the same area are enclosed in a triangle whose height is 400cm . The area of the shaded part in the figure below is 0.38m^2 .

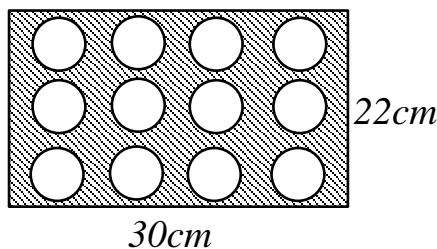


- Find in square centimetres, the area covered by the three circles.
- Find the radius of each circle. (Use $\pi = \frac{22}{7}$)

TOPIC 10: LENGTH, MASS AND CAPACITY

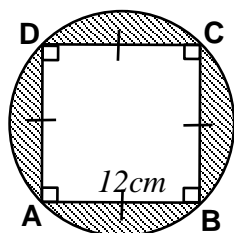


13. The drawing below shows a number of pancakes cut from a rectangular dough. The shaded part represents the remaining part of the dough.



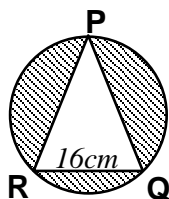
- a) Calculate the area of the rectangular dough.
b) If the area of the remaining dough is 198cm^2 , Find the radius of each pancake. (Use $\pi = \frac{22}{7}$)

14. The area of the shaded part in the figure below is 10cm^2 .



- a) Find the area of the square ABCD.
b) Find the length of diagonal BD. (Use $\pi = \frac{22}{7}$)

15. The figure below shows triangle PQR enclosed in a circle. Line PQ = RP = 10cm and line RQ = 16cm. The area of the shaded part is 106cm^2 . Study it carefully and use it to answer questions that follow.

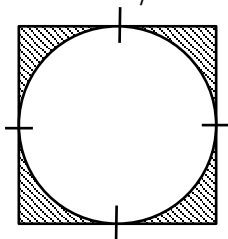


- a) Find the height of the triangle.
b) Find the radius of the circle. (Use $\pi = \frac{22}{7}$)

More problems involving finding the radius of a circle when area is given

Example 1

The area of the shaded part in the figure below is 168cm^2 . Find the perimeter of the square. (Use $\pi = \frac{22}{7}$)



Length of a square

Side = Diameter

$$S = r + r$$

$$S = 2r$$

Value of r

Square – circle = Shaded part

$$(S \times S) - (\pi r^2) = A$$

$$(2r \times 2r) - \left(\frac{22}{7} r^2\right) = 168\text{cm}^2$$

$$4r^2 - \frac{22}{7} r^2 = 168\text{cm}^2$$

$$(7 \times 4r^2) - \left(7 \times \frac{22}{7} r^2\right) = (7 \times 168\text{cm}^2)$$

$$28r^2 - 22r^2 = 1176\text{cm}^2$$

$$\frac{6r^2}{6} = \frac{1176\text{cm}^2}{6}$$

$$\sqrt{r^2} = \sqrt{196\text{cm}^2}$$

$$r = 14\text{cm}$$

Radius is 14cm

Length of each side of the square

$$2r$$

$$2 \times 14\text{cm}$$

$$28\text{cm}$$

Perimeter

$$P = 4s$$

$$P = 4 \times 28\text{cm}$$

$$P = 112\text{cm}$$

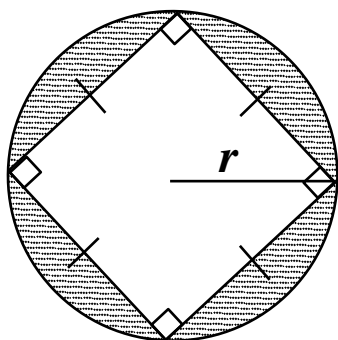
The perimeter is 112cm

TOPIC 10: LENGTH, MASS AND CAPACITY



Example 2

The area of the shaded part in the figure below is 224cm^2 . Find the value of r . (Use $\pi = \frac{22}{7}$)



Length of each diagonal of a square

$$r + r = 2r$$

$$d_1 = d_2 = 2r$$

Value of r

Circle – square = Shaded part

$$(\pi r^2) - \left(\frac{1}{2} \times d_1 \times d_2\right) = A$$

$$\left(\frac{22}{7}r^2\right) - \left(\frac{1}{2} \times 2r \times 2r\right) = 224\text{cm}^2$$

$$\frac{22}{7}r^2 - 2r^2 = 224\text{cm}^2$$

$$\left(7 \times \frac{22}{7}r^2\right) - (7 \times 2r^2) = (7 \times 224\text{cm}^2)$$

$$22r^2 - 14r^2 = 1568\text{cm}^2$$

$$\frac{8r^2}{8} = \frac{1568\text{cm}^2}{8}$$

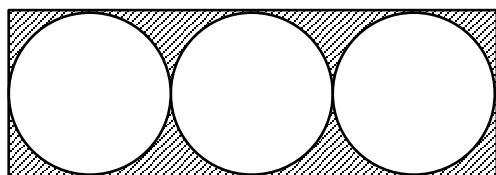
$$\sqrt{r^2} = \sqrt{196\text{cm}^2}$$

$$r = 14\text{cm}$$

Example 3

The area of the shaded part in the figure below is 126cm^2 . Find the length of the rectangle.

(Use $\pi = \frac{22}{7}$)



Length = 3 (diameter)

$$\text{Length} = 3 \times 2r$$

$$\text{Length} = 6r$$

Width = Diameter

$$\text{Width} = 2r$$

Value of r

Rectangle – 3(circle) = Shaded part

$$(L \times W) - 3(\pi r^2) = A$$

$$(6r \times 2r) - \left(3 \times \frac{22}{7}r^2\right) = 126\text{cm}^2$$

$$12r^2 - \frac{66}{7}r^2 = 126\text{cm}^2$$

$$(7 \times 12r^2) - \left(7 \times \frac{66}{7}r^2\right) = (7 \times 126\text{cm}^2)$$

$$84r^2 - 66r^2 = 882\text{cm}^2$$

$$\frac{18r^2}{18} = \frac{882\text{cm}^2}{18}$$

$$\sqrt{r^2} = \sqrt{49\text{cm}^2}$$

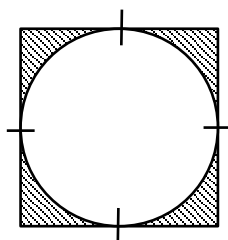
$$r = 7\text{cm}$$

$$\text{Length} = 6 \times 7\text{cm}$$

$$\text{Length} = 42\text{cm}$$

Exercise

1. The area of the shaded part in the figure below is 42cm^2 .



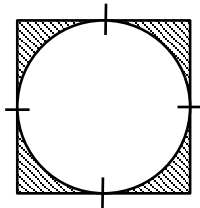
a) Find the radius of the circle. (Use $\pi = \frac{22}{7}$)

b) Calculate the area of the square.

TOPIC 10: LENGTH, MASS AND CAPACITY



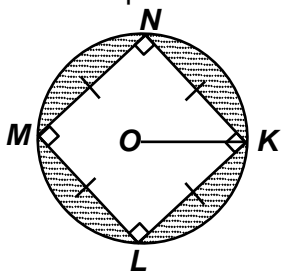
2. Below is a circle enclosed in a square. The area of the shaded part is 378cm^2 .



a) Find the area of the circle. (Use $\pi = \frac{22}{7}$)

b) Calculate the total distance around the square.

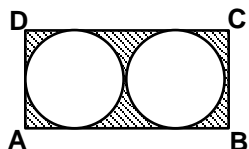
3. In the figure below, $KLMN$ is a square enclosed in a circle with center O . The area of the shaded part is 56cm^2 .



a) Find length OK . (Use $\pi = \frac{22}{7}$)

b) Calculate the area of square $KLMN$.

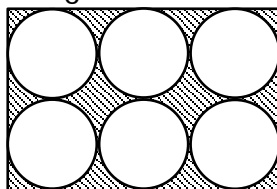
4. Two circular cards were cut from a rectangular paper as shown below. The area of the remaining paper is 84cm^2 .



a) Find length AB . (Use $\pi = \frac{22}{7}$)

b) Calculate the area of each circle.

5. Circular carpets are laid on a rectangular floor as shown in the drawing below. Given that the area of the ground not covered by the carpet is 63m^2 .

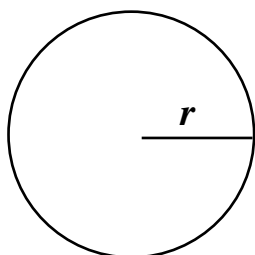


Find the length of the floor in metres. (Use $\pi = \frac{22}{7}$)

Finding circumference of a circle when area is given.

Example

The area of a circle is 9856cm^2 . Calculate its circumference. (Use $\pi = \frac{22}{7}$)



$$\begin{aligned}\pi r^2 &= A \\ \frac{22}{7} \times r^2 &= 9856\text{cm}^2 \\ 7 \times \frac{22}{7} r^2 &= 9856\text{cm}^2 \times 7 \\ \frac{22r^2}{22} &= \frac{9856\text{cm}^2 \times 7}{22} \\ r^2 &= 448\text{cm}^2 \times 7 \\ r^2 &= 3136\text{cm}^2 \\ \sqrt{r^2} &= \sqrt{3136\text{cm}^2} \\ r &= 56\text{cm}\end{aligned}$$

$$\begin{aligned}\text{Circumference} \\ C &= 2\pi r \\ C &= 2 \times \frac{22}{7} \times 56\text{cm} \\ C &= 2 \times 22 \times 8\text{cm} \\ C &= 352\text{cm}\end{aligned}$$



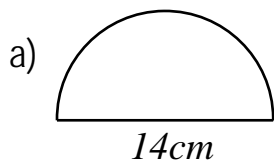
Exercise

- Find the circumference of a circle whose area is; (Use $\pi = \frac{22}{7}$)
 - 154cm²
 - 1386cm²
 - 616cm²
 - 3850cm²
 - 15400cm²
 - 5544cm²
 - $38\frac{1}{2}$ cm²
 - $9\frac{5}{8}$ cm²
 - 1.54cm²
 - 6.16cm²
 - 13.86cm²
 - 38.5cm²
- The area of a circular fish pond is 154m². Calculate its circumference.
- The area of a circular garden is 38.5m².
 - Find the diameter of the garden.
 - Calculate its circumference.
- A flower garden of area 616m² was fenced using poles placed at intervals of 80cm.
 - Find the number of poles used. (Use $\pi = \frac{22}{7}$)
 - If each pole cost sh. 3000. Find the amount of money spent on the poles.

Finding area of different sectors of a circle

Example 1

Find the area of the figures below.

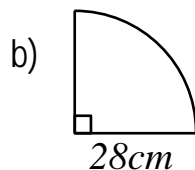


$$A = \frac{1}{2} \pi r^2$$

$$A = \frac{1}{2} \times \frac{22}{7} \times \frac{14\text{cm}}{2} \times \frac{14\text{cm}}{2}$$

$$A = 11 \times 1\text{cm} \times 7\text{cm}$$

$$A = 77\text{cm}^2$$

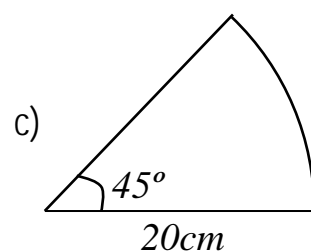


$$A = \frac{1}{4} \pi r^2$$

$$A = \frac{1}{4} \times \frac{22}{7} \times 28\text{cm} \times 28\text{cm}$$

$$A = 22 \times 1\text{cm} \times 28\text{cm}$$

$$A = 616\text{cm}^2$$



$$A = \frac{45}{360} \pi r^2$$

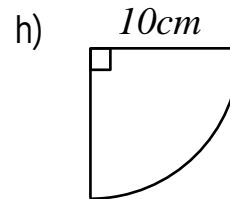
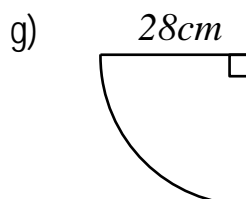
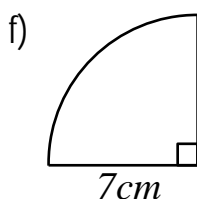
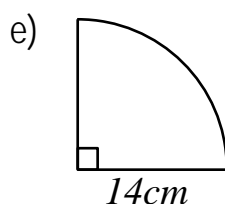
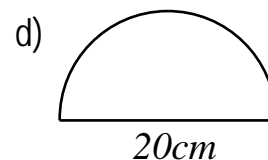
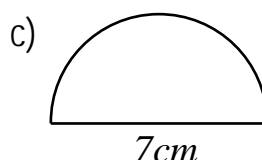
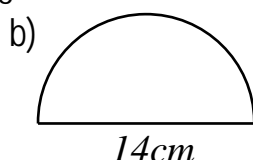
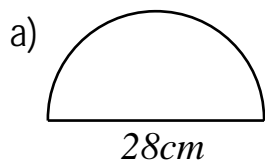
$$A = \frac{1}{8} \times 3.14 \times 20\text{cm} \times 20\text{cm}$$

$$A = \frac{1}{8} \times \frac{314}{100} \times 20\text{cm} \times 20\text{cm}$$

$$A = 157\text{cm}^2$$

Exercise

- Find the area of the figures below.

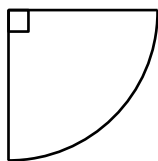


TOPIC 10: LENGTH, MASS AND CAPACITY

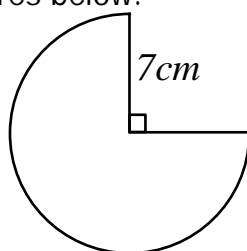


2. Find the area of the figures below.

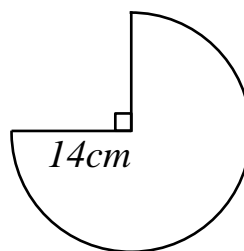
a) 20cm



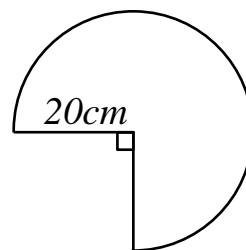
b) 7cm



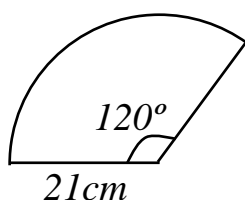
c)



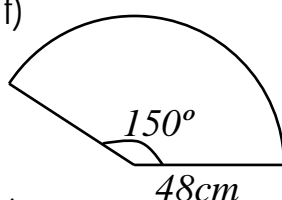
d)



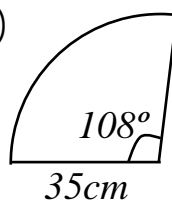
e)



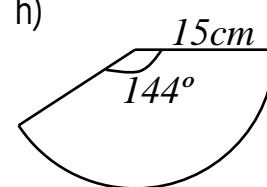
f)



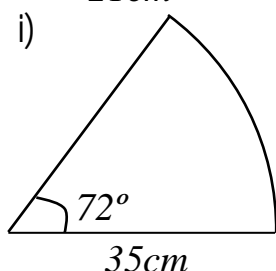
g)



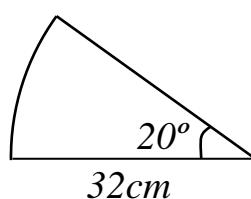
h)



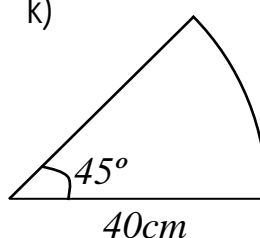
i)



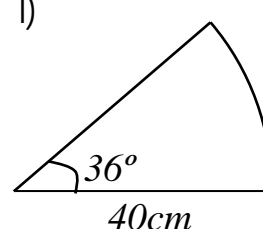
j)



k)



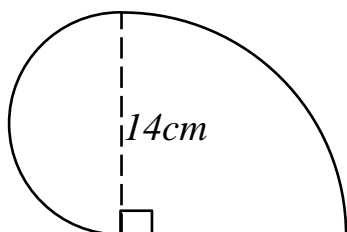
l)



Finding area of combined shapes .

Example 1

Find the area of the figure below.



Radius of a semicircle

$$\text{Radius} = 14\text{cm} \div 2 \\ = 7\text{cm}$$

Area of a semicircle

$$A = \frac{1}{2} \pi r^2$$

$$A = \frac{1}{2} \times \frac{22}{7} \times 7\text{cm} \times 7\text{cm}$$

$$A = 11 \times 7\text{cm} \times 7\text{cm}$$

$$A = 77\text{cm}^2$$

Area of a quadrant

$$A = \frac{1}{4} \pi r^2$$

$$A = \frac{1}{4} \times \frac{22}{7} \times 14\text{cm} \times 14\text{cm}$$

$$A = 11 \times 14\text{cm} \times 14\text{cm}$$

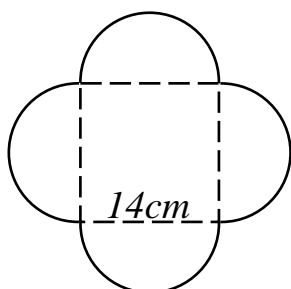
$$A = 154\text{cm}^2$$

Area of the whole figure

$$154\text{cm}^2 + 77\text{cm}^2 = 231\text{cm}^2$$

Example 2

Find the area of the figure below.



Area of 4 semicircles

$$A = \frac{1}{2} \pi r^2 \times 4$$

$$A = \frac{1}{2} \times \frac{22}{7} \times \frac{14\text{cm}}{2} \times \frac{14\text{cm}}{2} \times 4$$

$$A = 11 \times 7\text{cm} \times 7\text{cm} \times 4$$

$$A = 308\text{cm}^2$$

Area of the square

$$A = S \times S$$

$$A = 14\text{cm} \times 14\text{cm}$$

$$A = 196\text{cm}^2$$

Area of the whole figure

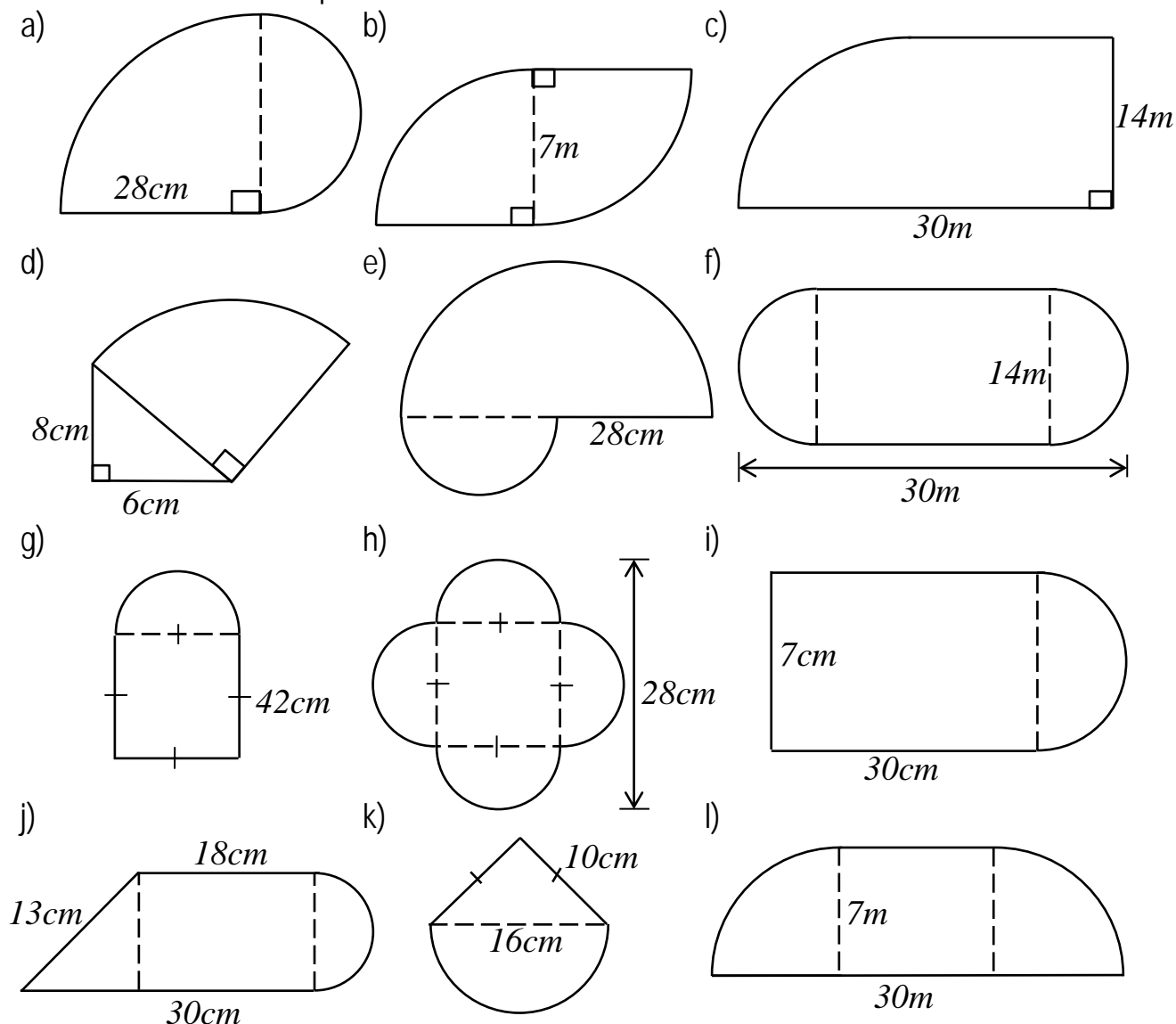
$$308\text{cm}^2 + 196\text{cm}^2 = 504\text{cm}^2$$

TOPIC 10: LENGTH, MASS AND CAPACITY



Exercise

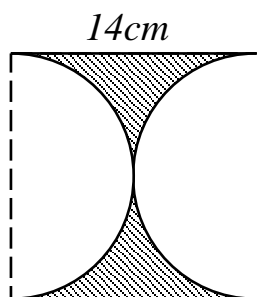
Find the area of the shapes below.



Finding area of the shaded part

Example 1

Find the area of the shaded part.



Area of 2 semicircles

$$\text{Radius} = 14\text{cm} \div 2 = 7\text{cm}$$

$$A = \frac{1}{2} \pi r^2 \times 2$$

$$A = \frac{1}{2} \times \frac{22}{7} \times 7\text{cm} \times 7\text{cm} \times 2$$

$$A = 11 \times 1\text{cm} \times 7\text{cm} \times 2$$

$$A = 154\text{cm}^2$$

Area of the square

$$A = S \times S$$

$$A = 14\text{cm} \times 14\text{cm}$$

$$A = 196\text{cm}^2$$

Area of the shaded part

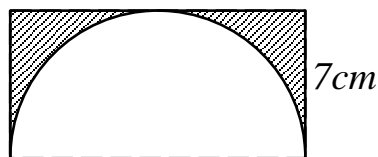
$$196\text{cm}^2 - 154\text{cm}^2 = 42\text{cm}^2$$

TOPIC 10: LENGTH, MASS AND CAPACITY



Example 2

Find the area of the shaded part.



Area of the semicircle

$$A = \frac{1}{2} \pi r^2$$

$$A = \frac{1}{2} \times \frac{22}{7} \times 7\text{cm} \times 7\text{cm}$$

$$A = 11 \times 7\text{cm}$$

$$A = 77\text{cm}^2$$

Area the rectangle

$$\text{Length} = 7\text{cm} \times 2$$

$$= 14\text{cm}$$

$$A = L \times W$$

$$A = 14\text{cm} \times 7\text{cm}$$

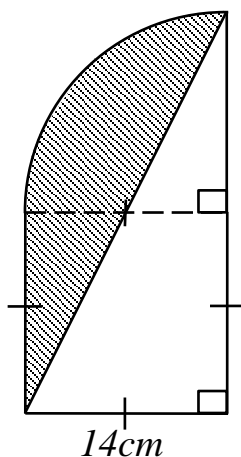
$$A = 98\text{cm}^2$$

Area of the shaded part

$$98\text{cm}^2 - 77\text{cm}^2 = 21\text{cm}^2$$

Example 3

Find the area of the shaded part.



Area of the square

$$A = S \times S$$

$$A = 14\text{cm} \times 14\text{cm}$$

$$A = 196\text{cm}^2$$

Area of a quadrant

$$A = \frac{1}{4} \pi r^2$$

$$A = \frac{1}{4} \times \frac{22}{7} \times 14\text{cm} \times 14\text{cm}$$

$$A = 11 \times 14\text{cm}$$

$$A = 154\text{cm}^2$$

Area of the triangle

$$\text{Height} = 14\text{cm} + 14\text{cm}$$

$$= 28\text{cm}$$

$$A = \frac{1}{2} \times b \times h$$

$$A = \frac{1}{2} \times 14\text{cm} \times 28\text{cm}$$

$$A = 196\text{cm}^2$$

Area of the shaded part

(Square + Quadrant) – triangle

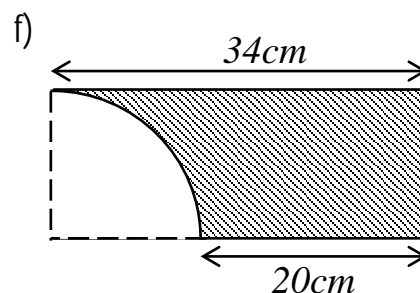
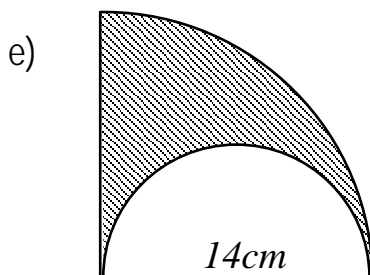
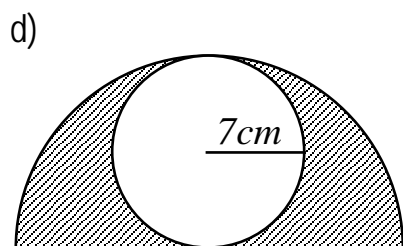
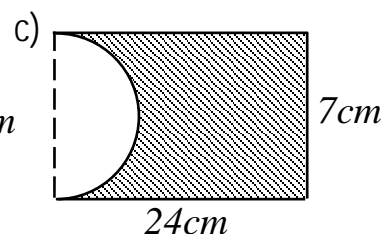
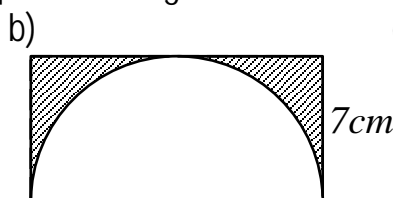
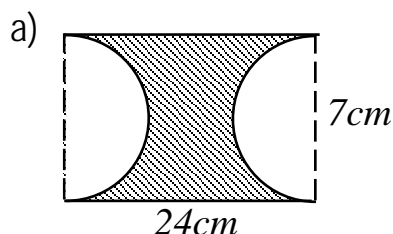
$$(196\text{cm}^2 + 154\text{cm}^2) - 196\text{cm}^2$$

$$350\text{cm}^2 - 196\text{cm}^2$$

$$154\text{cm}^2$$

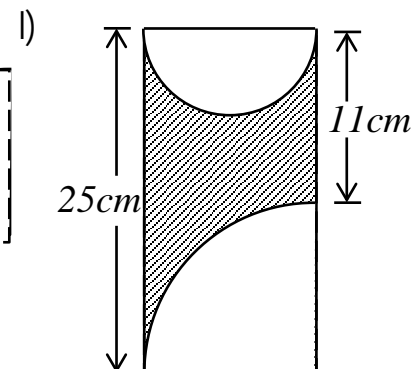
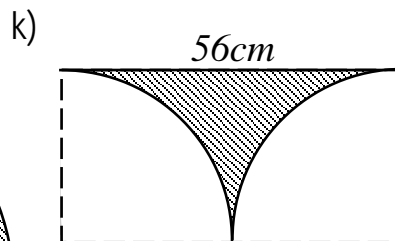
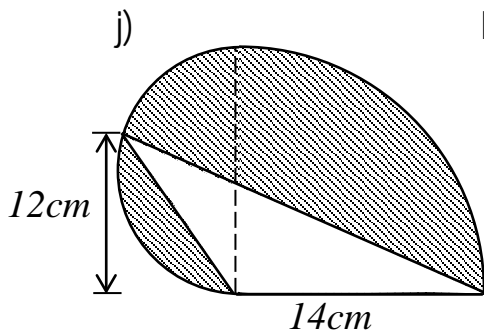
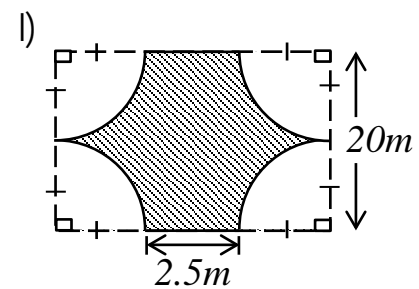
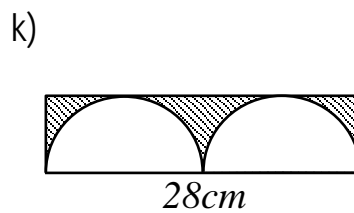
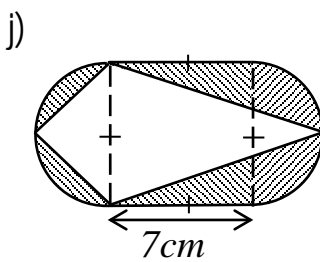
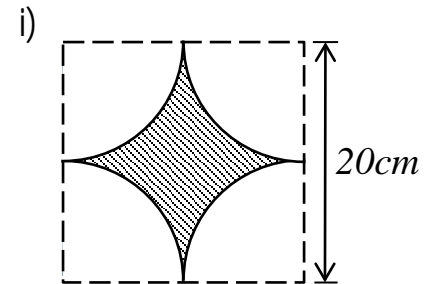
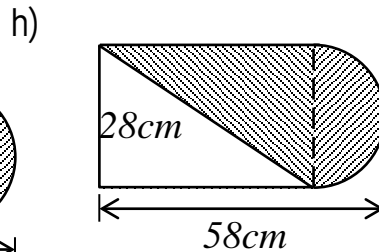
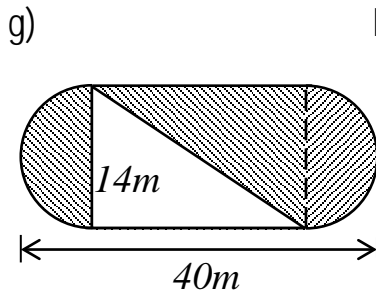
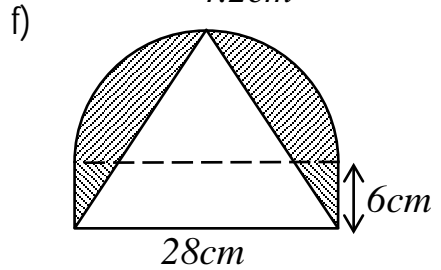
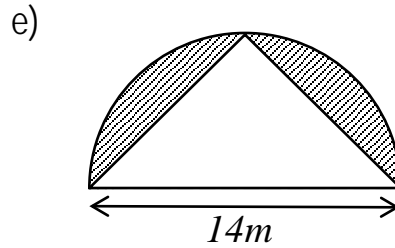
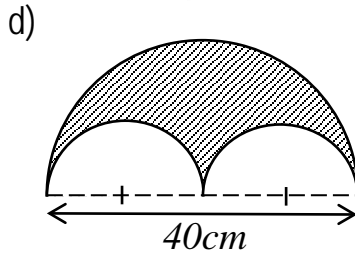
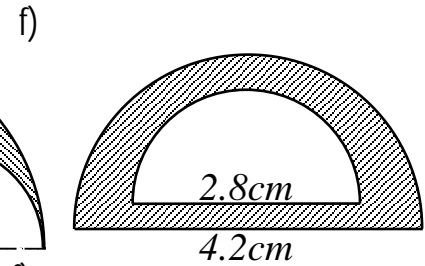
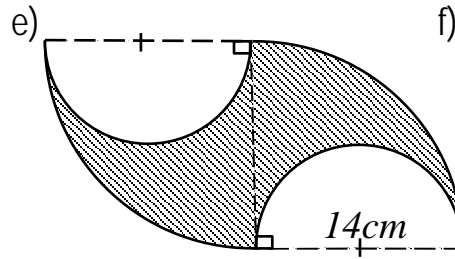
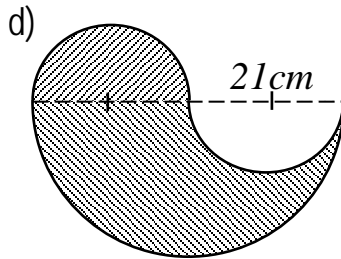
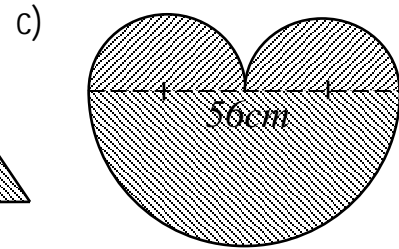
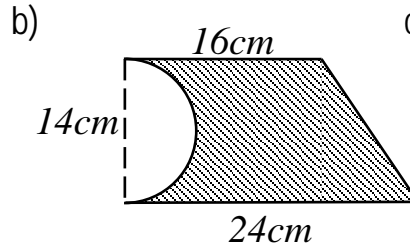
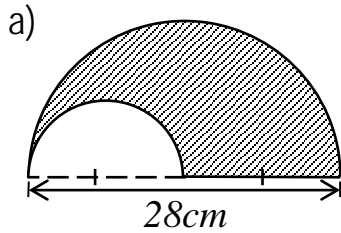
Exercise

1. Find the area of the shaded part in the figures below.





2. Calculate the area of the shaded part.



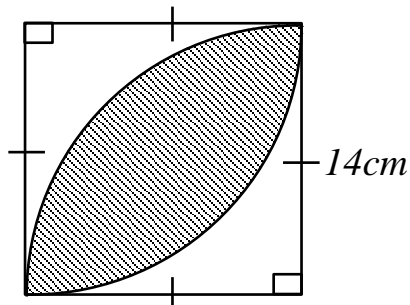
TOPIC 10: LENGTH, MASS AND CAPACITY



More problems involving find area of the shaded part

Example

Calculate the area of the shaded part.



Area of 2 quadrants

$$A = \frac{1}{4} \pi r^2 \times 2$$

$$A = \frac{1}{4} \times \frac{22}{7} \times 14\text{cm} \times 14\text{cm} \times 2$$

$$A = 11 \times 14\text{cm} \times 2$$

$$A = 308\text{cm}^2$$

Area of the square

$$A = S \times S$$

$$A = 14\text{cm} \times 14\text{cm}$$

$$A = 196\text{cm}^2$$

Area of the shaded part

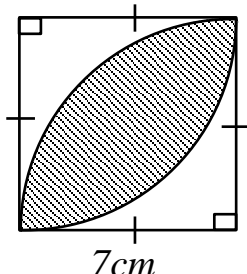
$$308\text{cm}^2 - 196\text{cm}^2$$

$$112\text{cm}^2$$

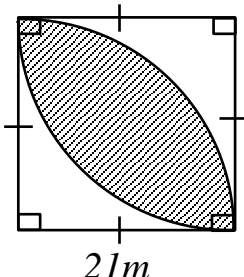
Exercise

1. Find the area of the shaded part.

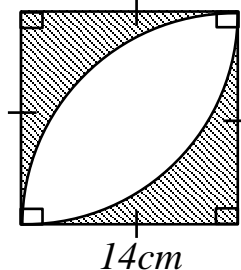
a)



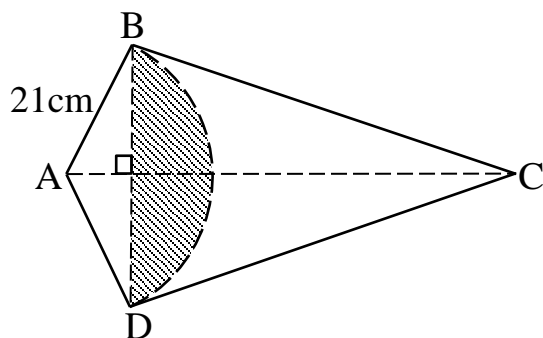
b)



c)



2. In the figures below ABCD is a kite where diagonals $AC = 30\text{cm}$ and $BD = 24\text{cm}$. Angle $BAD = 120^\circ$. Study it carefully and use it to answer questions that follow.

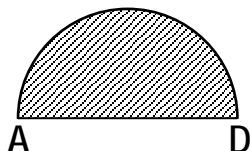


a) Find the area of kite ABCD.

b) Calculate the area of the shaded part.
(Use $\pi = \frac{22}{7}$)

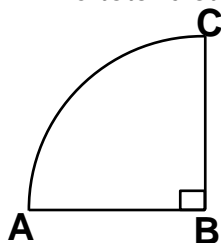
Group activity

1. The perimeter of the figure below is 162cm.



- a) Find the length of arc AD. (Use $\pi = \frac{22}{7}$)
b) Calculate the area of the figure.

2. The total distance around the figure below is 50cm.



- a) Find length AB. (Use $\pi = \frac{22}{7}$)
b) Find the area of the figure.

TOPIC 10: LENGTH, MASS AND CAPACITY

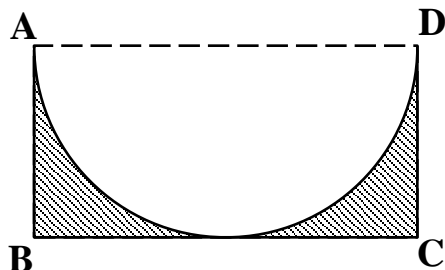


Finding radius of a sector when the area of the shaded part is given.

Example

The area of the shaded part in the figure below is 21cm^2 .

- a) Find length BC. (Use $\pi = \frac{22}{7}$)



Width = r

Length = $2r$

Value of r

Rectangle – Semicircle = Shaded part

$$(L \times W) - \left(\frac{1}{2} \pi r^2\right) = A$$

$$(2r \times r) - \left(\frac{1}{2} \times \frac{22}{7} r^2\right) = 21\text{cm}^2$$

$$2r^2 - \frac{11}{7} r^2 = 21\text{cm}^2$$

$$(7 \times 2r^2) - (7 \times \frac{11}{7} r^2) = (7 \times 21\text{cm}^2)$$

$$14r^2 - 11r^2 = 147\text{cm}^2$$

$$\frac{3r^2}{3} = \frac{147\text{cm}^2}{3}$$

$$\sqrt{r^2} = \sqrt{49\text{cm}^2}$$

$$r = 7\text{cm}$$

Length BC = $2 \times 7\text{cm}$

Length BC = 14cm

- b) Calculate the area of the rectangle

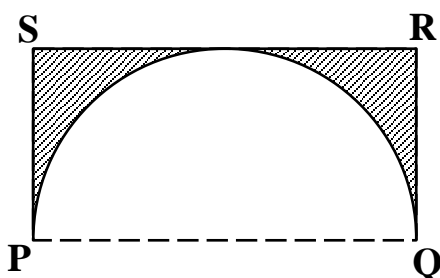
$$A = L \times W$$

$$A = 14\text{cm} \times 7\text{cm}$$

$$A = 98\text{cm}^2$$

Exercise

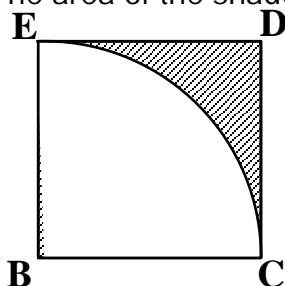
1. The area of the shaded part in the figure below is 84cm^2 .



- a) Find length QR. (Use $\pi = \frac{22}{7}$)

- b) Calculate the area of the
i) rectangle
ii) un shaded part.

2. The area of the shaded part in the figure below is 42cm^2 .



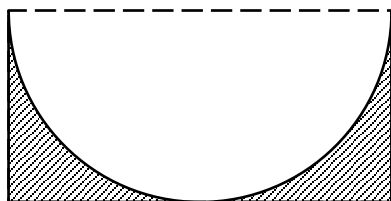
- a) Find length CD (Use $\pi = \frac{22}{7}$)

- b) Calculate the length arc EC

TOPIC 10: LENGTH, MASS AND CAPACITY

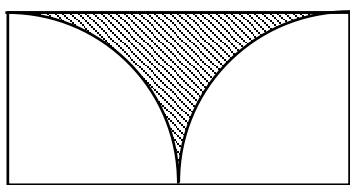


3. The figure below shows Mr. Dungu's flower garden whose area is 21m^2 . Study it carefully and use it to answer the questions that follow.



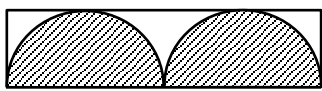
Calculate the total distance around Mr. Dungu's flower garden. (Use $\pi = \frac{22}{7}$)

4. The area of the shaded part in the figure below is 21cm^2 .



- Find the length of the rectangle. (Use $\pi = \frac{22}{7}$)
- Calculate the area of the rectangle.

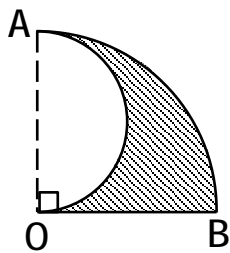
5. The area of the un shaded part in the figure below is 42cm^2 .



Find the area of the shaded part. (Use $\pi = \frac{22}{7}$)

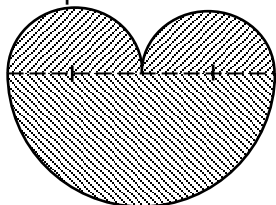
Group activity

1. The total distance around the figure below is 116cm .



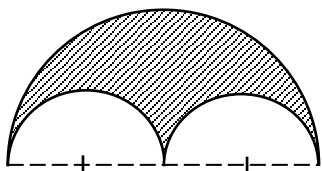
- Find length AB. (Use $\pi = \frac{22}{7}$)
- Calculate the area of the shaded part.

2. The perimeter of the figure below is 88cm .



Find the area of the figure above. (Use $\pi = \frac{22}{7}$)

3. Study the figure and use it to answer questions that follow.



- If the perimeter of the figure is 44cm , find the diameter of the biggest semicircle. (Use $\pi = \frac{22}{7}$)
- Find the area of the shaded part.

TOPIC 10: LENGTH, MASS AND CAPACITY

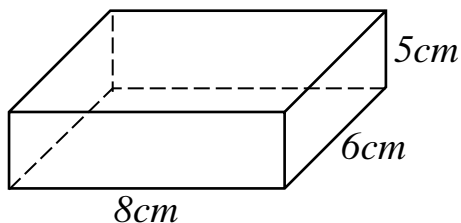


SURFACE AREA OF PRISMS

Finding total surface area of a cuboid

Example 1.

Finding total surface area of the box below.



$$TSA = 2lw + 2lh + 2wh$$

$$TSA = (2 \times 8\text{cm} \times 6\text{cm}) + (2 \times 8\text{cm} \times 5\text{cm}) + (2 \times 6\text{cm} \times 5\text{cm})$$

$$TSA = 96\text{cm}^2 + 80\text{cm}^2 + 60\text{cm}^2$$

$$TSA = 236\text{cm}^2$$

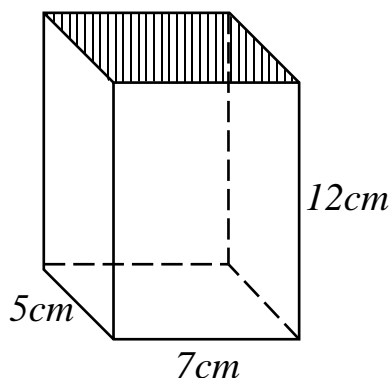
General formula

Total surface area equals

$$(2 \times \text{Base area}) + (\text{Perimeter} \times \text{height})$$

Example 2

Below is an open rectangular box. Find its total surface area.



$$TSA = lw + 2lh + 2wh$$

$$TSA = (7\text{cm} \times 5\text{cm}) + (2 \times 7\text{cm} \times 12\text{cm}) + (2 \times 5\text{cm} \times 12\text{cm})$$

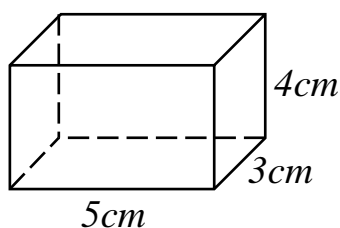
$$TSA = 35\text{cm}^2 + 168\text{cm}^2 + 120\text{cm}^2$$

$$TSA = 323\text{cm}^2$$

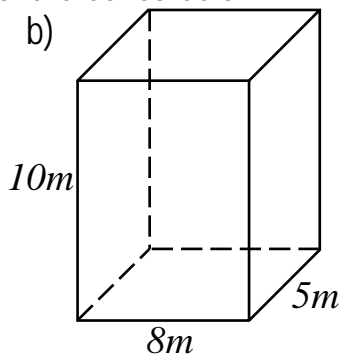
Exercise

1. Find the total surface area of the boxes below.

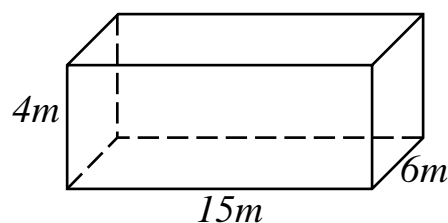
a)



b)

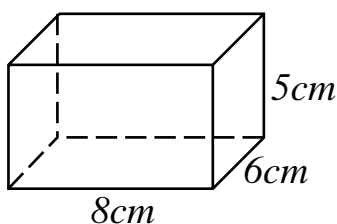


c)

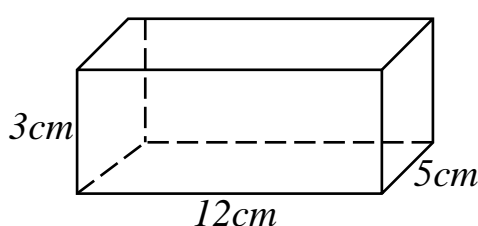


2. Each of the boxes in the figures below has no cover. Find the total surface area of each box.

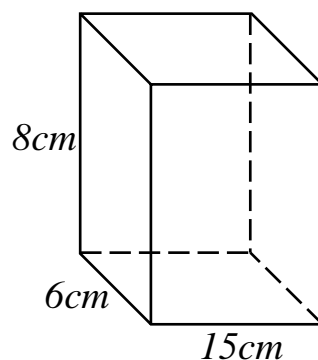
a)



b)



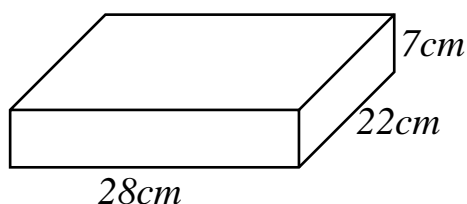
c)



TOPIC 10: LENGTH, MASS AND CAPACITY

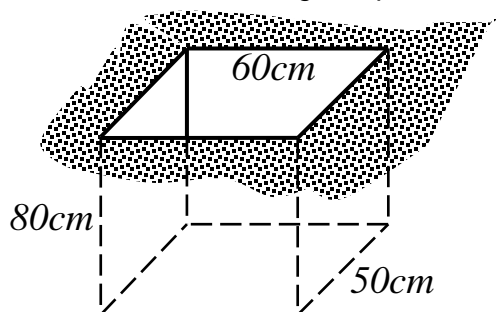


3. A box of books is 30cm by 20cm by 25cm. Find its total surface area.
4. The figure below represents an oxford dictionary.



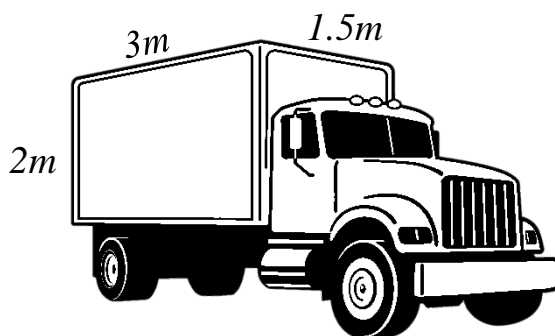
Find its total surface area.

5. Find the area of manila needed to make a rectangular box 15cm by 6cm by 5cm.
6. Calculate the area of the sheet of metal needed to make a rectangular tank 6m by 5m by 8m.
7. Below is a rectangular pit.



- a) Find its base area.
- b) Find the total surface area of its walls.

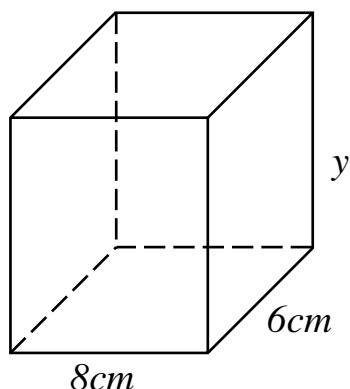
8. Find the surface area of the box body shown in the figure below.



Finding the missing side of a cuboid when total surface area is given .

Example 1

The total surface area of the box below is 236cm^2 . Find the value of y .



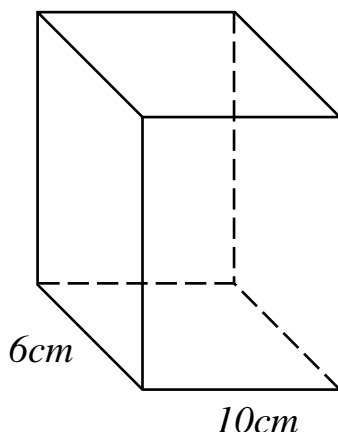
$$\begin{aligned}
 2lw + 2lh + 2wh &= \text{TSA} \\
 (2 \times 8\text{cm} \times 6\text{cm}) + (2 \times 8\text{cm} \times y) + (2 \times 6\text{cm} \times y) &= 236\text{cm}^2 \\
 96\text{cm}^2 + 16y\text{cm} + 12y\text{cm} &= 236\text{cm}^2 \\
 96\text{cm}^2 + 28y\text{cm} &= 236\text{cm}^2 \\
 96\text{cm}^2 - 96\text{cm}^2 + 28y\text{cm} &= 236\text{cm}^2 - 96\text{cm}^2 \\
 \frac{28y\text{cm}}{28\text{cm}} &= \frac{140\text{cm}^2}{28\text{cm}} \\
 y &= 5\text{cm}
 \end{aligned}$$

TOPIC 10: LENGTH, MASS AND CAPACITY



Example 2

Below is an open box. Its total surface area is 444cm^2 . Find its height.

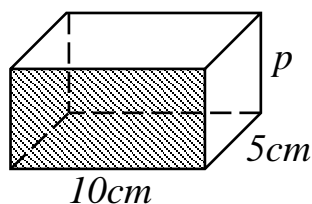


$$\begin{aligned}
 lw + 2lh + 2wh &= \text{TSA} \\
 (10\text{cm} \times 6\text{cm}) + (2 \times 10\text{cm} \times h) + (2 \times 6\text{cm} \times h) &= 444\text{cm}^2 \\
 60\text{cm}^2 + 20h\text{cm} + 12h\text{cm} &= 444\text{cm}^2 \\
 60\text{cm}^2 + 32h\text{cm} &= 444\text{cm}^2 \\
 60\text{cm}^2 - 60\text{cm}^2 + 32h\text{cm} &= 444\text{cm}^2 - 60\text{cm}^2 \\
 \frac{32h\text{cm}}{32\text{cm}} &= \frac{384\text{cm}^2}{32\text{cm}} \\
 h &= 12\text{cm}
 \end{aligned}$$

Height = 12cm

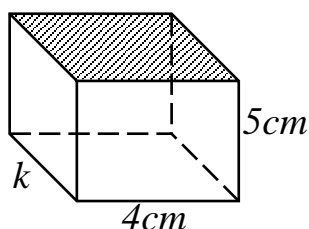
Exercise

1. The total surface area of the figure below is 220cm^2 .



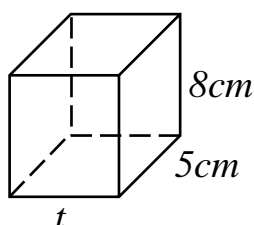
- Find the value of p .
- Calculate the area of the shaded part.

2. The total surface area of the box below is 94cm^2 .



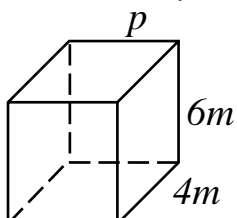
- Find the value of k .
- Calculate the area of the shaded part.

3. The total surface area of the box below is 236cm^2 .



- Find the value of t .
- Calculate the base area of the box.

4. Below is an open rectangular box. The sum of the area of its faces is 128m^2 .

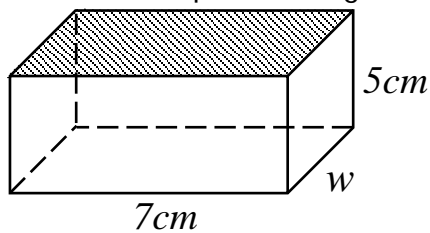


- Find the value of p .
- Calculate the area of the shaded part.

TOPIC 10: LENGTH, MASS AND CAPACITY

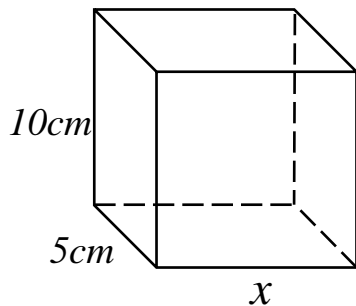


5. Below is an open rectangular container with total surface area 172cm^2 .



- Find the value of w .
- Find its base area.

6. Below is a rectangular tank with no cover. Its total surface area is 250m^2 .

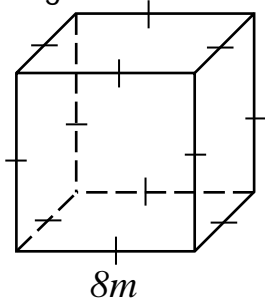


- Find the value of x .
- Calculate the area of a rectangular sheet metal needed to cover the tank.

Finding the total surface area of a cube.

Example 1

Find the total surface area of the figure below.

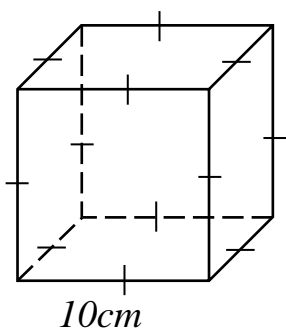


$$\begin{aligned}\text{TSA} &= 6s^2 \\ \text{TSA} &= 6 \times 8\text{m} \times 8\text{m} \\ \text{TSA} &= 384\text{m}^2\end{aligned}$$

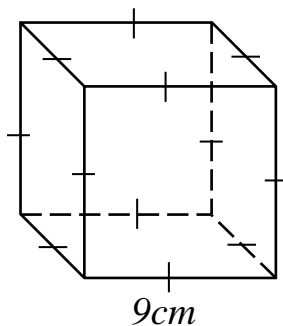
Exercise

1. Calculate the total surface area of the box.

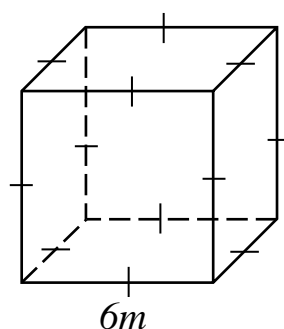
a)



b)

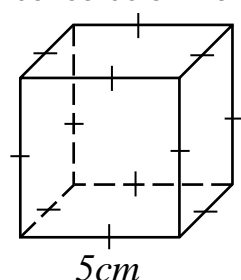


c)

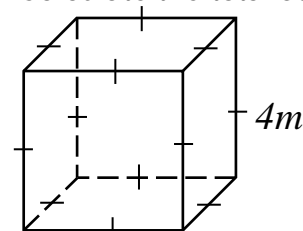


2. The boxes below have no cover. Calculate the total surface area of each of the box.

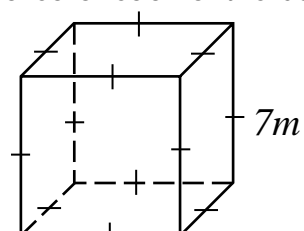
a)



b)



c)

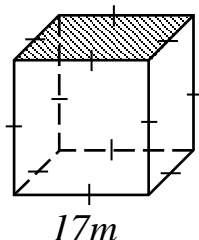


TOPIC 10: LENGTH, MASS AND CAPACITY



3. Find the total surface of a cube whose side is
- | | | |
|---------|---------|---------|
| a) 12cm | c) 15cm | e) 8cm |
| b) 20cm | d) 11cm | f) 23cm |

4. Below is an open cube.

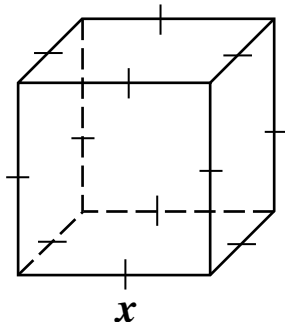


Find the sum of area of its faces.

Finding the side of a cube when total surface area is given

Example

The total surface of a cube is 600cm^2 . Find the length of its side.



$$6s^2 = \text{Total surface area}$$

$$6x^2 = 600\text{cm}^2$$

$$\frac{6x^2}{6} = \frac{600\text{cm}^2}{6}$$

$$x^2 = 100\text{cm}^2$$

$$\sqrt{x^2} = \sqrt{100\text{cm}^2}$$

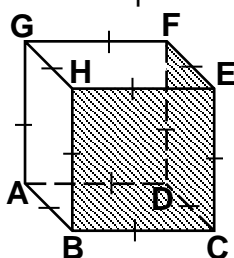
$$x = 10\text{cm}$$

Exercise

- Find the length of each side of a cube whose total surface area is;

a) 150cm^2	f) 1350cm^2	k) 1014cm^2
b) 486cm^2	g) 216cm^2	l) 2904cm^2
c) 384cm^2	h) 2166cm^2	m) 2400cm^2
d) 96cm^2	i) 726cm^2	n) 2646cm^2
e) 1176cm^2	j) 3456cm^2	o) 1734cm^2
- A hard paper was folded to form a cube. The area of the paper is 1944cm^2 . Find the length of each side of the cube formed.
- The total surface area of the cube with no lid is given below. Find the length of each side.

a) 180cm^2	d) 80cm^2	g) 720cm^2
b) 45cm^2	e) 500cm^2	h) 980cm^2
c) 320cm^2	f) 405cm^2	i) 1620cm^2
- Below is a prism. The area of the shaded part is 450m^2 .

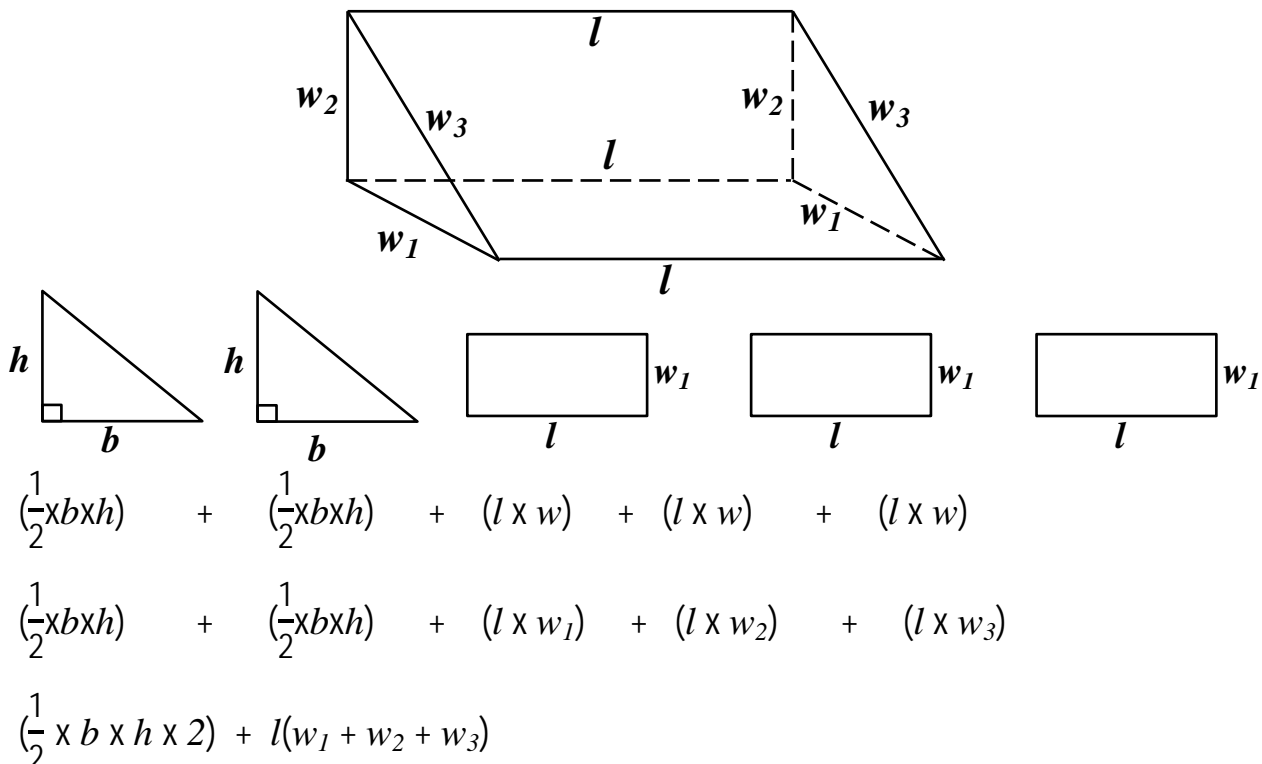


- Find length AB in centimetres.
- Find the sum of the length of all edges of the prism above.

TOPIC 10: LENGTH, MASS AND CAPACITY



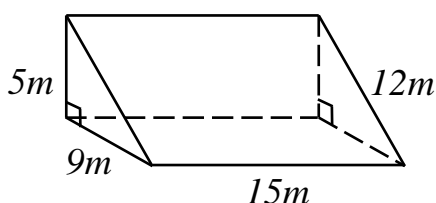
Total surface area of a triangular prism



Therefore, the total surface area of a triangular prism is $\left(\frac{1}{2} \times b \times h \times 2\right) + l(w_1 + w_2 + w_3)$ where w_1 , w_2 and w_3 are the sides of the triangular faces.

Example 1

Find the total surface area of the figure below.



$$\text{TSA} = \left(\frac{1}{2} \times b \times h \times 2\right) + l(w_1 + w_2 + w_3)$$

$$\text{TSA} = \left(\frac{1}{2} \times 9m \times 5m \times 2\right) + 15m(9m + 5m + 12m)$$

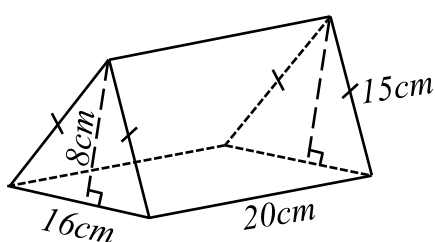
$$\text{TSA} = (9m \times 5m) + 15m(26m)$$

$$\text{TSA} = 45m^2 + 390m^2$$

$$\text{TSA} = 435m^2$$

Example 2

Find the total surface area of the figure below.



$$\text{TSA} = \left(\frac{1}{2} \times b \times h \times 2\right) + l(w_1 + w_2 + w_3)$$

$$\text{TSA} = \left(\frac{1}{2} \times 16cm \times 8cm \times 2\right) + 20cm(16cm + 15cm + 15cm)$$

$$\text{TSA} = (16cm \times 8cm) + 20cm(46cm)$$

$$\text{TSA} = 128cm^2 + 920cm^2$$

$$\text{TSA} = 1048cm^2$$

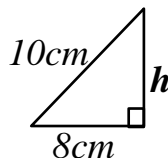
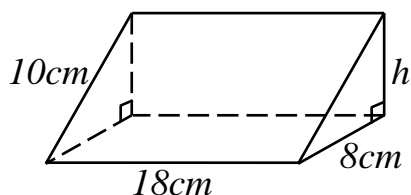
TOPIC 10: LENGTH, MASS AND CAPACITY



Example 3

Find the total surface area of the triangular prism below.

a) Find the value of h .



$$\begin{aligned} a^2 + b^2 &= c^2 \\ (8\text{cm})^2 + h^2 &= (10\text{cm})^2 \\ (8\text{cm} \times 8\text{cm}) + h^2 &= (10\text{cm} \times 10\text{cm}) \\ 64\text{cm}^2 + h^2 &= 100\text{cm}^2 \\ 64\text{cm}^2 - 64\text{cm}^2 + h^2 &= 100\text{cm}^2 - 64\text{cm}^2 \\ \sqrt{h^2} &= \sqrt{36\text{cm}^2} \\ h &= 6\text{cm} \end{aligned}$$

b) Calculate the total surface area of the prism above.

$$\text{TSA} = \left(\frac{1}{2} \times b \times h \times 2\right) + l(w_1 + w_2 + w_3)$$

$$\text{TSA} = \left(\frac{1}{2} \times 8\text{cm} \times 6\text{cm} \times 2\right) + 18\text{cm}(8\text{cm} + 6\text{cm} + 10\text{cm})$$

$$\text{TSA} = (8\text{cm} \times 6\text{cm}) + 18\text{cm}(24\text{cm})$$

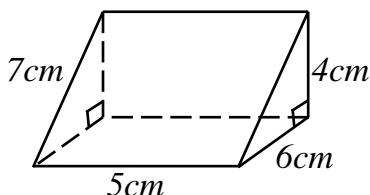
$$\text{TSA} = 48\text{cm}^2 + 432\text{cm}^2$$

$$\text{TSA} = 480\text{cm}^2$$

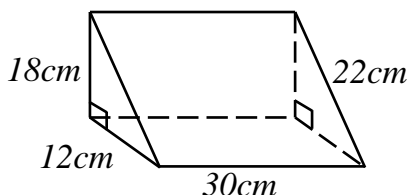
Exercise

1. Find the total surface area of each of the following triangular prisms.

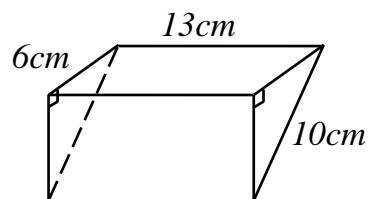
a)



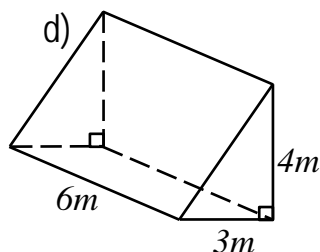
b)



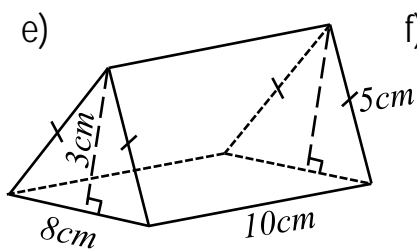
c)



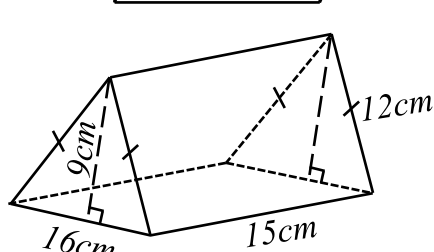
d)



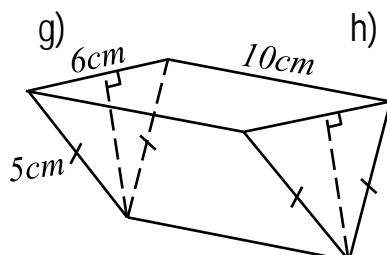
e)



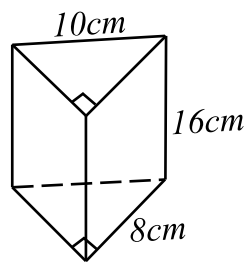
f)



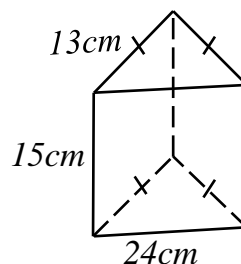
g)



h)



i)

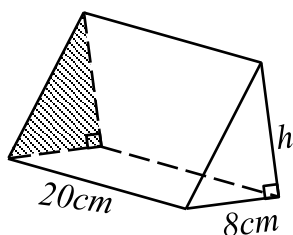


2. Calculate the total surface area of a prism of length 25cm and each of its triangular face with base 24 cm and height 5cm.

TOPIC 10: LENGTH, MASS AND CAPACITY



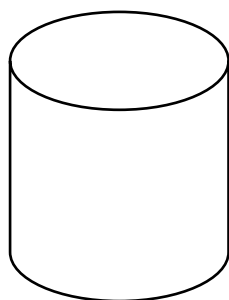
3. The area of the shaded part in the figure below is 24cm^2 .



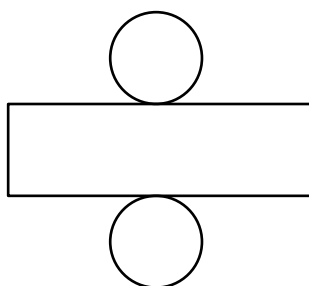
- Find the value of h
- Calculate its total surface area.

Surface area of a cylinder

Cylindrical prism



Net of a cylindrical prism



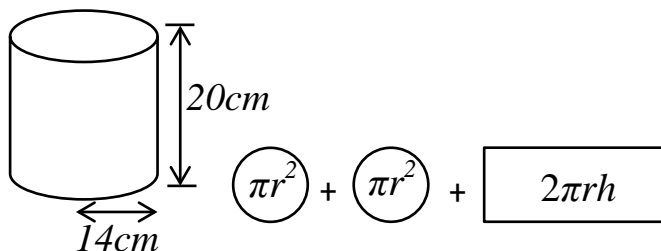
$$\pi r^2 + \pi r^2 + 2\pi r h$$

$$\begin{aligned} \pi r^2 + \pi r^2 + 2\pi r h \\ (\pi r^2 \times 2) + 2\pi r h \\ 2\pi r^2 + 2\pi r h \end{aligned}$$

Therefore, total surface area of a cylinder = $2\pi r^2 + 2\pi r h$

Example 1

Find the total surface area of a cylinder whose radius is 14cm and height 20cm.



$$\text{TSA} = 2\pi r^2 + 2\pi r h$$

$$\text{TSA} = (2 \times \frac{22}{7} \times 14\text{cm} \times 14\text{cm}) + (2 \times \frac{22}{7} \times 14\text{cm} \times 20\text{cm})$$

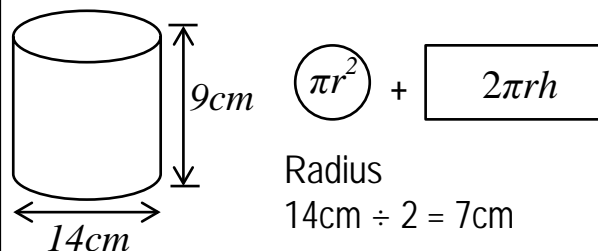
$$\text{TSA} = (2 \times 22 \times 2\text{cm} \times 14\text{cm}) + (2 \times 22 \times 2\text{cm} \times 20\text{cm})$$

$$\text{TSA} = 1232\text{cm}^2 + 1760\text{cm}^2$$

$$\text{TSA} = 2992\text{cm}^2$$

Example 2

Find the total surface area of an open cylinder whose diameter is 14cm and height 9cm.



$$\pi r^2 + 2\pi r h$$

$$\begin{aligned} \text{Radius} \\ 14\text{cm} \div 2 = 7\text{cm} \end{aligned}$$

$$\text{TSA} = \pi r^2 + 2\pi r h$$

$$\text{TSA} = (\frac{22}{7} \times 7\text{cm} \times 7\text{cm}) + (2 \times \frac{22}{7} \times 7\text{cm} \times 9\text{cm})$$

$$\text{TSA} = (22 \times 1\text{cm} \times 7\text{cm}) + (2 \times 22 \times 1\text{cm} \times 9\text{cm})$$

$$\text{TSA} = 154\text{cm}^2 + 396\text{cm}^2$$

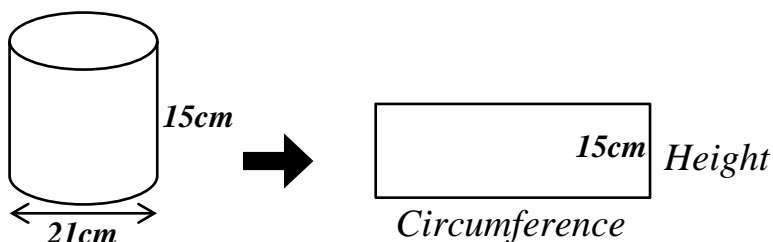
$$\text{TSA} = 550\text{cm}^2$$

TOPIC 10: LENGTH, MASS AND CAPACITY



Example 3

Find the area of the curved surface of a cylinder whose diameter is 21cm and height 15cm.



Area = Circumference \times height

$$\text{Area} = \pi d \times h$$

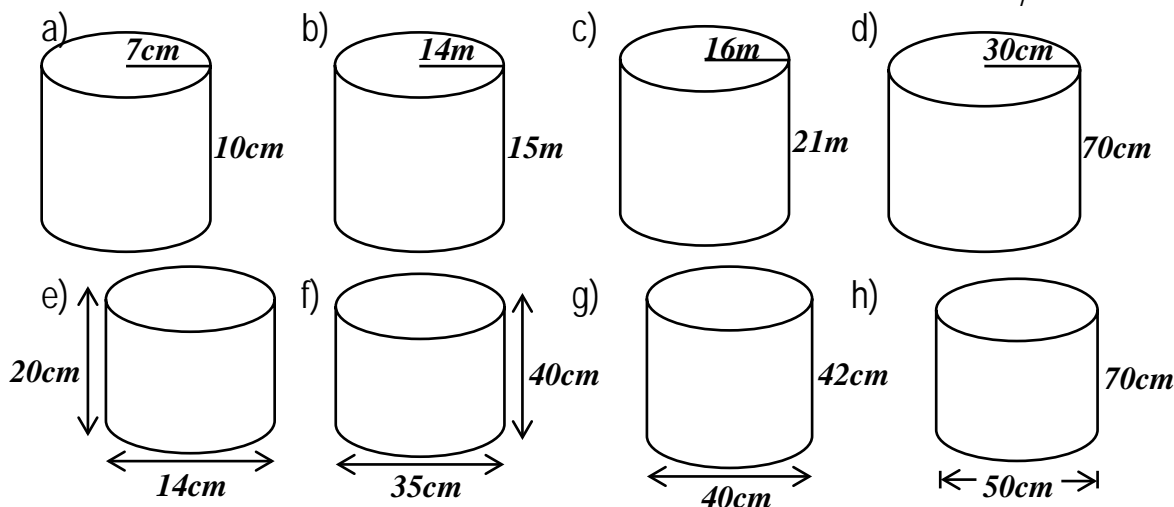
$$\text{Area} = \frac{22}{7} \times 21\text{cm} \times 15\text{cm}$$

$$\text{Area} = 22 \times 3\text{cm} \times 15\text{cm}$$

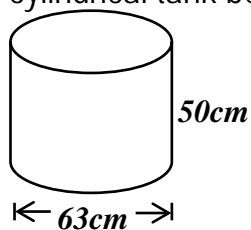
$$\text{Area} = 990\text{cm}^2$$

Exercise

1. Find the total surface area of each of the cylinders below. (Take $\pi = \frac{22}{7}$)



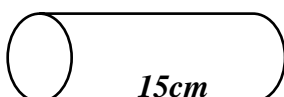
- A cylindrical tank is 8 metres high with radius $3\frac{1}{2}$ metres. Find its total surface area.
- Calculate the total surface area of an open cylindrical tin with radius 7cm and height 16cm.
- A basin has a radius of $24\frac{1}{2}$ cm and height 30cm. Find its total surface area.
- Find the area of the curved surface of a cylinder whose diameter is 25cm and height 28cm.
- The rectangular sheet of metal was folded to form a cylindrical tin of radius 7m and height 30cm. Find the area of the rectangular sheet of metal.
- The cylindrical tank below was cut open to form a rectangular door.



a) Find the length of the door formed.

b) Calculate the area of the rectangular door formed.

- A cylindrical tin of radius 14cm and height 18cm was cut open to form a rectangular sheet. Find the area of the rectangular sheet formed.
- The area surface of the curved surface of the cylinder below is 660cm^2 . Find its radius.



TOPIC 10: LENGTH, MASS AND CAPACITY



VOLUME

$$\text{Volume} = \text{Base area} \times \text{height}$$

Example 1

The base area of a tank is 125cm^2 . Its height is 80cm . Find the volume of the tank.

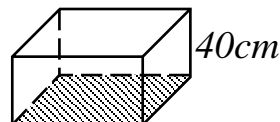
$$\text{Volume} = \text{Base area} \times \text{Height}$$

$$\text{Volume} = 125\text{cm}^2 \times 80\text{cm}$$

$$\text{Volume} = 10000\text{cm}^3$$

Example 2

The area of the shaded part in the figure below is 450cm^2 . Find its volume.



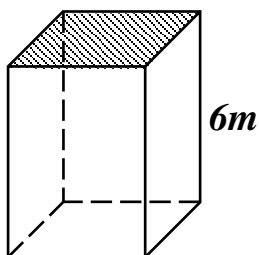
$$\text{Volume} = \text{Base area} \times \text{Height}$$

$$\text{Volume} = 450\text{cm}^2 \times 40\text{cm}$$

$$\text{Volume} = 18000\text{cm}^3$$

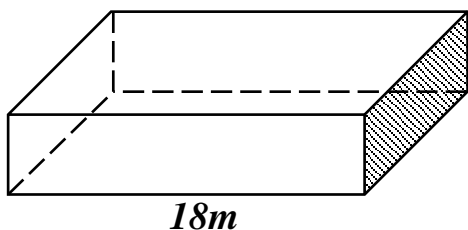
Exercise

- Find the volume of a container whose base area is 74cm^2 and height 10cm .
- The base area of a box is 120cm^2 . Find its volume if its height is 5cm .
- The base area and height of a cup is 154cm^2 and 8cm respectively. Find its volume.
- The area of the shaded part in the figure below is 80m^2 .



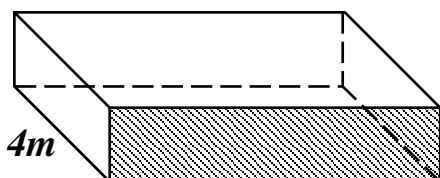
Calculate the volume of the figure.

- In the figure below, the area of the shaded part is 125cm^2 .



Find its volume.

- Below is a rectangular tank 4 metres wide. The area of the shaded parts is 39m^2 .



Calculate the volume of the tank.

- The base area of a tank is 54m^2 . If its height is 5 metres, find its volume in square centimetres
- The base area of an empty cup is 150cm^2 . Its height is 12cm . Find the volume of water needed to fill the cup.

TOPIC 10: LENGTH, MASS AND CAPACITY



Finding height or base area when volume is given.

Example 1

The volume of a cuboid is 120cm^3 .
Its base area is 30cm^2 . Find its height.

Method 1

$$\text{Height} = \frac{\text{Volume}}{\text{Base area}}$$

$$\text{Height} = \frac{120\text{cm}^3}{30\text{cm}^2}$$

$$\text{Height} = \frac{120 \times \text{cm} \times \text{cm} \times \text{cm}}{30 \times \text{cm} \times \text{cm}}$$

$$\text{Height} = 4\text{cm}$$

Method 2

$$\text{Base area} \times \text{height} = \text{Volume}$$

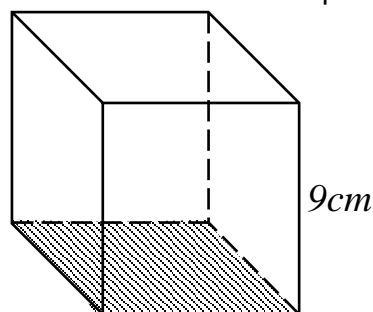
$$b \times 30\text{cm} = 120\text{cm}^3$$

$$\frac{b \times 30\text{cm}}{30\text{cm}} = \frac{120 \times \text{cm} \times \text{cm} \times \text{cm}}{30\text{cm}}$$

$$b = 4\text{cm}$$

Example 2

The volume of the figure below is 882cm^3 .
Find the area of the shaded part.



$$\text{Base area} = \frac{\text{Volume}}{\text{Base area}}$$

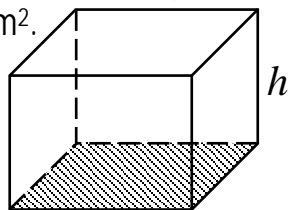
$$\text{Base area} = \frac{882\text{cm}^3}{9\text{cm}}$$

$$\text{Base area} = \frac{882 \times \text{cm} \times \text{cm} \times \text{cm}}{9 \times \text{cm}}$$

$$\text{Base area} = 98\text{cm}^2$$

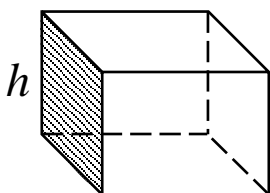
Exercise

- Find the height of the tank whose base area is 42cm^2 and volume 210cm^3 .
- The volume of a cup is 770cm^3 . Its base area is 154cm^2 . Find its height.
- Below is a rectangular tank whose volume is 504m^3 . The area of the shaded part is 63m^2 .



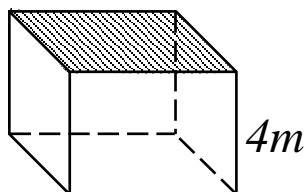
Find the value of h.

- In the figure, the area of the shaded part is 84cm^2 .



Find the value of k if the volume of the figure is 756cm^3 .

- The volume of a tank is 180m^3 . Its height is 4m . Calculate its base area.
- Find the base area of a tank whose volume is 1000m^3 and height 8m .
- The volume of the rectangular tank below is 140m^3 .



Find the area of the shaded part.

TOPIC 10: LENGTH, MASS AND CAPACITY



8. A welder was given a metal sheet shown in the figure below. He welded it into a hollow cylinder making a height of 50cm and volume 15400cm^3 .



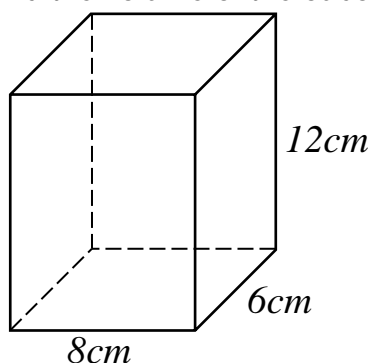
Find the surface area of the sheet of metal needed to cover the bottom of the cylinder.

Volume of rectangular prisms (cuboid)

$$\text{Volume of a cuboid} = \text{Length} \times \text{Width} \times \text{Height}$$

Example

Find the volume of the cuboid below.

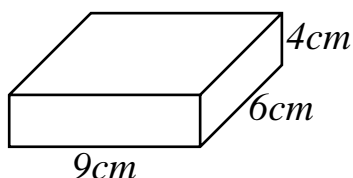


$$\begin{aligned} \text{Volume} &= \text{Base area} \times \text{height} \\ \text{Volume} &= (\text{Length} \times \text{Width}) \times \text{Height} \\ \text{Volume} &= 8\text{cm} \times 6\text{cm} \times 12\text{cm} \\ \text{volume} &= 576\text{cm}^3 \end{aligned}$$

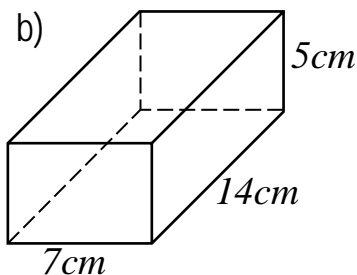
Exercise

1. Find the volume of the following figures.

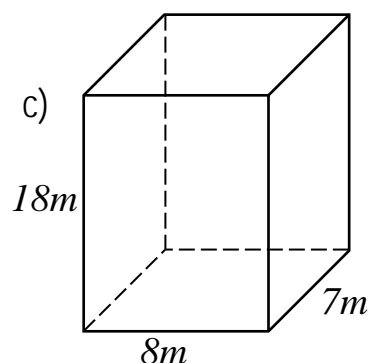
a)



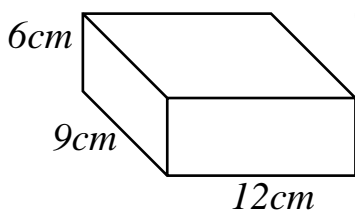
b)



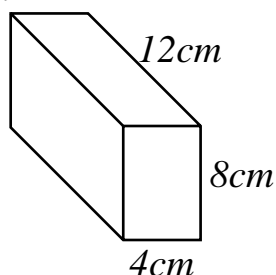
c)



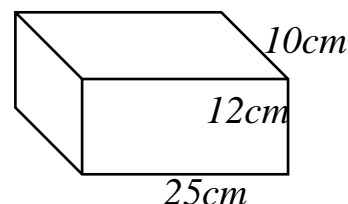
d)



e)



f)

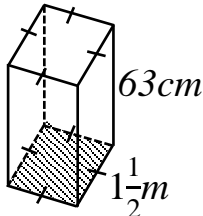


2. Find the volume of a rectangular tank 8m by 5m by 7m.
3. Calculate the volume of a box 65 cm long, 40 cm wide and 50 cm high.
4. A truck carries 1000 bricks per trip. Each brick is 20cm by 8cm by 9cm.
 - a) Find the volume of each brick.
 - b) Find in cubic metres, the volume of bricks carried by the truck in one trip.

TOPIC 10: LENGTH, MASS AND CAPACITY



- Nathan brought a smart phone packed in a box measuring 20cm by 7cm by 5cm. Find the volume of the box.
- Cylindrical tins are packed in a box measuring 80cm by 63 cm by 48cm. Find the volume of the box.
- Study the figure below.



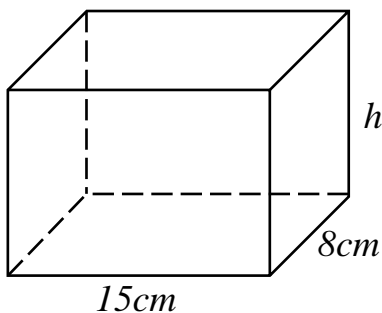
- Find the area of the shaded part in square centimetres.
- Calculate the volume of the figure above.

- A right tank of height $2\frac{1}{2}$ metres has a square base of 120cm. Calculate its volume.

Finding the missing side of a rectangular prism.

Example

The volume of the rectangular prism below is 420cm^3 . Find its height.



Base area \times height = Volume

$$l \times w \times h = 420\text{cm}^3$$

$$15\text{cm} \times 8\text{cm} \times h = 420\text{cm}^3$$

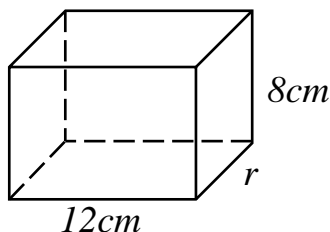
$$120\text{cm}^2 \times h = 420\text{cm}^3$$

$$\frac{120 \times \text{cm} \times \text{cm} \times h}{120 \times \text{cm} \times \text{cm}} = \frac{420 \times \text{cm} \times \text{cm} \times \text{cm}}{120 \times \text{cm} \times \text{cm}}$$

$$h = 3\frac{1}{2}\text{cm}$$

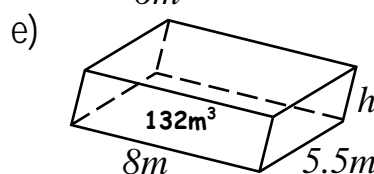
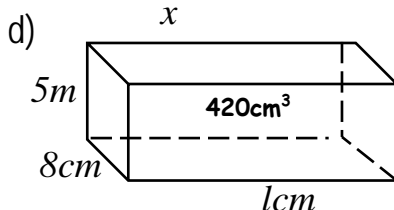
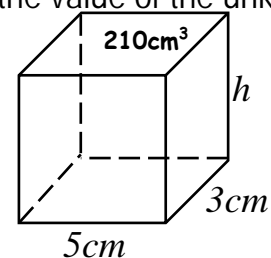
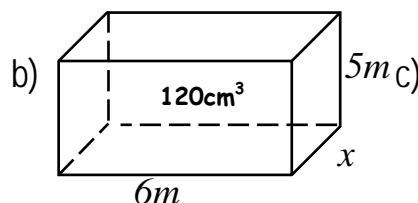
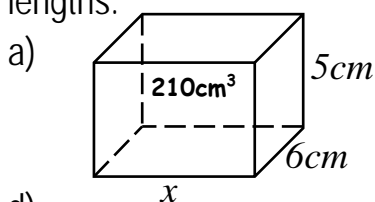
Exercise

- The volume of the box below is 480cm^3 .



- Find the volume of r.
- Calculate the area of the shaded part.

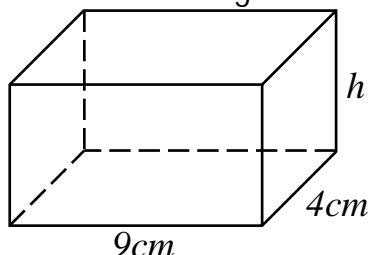
- The volume of each of the rectangular prism is given. Find the value of the unknown lengths.



TOPIC 10: LENGTH, MASS AND CAPACITY

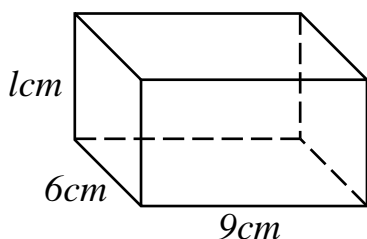


3. Below is a rectangular box whose volume is 180cm^3 .



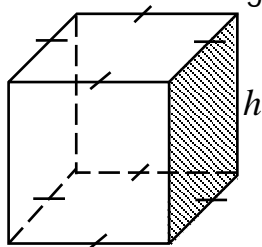
- Find the value of h .
- Calculate its total surface area.
- Find the sum of the length of its edges.

4. Mugonza folded a wire to form a cuboid shown in the figure below. Its volume is 270cm^3 .



- Find the value l
- Calculate the length of the wire used to make the cuboid.

5. The volume of the figure below is 972cm^3 and the area of its square base is 81cm^2 .

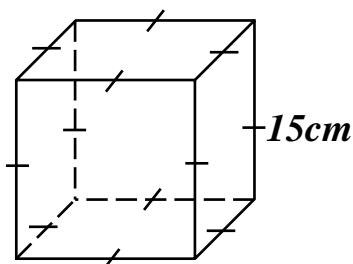


- Find the value of h .
- Calculate the area of the shaded part.

Volume of cubes

Example 1

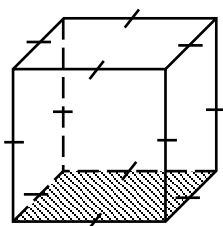
Find the volume of the cube below.



$$\begin{aligned}\text{Volume} &= \text{Base area} \times \text{height} \\ \text{Volume} &= \text{Side} \times \text{Side} \times \text{Side} \\ \text{Volume} &= 15\text{cm} \times 15\text{cm} \times 15\text{cm} \\ \text{Volume} &= 3375\text{cm}^3\end{aligned}$$

Example 2

The area of the shaded part in the figure below is 144cm^2 . Find the volume of the figure.



Length of each side

$$\begin{aligned}\text{Side} \times \text{Side} &= \text{Area} \\ s \times s &= 144\text{cm}^2 \\ s^2 &= 144\text{cm}^2 \\ \sqrt{s^2} &= \sqrt{144\text{cm}^2} \\ s &= 12\text{cm}\end{aligned}$$

Volume

$$\begin{aligned}\text{Volume} &= \text{Base area} \times \text{Height} \\ \text{Volume} &= S \times S \times S \\ \text{Volume} &= 12\text{cm} \times 12\text{cm} \times 12\text{cm} \\ \text{Volume} &= 1728\text{cm}^3\end{aligned}$$

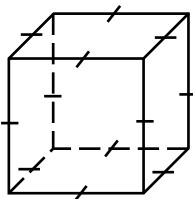
TOPIC 10: LENGTH, MASS AND CAPACITY



Exercise

- Find the volume the cube whose side is 17cm.
- Find the volume of a cube whose side is;

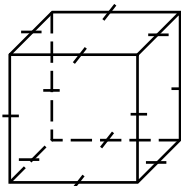
a) 5cm	d) 14cm	g) $2\frac{1}{2}$ cm
b) 85cm	e) 18cm	h) 7.5cm
c) 20cm	f) 7cm	i) $10\frac{1}{4}$ cm
- Bujingo used a wire of length 180cm to make the cube below.



- Find the length of its side.
- Calculate its volume.

- Find the volume of a cube whose base area is;

a) 64cm^2	c) 16cm^2	e) 100cm^2
b) 25cm^2	d) 9cm^2	f) 196cm^2
- Below is a cube. The area of the shaded part is 36cm^2 .



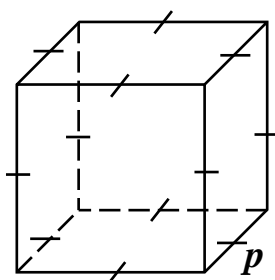
Find its volume.

- A carpenter makes an open box with square faces. The area of a plywood needed to make its cover is 225cm^2 . Find the volume of the box.

Finding the side of a cube.

Example

The volume of a cube is 1000cm^3 .



Find the value of p

Base area x height = Volume

$$s \times s \times s = V$$

$$p \times p \times p = 1000\text{cm}^3$$

$$\sqrt[3]{(p \times p \times p)} = \sqrt[3]{(2 \times 2 \times 2) \times (5 \times 5 \times 5) \times (\text{cm} \times \text{cm} \times \text{cm})}$$

$$p = 2 \times 5 \times \text{cm}$$

$$p = 10\text{cm}$$

Exercise

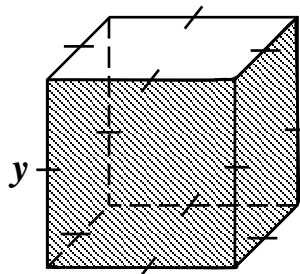
- Find the length of each side of a cube whose volume is ;

a) 125cm^3	e) 216cm^3
b) 64cm^3	f) 343cm^3
c) 8cm^3	g) 512cm^3
d) 729cm^3	h) 27cm^3

TOPIC 10: LENGTH, MASS AND CAPACITY



- Find the base area of a cube whose volume is 1728cm^3 .
- Pinto wanted to make a cube of volume 2744cm^3 using a wire. Find the length of the wire needed.
- Two faces of a cube whose volume is 512cm^3 are shaded as shown below.



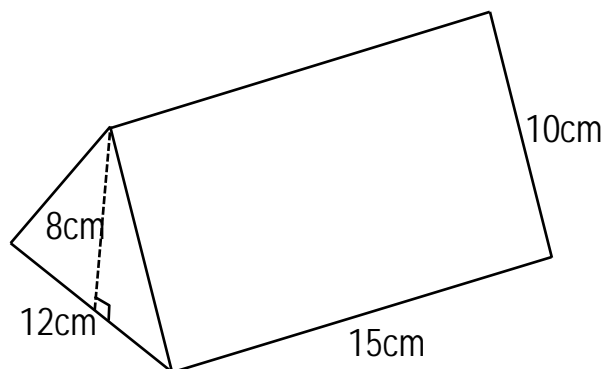
- Find the value of y .
- Calculate the sum of surface area of the un shaded faces.

Volume of a triangular prisms

$$\text{Volume of triangular prism} = \frac{1}{2} \times b \times h \times l$$

Example 1

Find the volume of the triangular prism in the figure below.



Volume = Base area x length

$$\text{Volume} = \frac{1}{2} \times b \times h \times l$$

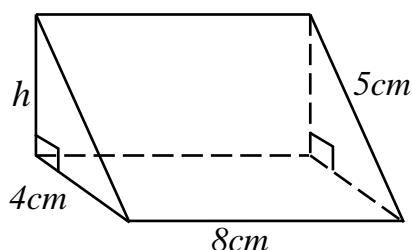
$$\text{Volume} = \frac{1}{2} \times 12\text{cm} \times 8\text{cm} \times 15\text{cm}$$

$$\text{Volume} = 1 \times 6\text{cm} \times 8\text{cm} \times 15\text{cm}$$

$$\text{Volume} = 720\text{cm}^3$$

Example 2

Calculate the volume of the figure.



Value of h

$$a^2 + b^2 = c^2$$

$$(4\text{cm})^2 + h^2 = (5\text{cm})^2$$

$$(4\text{cm} \times 4\text{cm}) + h^2 = (5\text{cm} \times 5\text{cm})$$

$$16\text{cm}^2 + h^2 = 25\text{cm}^2$$

$$16\text{cm}^2 - 16\text{cm}^2 + h^2 = 25\text{cm}^2 - 16\text{cm}^2$$

$$\sqrt{h^2} = \sqrt{9\text{cm}^2}$$

$$h = 3\text{cm}$$

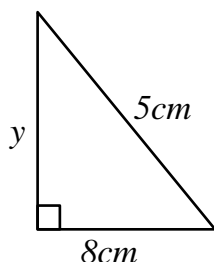
Volume

Volume = Base area x length

$$\text{Volume} = \frac{1}{2} \times 4\text{cm} \times 3\text{cm} \times 8\text{cm}$$

$$\text{Volume} = 1 \times 2\text{cm} \times 3\text{cm} \times 8\text{cm}$$

$$\text{Volume} = 48\text{cm}^3$$

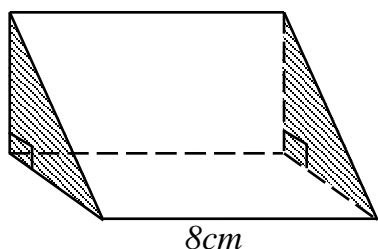


TOPIC 10: LENGTH, MASS AND CAPACITY



Example 3

Below is a triangular prism. The sum of the area of the shaded parts is 96cm^2 . Find its volume.



Base area

$$96\text{cm}^2 \div 2 = 48\text{cm}^2$$

Volume

$$\text{Volume} = \text{Base area} \times \text{length}$$

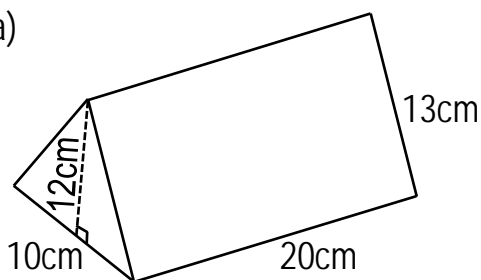
$$\text{Volume} = 48\text{cm}^2 \times 8\text{cm}$$

$$\text{Volume} = 384\text{cm}^3$$

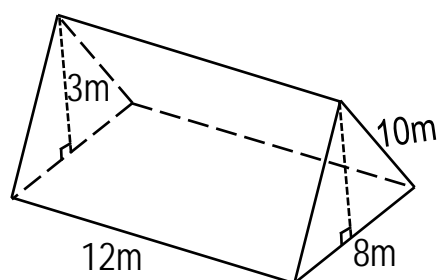
Exercise

1. Find the volume of each of the following.

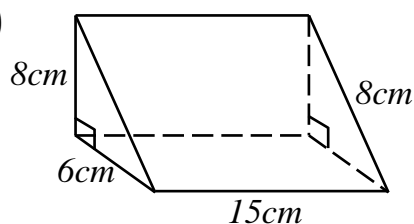
a)



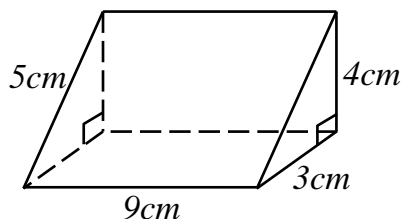
b)



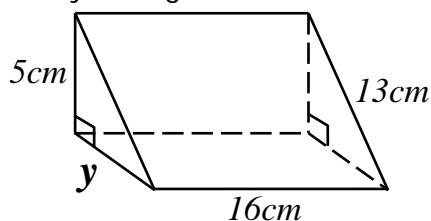
c)



d)



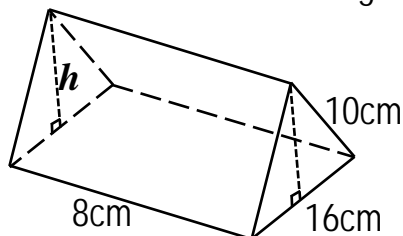
2. Study the figure below



a) Find the value of y.

b) Calculate the volume of the figure.

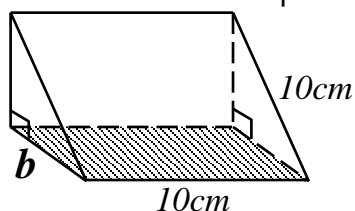
3. Below is an isosceles triangular prism. Use it to answer questions that follow.



a) Find the value of h.

b) Calculate its volume.

4. The area of the shaded part in the figure below is 60cm^2 .



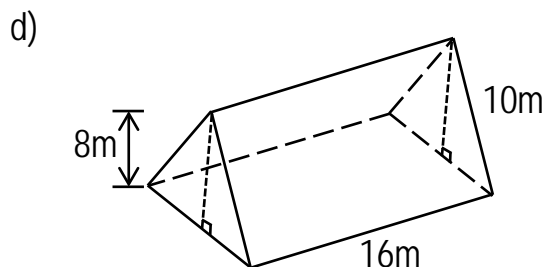
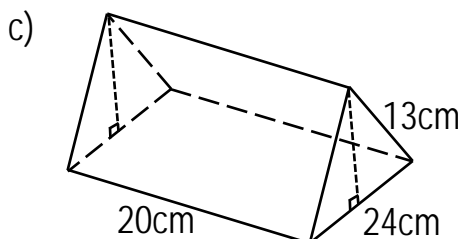
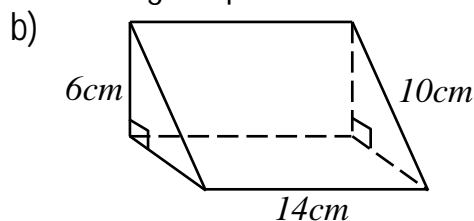
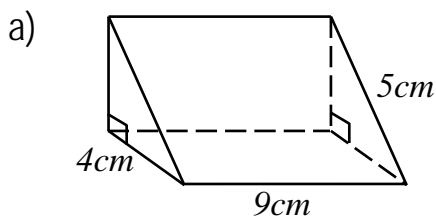
a) Find the value of b

b) Calculate the volume of the figure.

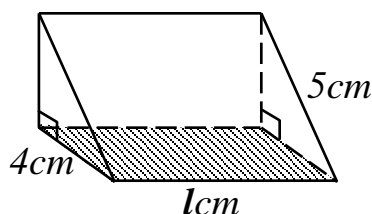
TOPIC 10: LENGTH, MASS AND CAPACITY



5. Find the total surface area of each of the triangular prisms below.



6. The total of the area of all faces of the triangular prism below is 132cm^2 .



a) Find the value of l .

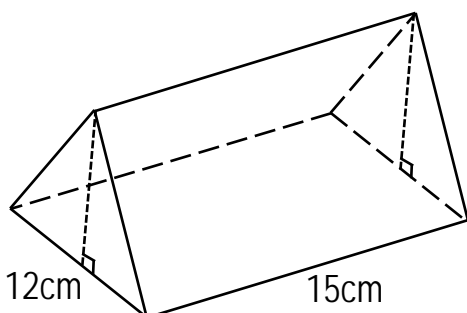
b) Calculate the volume of the triangular prism.

c) Find the area of the shaded part.

Finding the side of a triangular prism when volume is given

Example

The volume of the triangular prism shown in the figure below is 720cm^3 . Find the value of h .



Base area \times length = Volume

$$\frac{1}{2} \times b \times h \times l = \text{Volume}$$

$$\frac{1}{2} \times 12\text{cm} \times h \times 15\text{cm} = 720\text{cm}^3$$

$$6\text{cm} \times 15\text{cm} \times h = 720\text{cm}^3$$

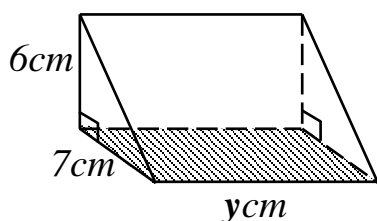
$$90\text{cm}^2 \times h = 720\text{cm}^3$$

$$\frac{90\text{cm} \times \text{cm} \times h}{90 \times \text{cm} \times \text{cm}} = \frac{720 \times \text{cm} \times \text{cm} \times \text{cm}}{90\text{cm} \times \text{cm} \times \text{cm}}$$

$$h = 8\text{cm}$$

Exercise

1. The volume of the figure below is 210cm^3 .



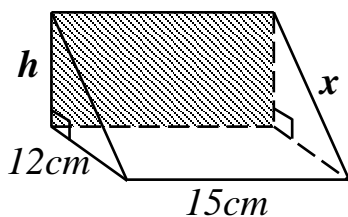
a) Find the value of y .

b) Calculate the area of the shaded part.

TOPIC 10: LENGTH, MASS AND CAPACITY



2. The volume of the figure below is 450cm^3 .



a) Find the value of

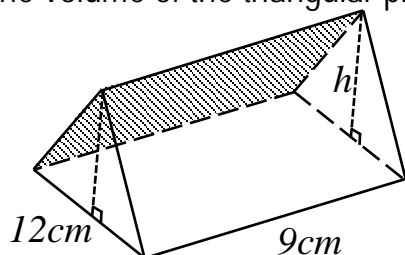
i) h

ii) x

b) Calculate the area of the shaded part.

c) Calculate the total surface area of the figure.

3. The volume of the triangular prism below is 432cm^3 .



a) Find the value of h .

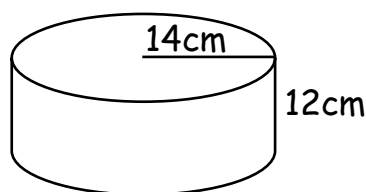
b) Calculate the area of the shaded part.

Volume of a cylindrical prism.

Example 1

Find the volume of the cylinder below.

(Use $\pi = \frac{22}{7}$)



Volume = Base area x height

Volume = $\pi r^2 \times h$

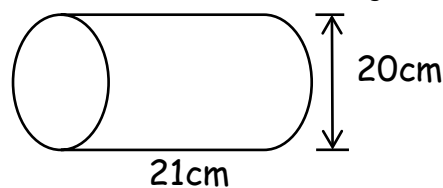
Volume = $\frac{22}{7} \times 14\text{cm} \times 14\text{cm} \times 12\text{cm}$

Volume = $22 \times 2\text{cm} \times 14\text{cm} \times 12\text{cm}$

Volume = 7392cm^3

Example 2

Calculate the volume of the figure.



Radius = $20\text{cm} \div 2$

= 10cm

Volume = Base area x height

Volume = $\pi r^2 \times h$

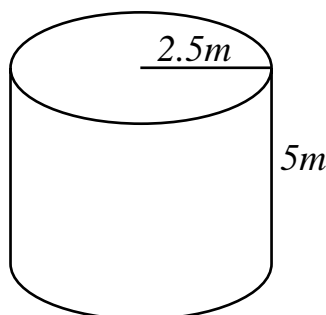
Volume = $\frac{22}{7} \times 10\text{cm} \times 10\text{cm} \times 21\text{cm}$

Volume = $22 \times 10\text{cm} \times 10\text{cm} \times 3\text{cm}$

Volume = 6600cm^3

Example 3

A cylindrical water tank has a radius of 2.5m and a height of 5m . Find the volume of the tank. (Use $\pi = 3.14$)



Volume = Base area x height

Volume = $\pi r^2 \times h$

Volume = $3.14 \times 2.5\text{m} \times 2.5\text{m} \times 5\text{m}$

Volume = $\frac{314}{100} \times \frac{25\text{m}}{10} \times \frac{25\text{m}}{10} \times 5\text{m}$

Volume = $\frac{981250\text{m}^3}{10000}$

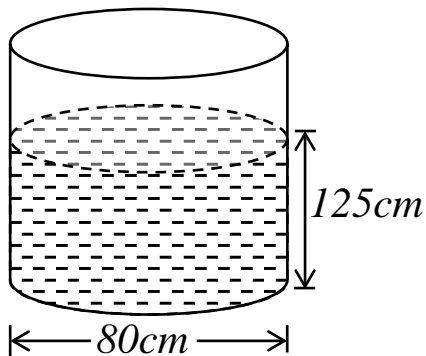
Volume = 98.125m^3

TOPIC 10: LENGTH, MASS AND CAPACITY



Example 4

A cylindrical tank of diameter 80cm contains water to a height of 125cm. Find the volume of water in the tank. (Use $\pi = 3.14$)



$$\begin{aligned}\text{Radius} &= 80\text{cm} \div 2 \\ &= 40\text{cm}\end{aligned}$$

Volume = Base area x height

$$\text{Volume} = \pi r^2 \times h$$

$$\text{Volume} = 3.14 \times 40\text{cm} \times 40\text{cm} \times 125\text{cm}$$

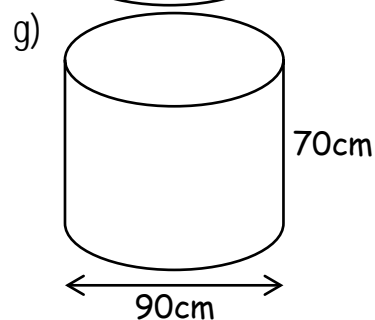
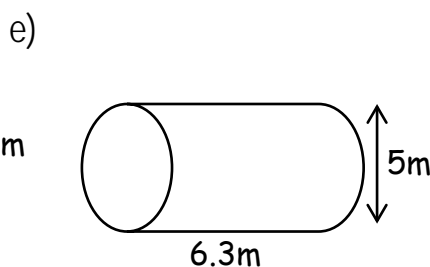
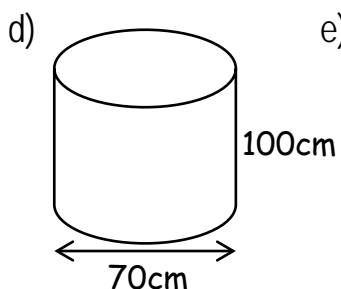
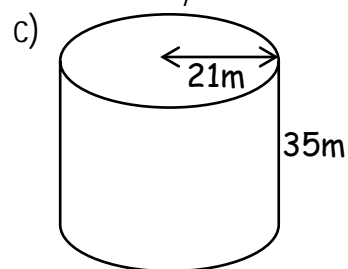
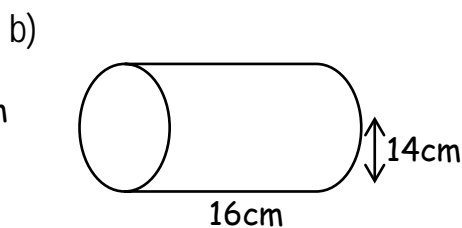
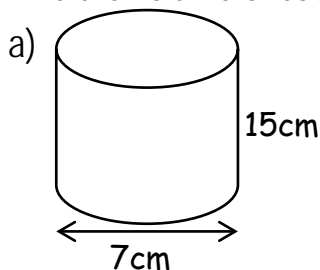
$$\text{Volume} = \frac{314}{100} \times 40\text{cm} \times 40\text{cm} \times 125\text{cm}$$

$$\text{Volume} = 314 \times 4\text{cm} \times 4\text{cm} \times 125\text{cm}$$

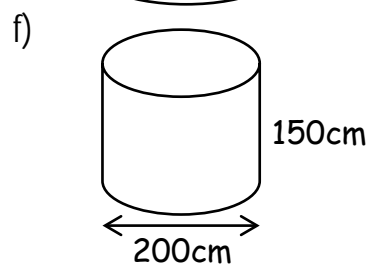
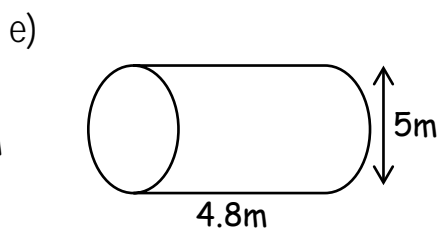
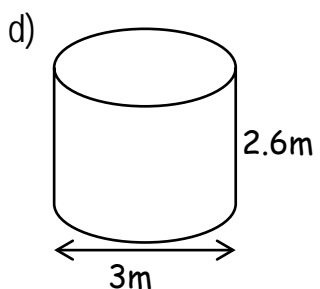
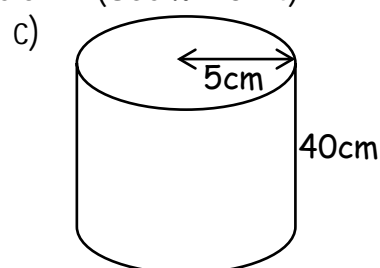
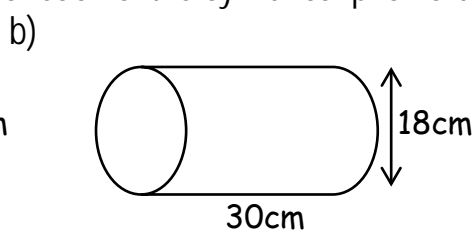
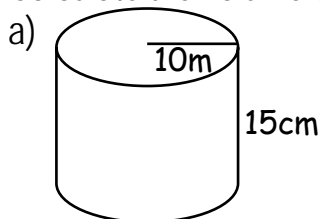
$$\text{Volume} = 628000\text{cm}^3$$

Exercise

1. Find the volume of each of the following cylinders below. (Use $\pi = \frac{22}{7}$)



2. Calculate the volume of each of the cylindrical prisms below. (Use $\pi = 3.14$)



TOPIC 10: LENGTH, MASS AND CAPACITY



3. Find the volume of Mugabi's tank of height 40cm and radius 70cm.
4. Calculate the volume of a cylindrical water tank of radius 70cm and height 250cm.
5. A welder bought a rectangular sheet of metal of area 22000cm². He welded it into a cylindrical water tank of height 50cm.



50cm

a) Find the radius of the tank.

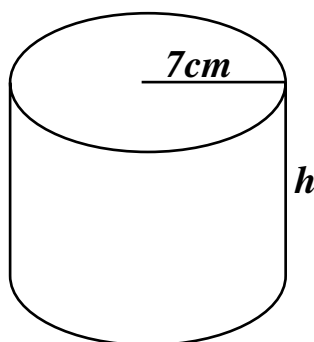
b) Calculate its volume.

6. Twenty four cylindrical beef tins of diameter 7cm and height 8cm were packed in a box. Find the volume of tins in the box.

Finding the height of a cylinder when volume is given.

Example 1

The volume of the cylindrical tin below is 1540cm³. Find the value of h . (Use $\pi = \frac{22}{7}$)



Base area x height = Volume

$$\pi r^2 \times h = \text{Volume}$$

$$\frac{22}{7} \times 7\text{cm} \times 7\text{cm} \times h = 1540\text{cm}^3$$

$$22 \times 1\text{cm} \times 7\text{cm} \times h = 1540\text{cm}^3$$

$$154\text{cm}^2 \times h = 1540\text{cm}^3$$

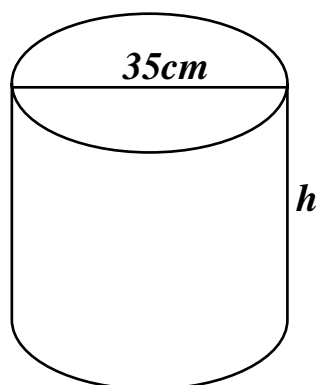
$$\frac{154 \times \text{cm} \times \text{cm} \times h}{154 \times \text{cm} \times \text{cm}} = \frac{1540 \times \text{cm} \times \text{cm} \times \text{cm}}{154 \times \text{cm} \times \text{cm}}$$

$$h = 10\text{cm}$$

Example 2

The figure below shows a cylindrical tank of volume 38500cm³ and diameter 3.5cm.

Find its height. (Use $\pi = \frac{22}{7}$)



Base area x height = Volume

$$\pi r^2 \times h = \text{Volume}$$

$$\frac{22}{7} \times \frac{35\text{cm}}{2} \times \frac{35\text{cm}}{2} \times h = 38500\text{cm}^3$$

$$\frac{11 \times 35\text{cm} \times 35\text{cm} \times h}{2} = 38500\text{cm}^3$$

$$2 \times \frac{1925 \times \text{cm} \times \text{cm} \times h}{2} = 38500\text{cm}^3 \times 2$$

$$1925\text{cm}^2 \times h = 77000\text{cm}^3$$

$$\frac{1925 \times \text{cm} \times \text{cm} \times h}{1925 \times \text{cm} \times \text{cm}} = \frac{77000 \times \text{cm} \times \text{cm} \times \text{cm}}{1925 \times \text{cm} \times \text{cm}}$$

$$h = 40\text{cm}$$

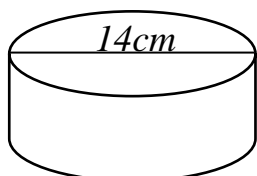
TOPIC 10: LENGTH, MASS AND CAPACITY



Exercise

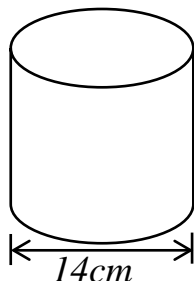
(Use $\pi = \frac{22}{7}$)

- The volume of a cylindrical tin is 3080cm^3 . Its radius is 7cm . Find its height.
- Find the height of a cylinder whose volume is 12320cm^3 and radius 14cm .
- Find the height of a cylindrical prism of radius 14cm and volume is 6160cm^3 .
- Below is a cylindrical tin whose volume is 1540cm^3 .



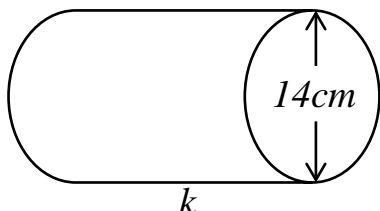
- Find its height.
- Calculate its total surface area.

- The volume of the figure below is 3080cm^3 .



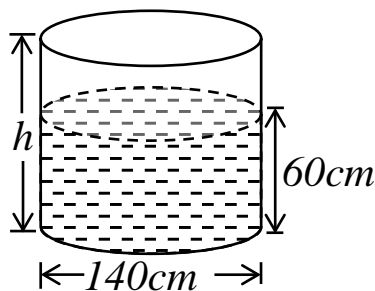
- Calculate the area of the shaded part.
- Find the value of h .

- The diagram below shows a metallic drum whose volume is 2310cm^3 . It was cut open to form a door sheet. Use it to answer questions that follow.



- Find the value of k .
- Work out the area of the door which was made out of the sheet.

- A cylindrical tin of radius 7cm contains 5400cm^3 of milk. 3860cm^3 of the milk is sold.
 - Find the height of the milk remaining in the tin.
 - If the remaining milk is poured in a cup whose base area is 77cm^2 , what is the height of the milk in the cup?
- The tank below needs 61600cm^3 of water to become full.



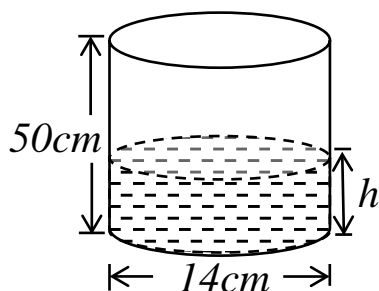
- Find the volume of water in the tank.
- Find the value of h .

- A cylindrical tin of diameter 28cm contained 6160cm^3 of cooking oil. When more cooking oil was added, the height of cooking oil in the tin increased by 5cm . Calculate the final volume of cooking oil in the tin.

TOPIC 10: LENGTH, MASS AND CAPACITY

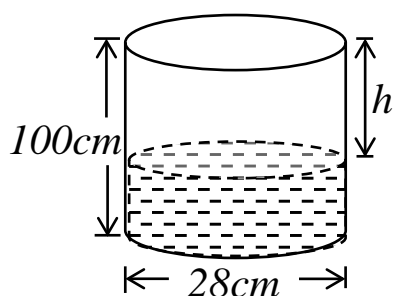


10. The below is contains 1540cm^3 of water.



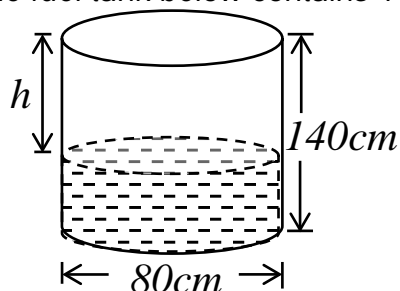
- Find the value of h .
- Find the volume of water needed to fill the tank.

11. The tank below requires 36960cm^3 of water to become full.



- Find the value of h .
- Calculate the volume of water in the tank.

12. The fuel tank below contains 176000cm^3 petrol. Use it to answer questions that follow.

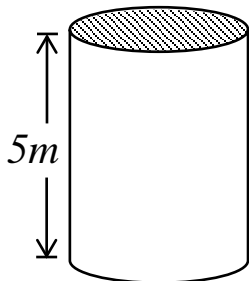


- Calculate the volume of fuel tank.
- Find the value of h .

Finding radius when volume is given

Example

The volume of the cylinder below is 3080m^3 . Find its;



- radius. (Use $\pi = \frac{22}{7}$)

$$\begin{aligned}\pi r^2 \times h &= \text{Volume} \\ \frac{22}{7} \times r^2 \times 5\text{m} &= 3080\text{m}^3 \\ \frac{110\text{m}}{7} r^2 &= 3080\text{m}^3 \\ 7 \times \frac{110\text{m}}{7} r^2 &= 3080\text{m}^3 \times 7 \\ 110\text{m} \times r^2 &= 21560\text{m}^3 \\ \frac{110\text{m} \times r^2}{110\text{m}} &= \frac{21560\text{m}^3}{110\text{m}} \\ r^2 &= 196\text{m}^2 \\ \sqrt{r^2} &= \sqrt{196\text{m}^2} \\ r &= 14\text{m}\end{aligned}$$

- total surface area

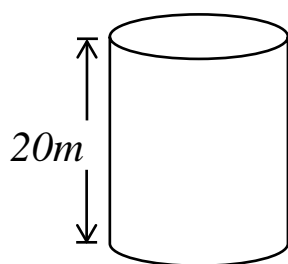
$$\begin{aligned}\text{TSA} &= 2\pi r^2 + 2\pi rh \\ \text{TSA} &= (2 \times \frac{22}{7} \times 14\text{m} \times 14\text{m}) + (2 \times \frac{22}{7} \times 14\text{m} \times 5\text{m}) \\ \text{TSA} &= (2 \times 22 \times 2\text{m} \times 14\text{m}) + (2 \times 22 \times 2\text{m} \times 5\text{m}) \\ \text{TSA} &= 1232\text{m}^2 + 440\text{m}^2 \\ \text{TSA} &= 1672\text{m}^2\end{aligned}$$

TOPIC 10: LENGTH, MASS AND CAPACITY



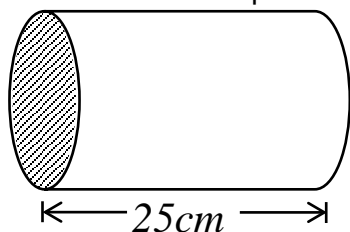
Exercise

- The volume of a cylinder is 1540cm^3 . Its height is 10cm .
 - Find its radius. (Use $\pi = \frac{22}{7}$)
 - Calculate the area of its curved surface.
- Find the radius of a cylinder with volume 6160cm^3 and height 10cm .
- The volume of a cylinder is 231cm^3 .
 - Find the radius if the height is 6cm .
 - Calculate its total surface area
- Below is a circular underground tank which holds 3080m^3 of water when completely full. If 2310m^3 of water is drawn from it;



- Find the remaining volume of water in the tank.
- Calculate the radius of the tank. (Use $\pi = \frac{22}{7}$)
- What will be the level of water left in tank?
- Find the total surface area of the tank.

- The volume of the prism below is 15400cm^2 .

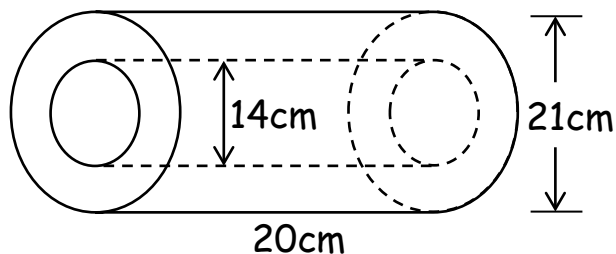


- Calculate the area of the shaded part.
(Use $\pi = \frac{22}{7}$)
- Find the diameter of the prism.

Finding volume of hollow cylinders

Example

Find the volume of the concrete in the cylinder below.



Volume of the outer cylinder

$$\text{Volume} = \pi r^2 \times h$$

$$\text{Volume} = \frac{22}{7} \times \frac{21\text{cm}}{2} \times \frac{21\text{cm}}{2} \times 20\text{cm}$$

$$\text{Volume} = 11 \times 3\text{cm} \times 21\text{cm} \times 10\text{cm}$$

$$\text{Volume} = 6930\text{cm}^3$$

Volume of the inner cylinder

$$\text{Volume} = \pi r^2 \times h$$

$$\text{Volume} = \frac{22}{7} \times \frac{14\text{cm}}{2} \times \frac{14\text{cm}}{2} \times 20\text{cm}$$

$$\text{Volume} = 22 \times 1\text{cm} \times 7\text{cm} \times 20\text{cm}$$

$$\text{Volume} = 3080\text{cm}^3$$

Volume of the concrete

$$\text{Outer cylinder} - \text{Inner cylinder}$$

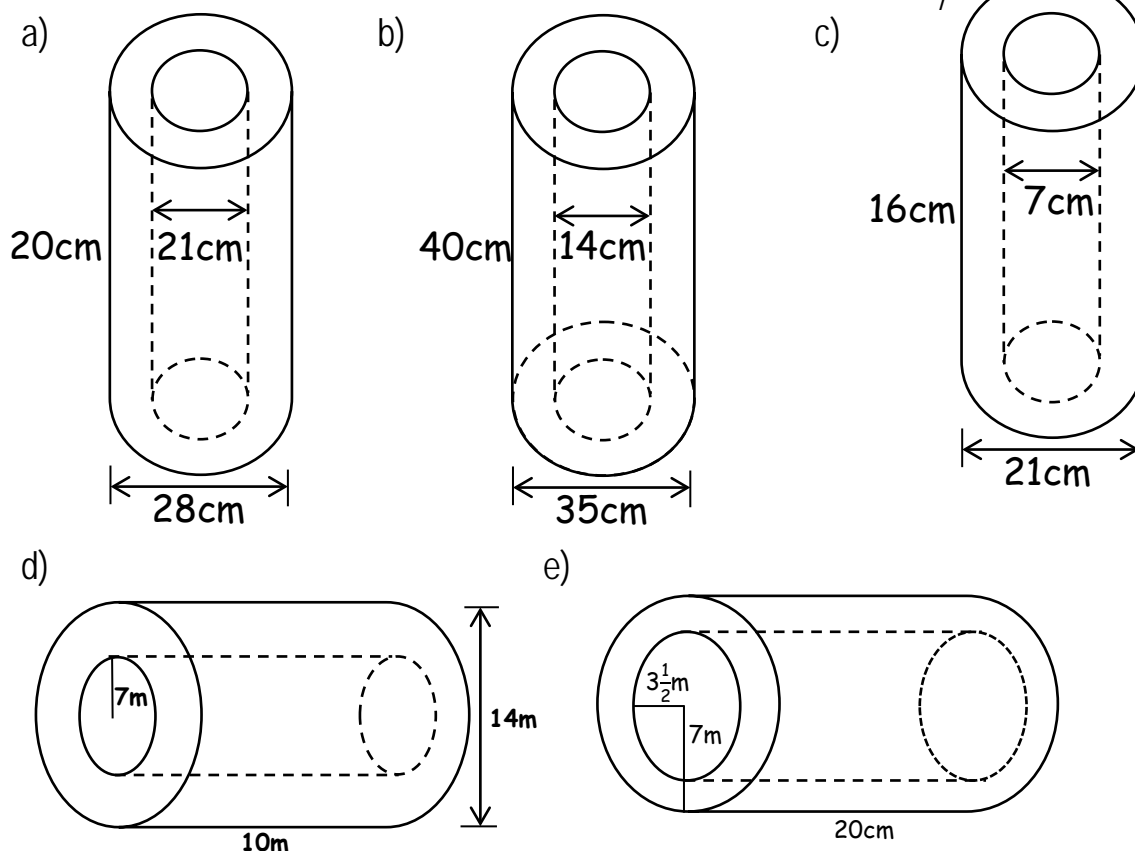
$$6930\text{cm}^3 - 3080\text{cm}^3$$

$$3850\text{cm}^3$$

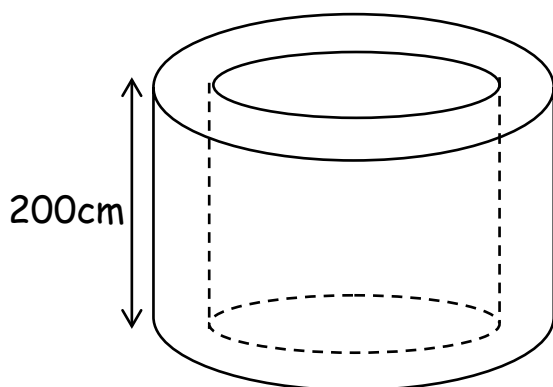


Exercise

1. Find the volume of the concrete of the cylinders below. (Use $\pi = \frac{22}{7}$)

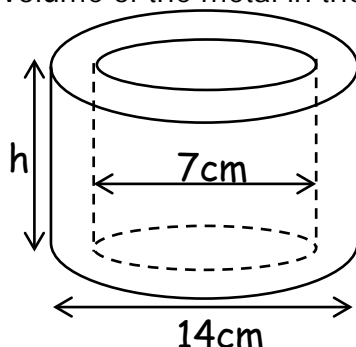


2. A wall of thickness 14cm was built around a cylindrical tank of volume $3,080,000\text{cm}^3$ and height 2000cm as shown below.



- a) Find the radius of the tank. (Use $\pi = \frac{22}{7}$)
- b) Calculate the volume of the wall.

3. The volume of the metal in the hollow metallic pipe in the figure below is 11550cm^3 .



- a) Find the value of h .
- b) Calculate the volume of water needed to fill the hollow metallic pipe above.

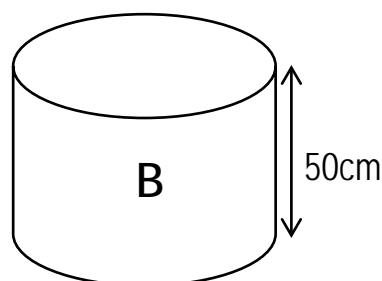
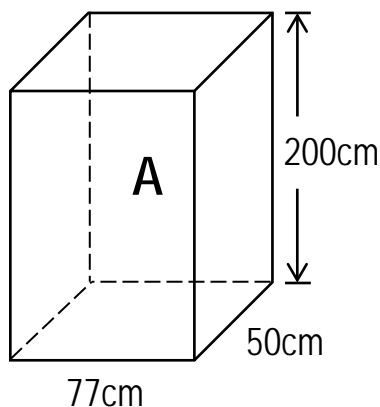
TOPIC 10: LENGTH, MASS AND CAPACITY



More problems about volume of rectangular prisms and cylinders .

Example 1

The two tanks below hold the same volume of water when completely full.



- a) Calculate the base area of tank B.

Volume of tank A

$$V = l \times w \times h$$

$$V = 77\text{cm} \times 50\text{cm} \times 200\text{cm}$$

$$V = 770000\text{cm}^3$$

Base area of tank B

$$\text{Base area} = \frac{\text{Volume}}{\text{Height}}$$

$$\text{Base area} = \frac{770000\text{cm}^3}{50\text{cm}}$$

$$\text{Base area} = \frac{770000\text{cm} \times \text{cm} \times \text{cm}}{50\text{cm}}$$

$$\text{Base area} = 15400\text{cm}^2$$

- b) Find the diameter of tank B.

Radius

$$\pi r^2 = A$$

$$\frac{22}{7} \times r^2 = 15400\text{cm}^2$$

$$7 \times \frac{22}{7} r^2 = 15400\text{cm}^2 \times 7$$

$$\frac{22r^2}{22} = \frac{15400\text{cm}^2 \times 7}{22}$$

$$r^2 = 700\text{cm}^2 \times 7$$

$$r^2 = 4900\text{cm}^2$$

$$\sqrt{r^2} = \sqrt{4900\text{cm}^2}$$

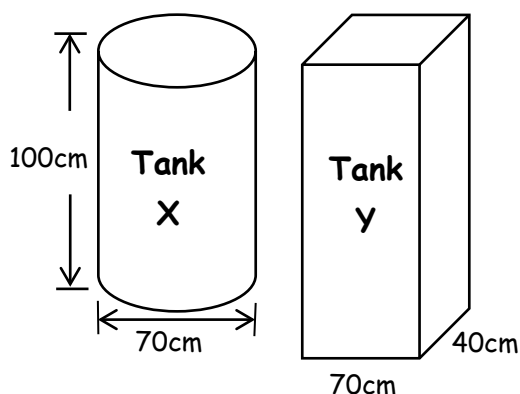
$$r = 70\text{cm}$$

Diameter

$$70\text{cm} + 70\text{cm} = 140\text{cm}$$

Example 2

Tank X is $\frac{4}{5}$ full of water. If water in tank X is all poured in tank Y, find the height of water in tank Y.



Height of water in tank X

$$\frac{4}{5} \text{ of } 100\text{cm}$$

$$\frac{4}{5} \times 100\text{cm}$$

$$\text{Height} = 80\text{cm}$$

Radius

$$70\text{cm} \div 2 = 35\text{cm}$$

Volume of water in tank X

$$\text{Volume} = \pi r^2 \times h$$

$$\text{Volume} = \frac{22}{7} \times 35\text{cm} \times 35\text{cm} \times 80\text{cm}$$

$$\text{Volume} = 308000\text{cm}^3$$

Height of water in tank Y

$$\text{Height} = \frac{\text{Volume}}{\text{Base area}}$$

$$\text{Height} = \frac{308000\text{cm}^3}{70\text{cm} \times 40\text{cm}}$$

$$\text{Height} = \frac{308000\text{cm} \times \text{cm} \times \text{cm}}{2800\text{cm} \times \text{cm}}$$

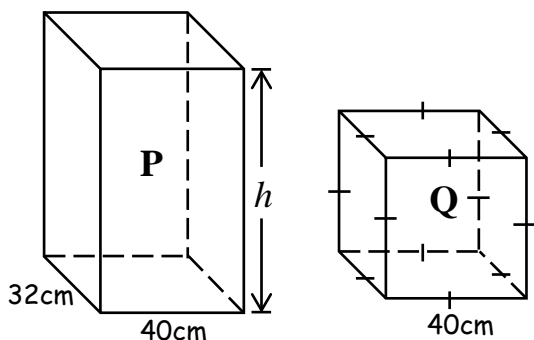
$$\text{Height} = 110\text{cm}$$

TOPIC 10: LENGTH, MASS AND CAPACITY



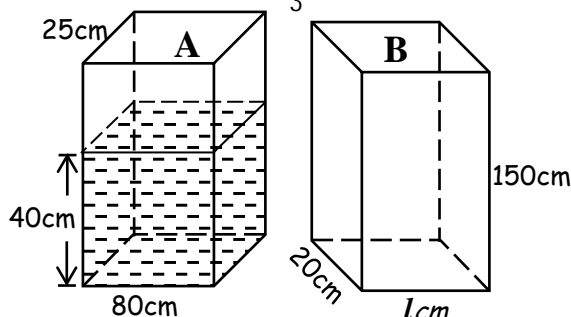
Exercise

1. Containers P and Q hold the same volume of water when completely full.



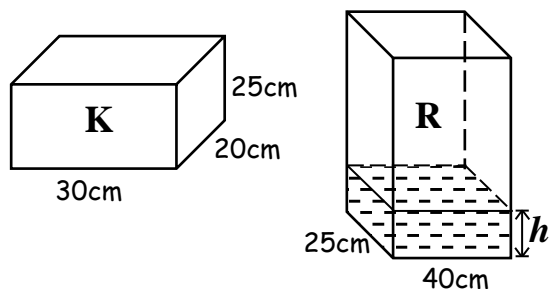
- Find the volume of container Q.
- Find the value of h .
- If $24,000\text{cm}^3$ of water in container Q is used, find height of the remaining water in the container.

2. Below are two tanks, A and B which hold the same volume of water when completely full. Tank A is $\frac{2}{3}$ full of water.



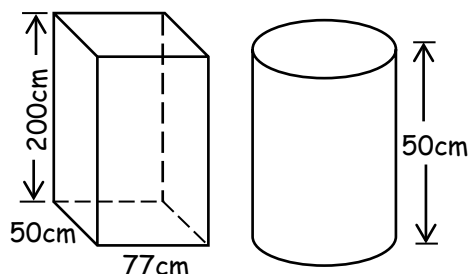
- Find the volume of water in tank A.
- Find the volume of tank B.
- Find the value of l .

3. Below are rectangular containers K and R. Container K was completely full of water. When water in container K was all poured in container R, it became $\frac{1}{5}$ full.



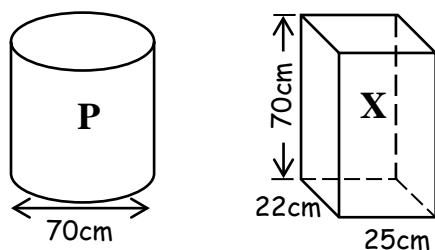
- Find the value of h .
- Calculate the volume of water needed to fill container R.

4. The two tanks below hold the same volume of water.



- Find the volume of the rectangular tank.
- Calculate the base area of the cylindrical tank.
- Find the radius of the cylindrical tank.

5. Tank X was full with water. The water was later poured in tank P.

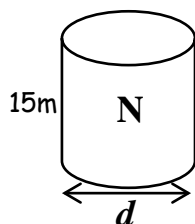
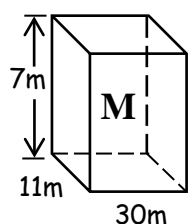


- Find the volume of water in tank X.
- Find the height of water in tank P.

TOPIC 10: LENGTH, MASS AND CAPACITY

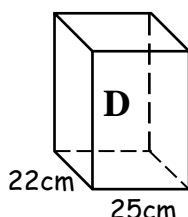
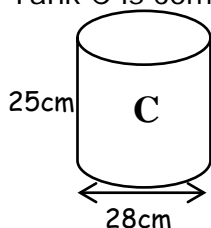


6. Below are two tanks; M and N which hold the same volume of water.



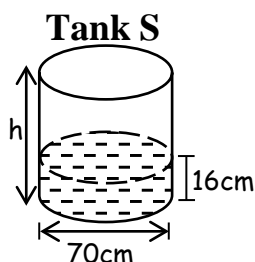
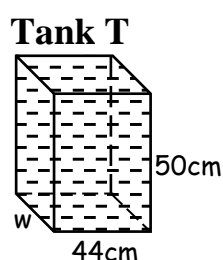
- Calculate the base area of tank N.
- Find the value of d in centimetres.

7. Tank C is completely full of water.



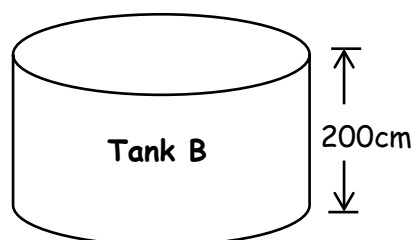
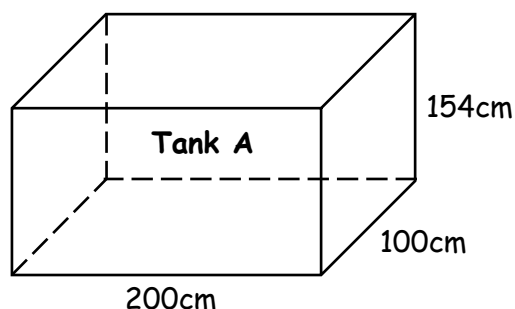
If water in tank C is all poured in tank D, find the height of water in tank D.

8. The tanks below contain the same volume of water. Tank S is $\frac{4}{5}$ full.



- Find the value of h .
- Find the value of w .
- Find the volume of water needed to fill tank S.

9. The two water tanks below contain the same volume of water when filled up.



Find the diameter of tank B.

Comparing volume by division

Example 1

How many cubes of $\frac{2}{3}\text{cm}^3$ volume are contained in a cube of 6cm^3 volume?

$$6\text{cm}^3 \div \frac{2}{3}\text{cm}^3$$

$$6\text{cm}^3 \times \frac{3}{2\text{cm}^3}$$

9 cubes

Example 2

Find the number of 550cm^3 bottles of water that are contained in 13200cm^3 of water.

Bigger volume \div Smaller volume

$$13200\text{cm}^3 \div 550\text{cm}^3$$

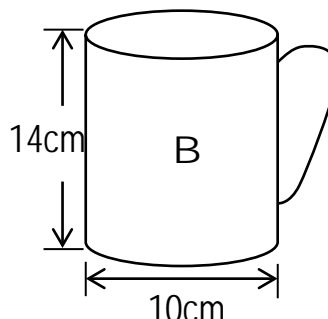
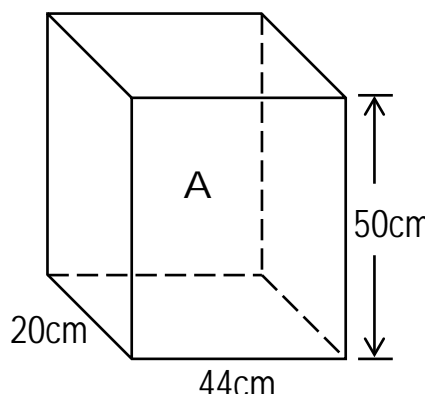
24 bottles

TOPIC 10: LENGTH, MASS AND CAPACITY



Example 3

Find the number of full cups of size B which can fill a container of size A.



Volume of container A

$$V = l \times w \times h$$

$$V = 44\text{cm} \times 20\text{cm} \times 50\text{cm}$$

$$V = 44000\text{cm}^3$$

Radius

$$10\text{cm} \div 2 = 5\text{cm}$$

Volume of container B

$$V = \pi r^2 \times h$$

$$V = \frac{22}{7} \times 5\text{cm} \times 5\text{cm} \times 14\text{cm}$$

$$V = 22 \times 5\text{cm} \times 5\text{cm} \times 2\text{cm}$$

$$V = 1100\text{cm}^3$$

Number of cups

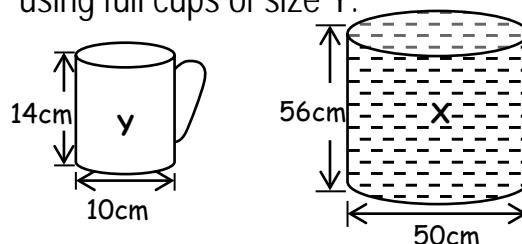
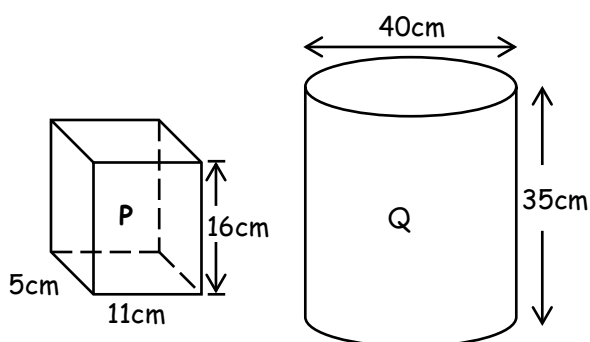
$$\text{Volume A} \div \text{Volume B}$$

$$\frac{44000\text{cm}^3}{1100\text{cm}^3}$$

$$40 \text{ cups}$$

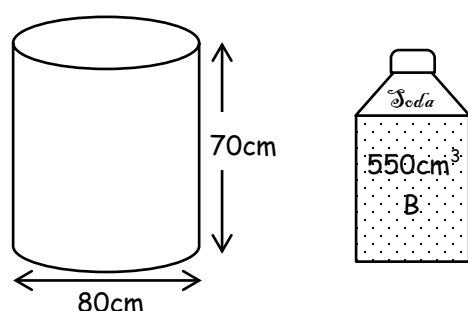
Exercise

- How many cubes of 3cm^3 volume are contained in a cube 51cm^3 volume?
- Find the number of 500cm^3 bottles that are contained a 15000cm^3 jerry can.
- Find the number of full containers of size P that can fill a bucket size Q.
- Maama Maria prepared tea in container of size X and later served it to guest using full cups of size Y.



If each guest got one cup of tea, find the total number of guests who attended the party.

- A factory produced soda in a container size A. The soda was later sold using bottles of size B

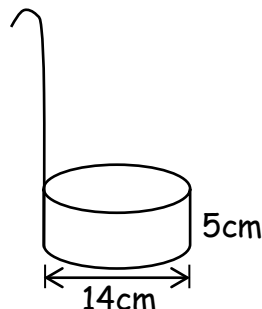


- Find the number of bottles of soda produced .
- If each bottle was sold at sh.1500, how much money did the factory collect altogether.

TOPIC 10: LENGTH, MASS AND CAPACITY

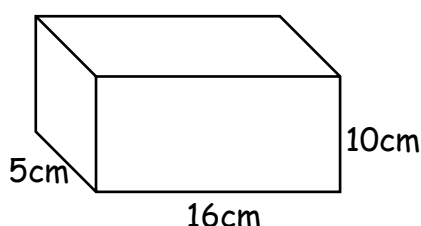


6. A cooking oil dealer sells cooking oil using a container shown in the figure below. On Christmas day, he sold 15400cm^3 of cooking oil.



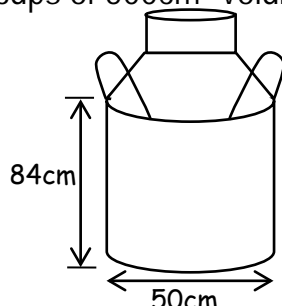
- Find the number of such containers he sold.
(Use $\pi = \frac{22}{7}$)
- If each container was sold at sh. 200, how much money did he collect on cooking oil that day?

7. Mafuta bought 20000cm^3 of paraffin at sh. 105,000 which he later sold using the container shown in the figure below.



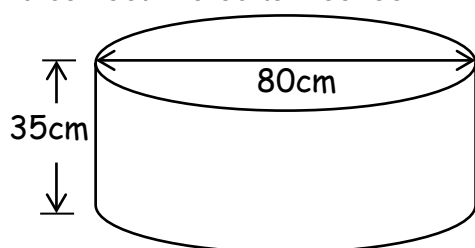
- Find the number of such containers he sold.
- If each container was sold at sh. 4800, calculate the profit he made.

8. The height of milk in the can below is 84cm. The milk in the can is to be sold using cups of 500cm^3 volume at sh. 1500 for every two cups.



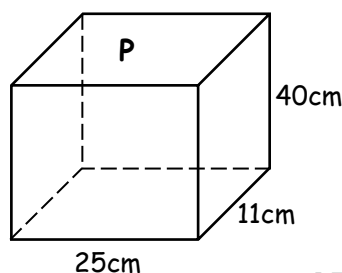
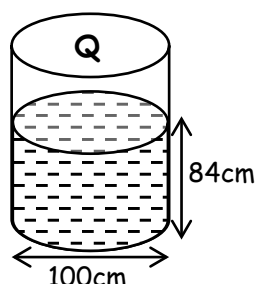
- Find the number of full cups of milk that will be obtained from the can.
- Calculate the amount of money to be collected altogether.

9. A full source pan of porridge shown in the figure below was prepared to be served at breakfast in a certain school.



If the porridge was served in cups of volume 550cm^3 . Find the number of full cups of porridge obtained.

10. The height of water in tank Q was 84cm and this was $\frac{3}{4}$ of the height the tank. When some water in the tank was sold using containers of size P, two fifths of it remained.



- Find in cm^3 , the volume of water sold.
- If each container was sold at sh. 250, how much money was collected altogether?

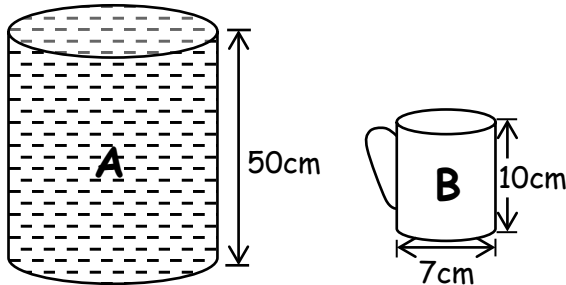
TOPIC 10: LENGTH, MASS AND CAPACITY



More about comparing volume .

Example

Beatrice filled container **A** below with drinking water to be served to visitors. She served 80 full cups of water of size **B** to the visitors.



a) Find the volume of cup B

$$V = \pi r^2 \times h$$

$$V = \frac{22}{7} \times \frac{7\text{cm}}{2} \times \frac{7\text{cm}}{2} \times 10\text{cm}$$

$$V = 11 \times 1\text{cm} \times 7\text{cm} \times 5\text{cm}$$

$$V = 385\text{cm}^3$$

b) Find the base area of container A

Volume of container A

$$80 \times 385\text{cm}^3 = 30800\text{cm}^3$$

Base area

$$\text{Base area} = \frac{\text{Volume}}{\text{Height}}$$

$$\text{Base area} = \frac{30800\text{cm}^3}{50\text{cm}}$$

$$\text{Base area} = \frac{30800\text{cm} \times \text{cm} \times \text{cm}}{50\text{cm}}$$

$$\text{Base area} = 616\text{cm}^2$$

b) Find the diameter of container A.

Radius

$$\pi r^2 = A$$

$$\frac{22}{7} \times r^2 = 616\text{cm}^2$$

$$7 \times \frac{22}{7} r^2 = 616\text{cm}^2 \times 7$$

$$\frac{22r^2}{22} = \frac{616\text{cm}^2 \times 7}{22}$$

$$r^2 = 28\text{cm}^2 \times 7$$

$$r^2 = 196\text{cm}^2$$

$$\sqrt{r^2} = \sqrt{196\text{cm}^2}$$

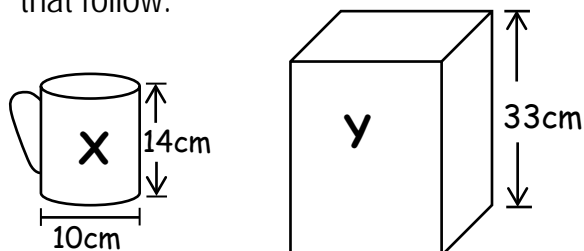
$$r = 14\text{cm}$$

Diameter

$$14\text{cm} + 14\text{cm} = 28\text{cm}$$

Exercise

1. Fifteen full cups of size X fill container Y. Study the diagram and answer questions that follow.



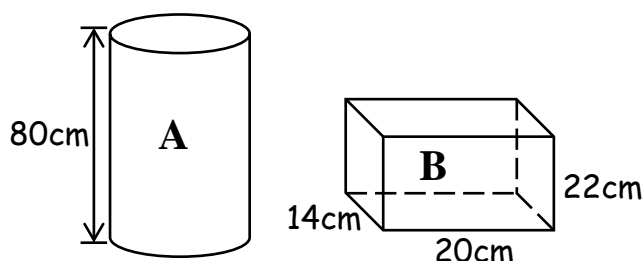
a) Find the volume of;

i) Cup X

ii) Container Y

b) Find the base area of container Y.

2. Fifty full containers of size B fill tin A.



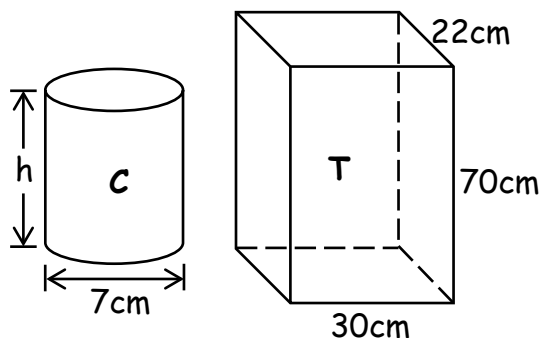
a) Find the volume of tin A.

b) Calculate the circumference of tin A.

TOPIC 10: LENGTH, MASS AND CAPACITY

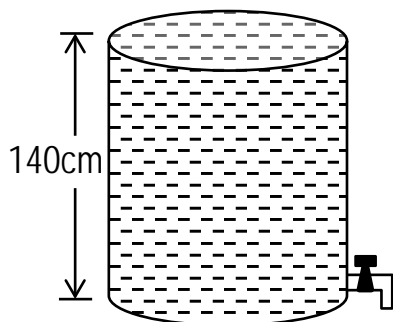


3. Sixty full containers of size C can fill tank T. Study the figures and use them to answer the questions that follow.



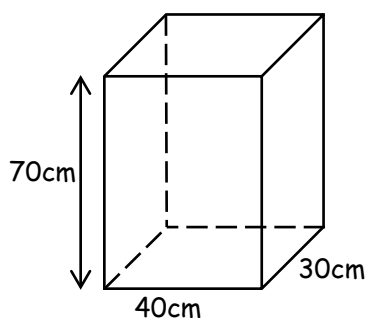
- Calculate the volume of tank T.
- Find the value of h

4. A tap is connected to a tank full of water. The tap draws 4400cm^3 of water per minute. If the tap is left open for 2 hours, the tank becomes $\frac{1}{4}$ full. Study the diagram and use it to answer questions that follow.



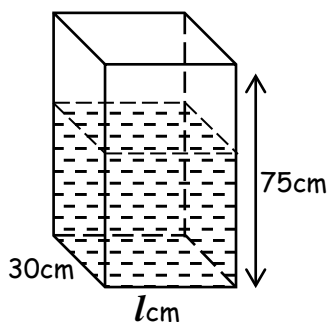
- Calculate the volume of the tank.
 - Find the diameter of the tank.
- (Use $\pi = \frac{22}{7}$)

5. The diagram below shows a water tank full of water. The water leaks at a rate of 1500cm^3 per hour. Study the diagram and use it to answer questions that follow.



- Find the volume of the tank.
- Calculate the volume of water that leaks out of the tank in 32 hours
- Find the height of water that remains in the tank after the 32 hours.

6. The tank below contained $90,000\text{cm}^3$ of water. The height of water in the tank was 75cm. Some water was drawn using sixty bottles of volume 500cm^3 each.

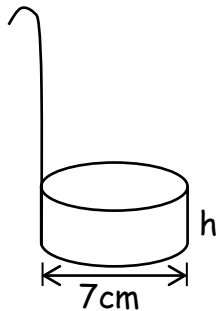


- Find the value of l .
- Calculate the height of water that remained in the tank.

TOPIC 10: LENGTH, MASS AND CAPACITY

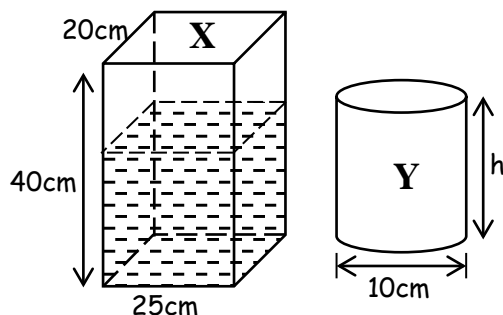


7. The diagram below represents a container Betty uses to sell cooking oil.



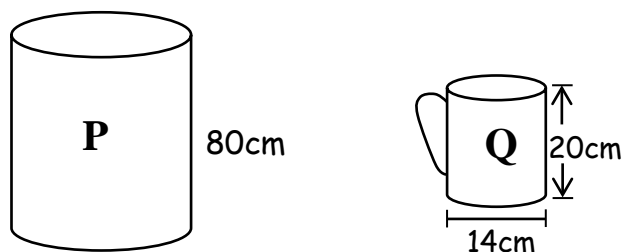
One day, Betty sold 7700cm^3 of cooking oil using 20 containers. Find the value of h . (Use $\pi = \frac{22}{7}$)

8. Container X below was $\frac{9}{10}$ full of paraffin. When some paraffin was sold using six small containers of size Y, $\frac{1}{2}$ of it remained.

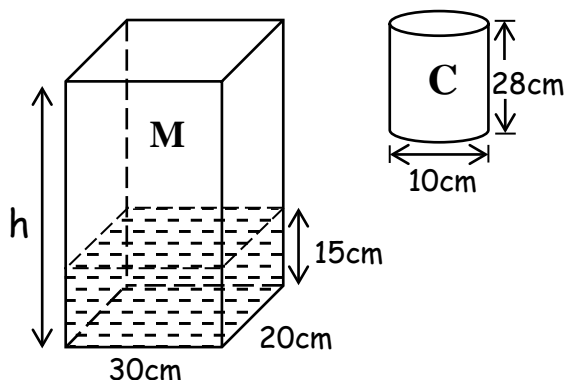


- Find the volume of container X.
- Find the volume of container Y.
- Find the value of h . (Use $\pi = \frac{22}{7}$)

9. 60 full cups of size Q fill container P with water. Study the diagrams and answer questions that follow.



- Calculate the volume of cup Q.
 - Calculate the base area of container P.
10. In the figures below, M is a water tank and C is a container. Tank M needs 15 full containers of size C to become full.



- Calculate the volume of the container. (Use $\pi = \frac{22}{7}$)
- Find the value of h .

TOPIC 10: LENGTH, MASS AND CAPACITY



CAPACITY

Changing litres to millilitres.

Note:

10 millilitres = 1 centilitre

10 centilitres = 1 Decilitre

10 Decilitres = 1 litre

<i>Kl</i>	<i>Hl</i>	<i>Dl</i>	<i>L</i>	<i>dl</i>	<i>cl</i>	<i>ml</i>
			<i>1</i>	<i>0</i>	<i>0</i>	<i>0</i>

So, 1 litre = 1000 millilitres

→ To change big units to small units ; we multiply

Example 1

Change 9 litres into millilitres.

1 litre = 1000ml

9 litres = (9 x 1000) ml

9 litres = 9000ml

Example 2

Mukwaya bought fourteen 20 – litres jerry cans of cooking oil. How many millilitres did he buy altogether?

14 x 20 litres = 280 litres

1 litre = 1000ml

280 litres = (280 x 1000) ml

280 litres = 280000ml

Example 3

Convert $16\frac{3}{4}$ litres into millilitres.

1 litre = 1000ml

$16\frac{3}{4}$ litres = $\frac{67}{4}$ x 1000ml

$16\frac{3}{4}$ litres = (67 x 250)ml

$16\frac{3}{4}$ litres = 16750ml

Example 4

Express 46.25 litres as millilitres.

1 litre = 1000ml

46.25 litres = $\frac{4625}{100}$ x 1000ml

46.25 litres = (4625 x 10)ml

46.25 litres = 46250ml

Exercise

1. Change litres to millilitres

a) 7 litres

e) 340 litres

i) $12\frac{1}{2}$ litres

b) 4 litres

f) 2400 litres

j) 0.6 litres

c) 15 litres

g) $2\frac{1}{2}$ litres

k) 2.4 litres

d) 27 litres

h) $4\frac{1}{8}$ litres

l) 8 litres 250 millilitres

2. A car consumes $14\frac{1}{2}$ litres of petrol to cover a distance. Express as millilitres, the litres of petrol consumed.

TOPIC 10: LENGTH, MASS AND CAPACITY



3. Kent's farm produces 78 litres of milk daily. Express its daily milk production in millilitres.
4. Namazzi fetched 16 litres of water in the morning and 14 litres in the evening. How many millilitres of water did she fetch altogether?
5. Bogere bought twelve 1.5 litre bottles of water. Express as millilitres the total amount of water he bought.
6. A container holds 2.5 litres of milk. A trader bought 24 similar containers full of milk. Find in millilitres, the total amount of milk the trader bought.
7. Forty five jerry cans of capacity 20 litres each fill a water tank. Find in millilitres, the capacity of the tank.
8. Mubisi bought 9 litres of honey. The honey was shared among his two children. How much honey in millilitres did each get?
9. Eight people shared 1 litre of cooking oil. How many millilitres did each get?
10. The total amount of water in 5 similar bottles is 3 litres. Find in millilitres, the capacity of each bottle.

Changing millilitres to litres.

Example 1

Change 7000 millilitres.

$$1000\text{ml} = 1 \text{ litre}$$

$$7000\text{ml} = \frac{7000}{1000} \text{ litres}$$

$$7000\text{ml} = 7 \text{ litres}$$

Example 2

Express 250 millilitres as litres

$$1000\text{ml} = 1 \text{ litre}$$

$$250\text{ml} = \frac{250}{1000} \text{ litres}$$

$$250\text{ml} = 0.25 \text{ litres}$$

Example 3

Kadogo bought seven 500ml bottles of soda. How many litres of soda did he buy?

$$7 \times 500\text{ml} = 3500\text{ml}$$

$$1000\text{ml} = 1 \text{ litre}$$

$$3500\text{ml} = \frac{3500}{1000} \text{ litres}$$

$$3500\text{ml} = 3.5 \text{ litres}$$

TOPIC 10: LENGTH, MASS AND CAPACITY



Exercise.

- Change each of the following into litres.
 - 400ml
 - 900ml
 - 600ml
 - 1200ml
 - 650ml
 - 400ml
 - 300ml
 - 240ml
 - 750ml
- A tin holds 20,000ml. How many litres does it hold?
- Alex's cow produced 1500ml of milk on the first day, 4500ml on the second day and 6,000ml on the third day. Find in litres, the amount of milk the cow produced in the three days.
- A motorcycle consumes 450 millilitres of petrol in 1km. How many litres of petrol will it consume in 6km?
- Kabisi makes 4000 millilitres of juice every day.
 - How many litres of juice does he make every day?
 - How many litres of juice does he make in 2 weeks?
- Thirty five cups of 400 millilitres were obtained from a full milk can. Find in litres, the capacity of the can.
- A petrol station sold 350000 millilitres of diesel, 640000 millilitres of petrol and 480000 millilitres of paraffin. How many litres of fuel were sold altogether?
- Jackie prepared 4 litres of tea. She sold the tea using 9 small cups of 250 millilitres. How many litres of tea remained?

Changing litres to cm³.

Note

1ml = 1cm³, 1 litre = 1000ml. So, 1 litre = 1000cm³

Example 1

Change 72 litres into cm³.

$$1 \text{ litre} = 1000\text{cm}^3$$

$$72 \text{ litres} = 72 \times 1000\text{cm}^3$$

$$72 \text{ litres} = 72000\text{cm}^3$$

Example 2

Convert 6.5 litres into cm³.

$$1 \text{ litre} = 1000\text{cm}^3$$

$$6.5 \text{ litres} = \frac{65}{10} \times 1000\text{cm}^3$$

$$6.5 \text{ litres} = (65 \times 100)\text{cm}^3$$

$$6.5 \text{ litres} = 6500\text{cm}^3$$

Example 3

Express $12\frac{1}{2}$ litres as cm³.

$$1 \text{ litre} = 1000\text{cm}^3$$

$$12\frac{1}{2} \text{ litres} = \frac{25}{2} \times 1000\text{cm}^3$$

$$12\frac{1}{2} \text{ litres} = (25 \times 500)\text{cm}^3$$

$$12\frac{1}{2} \text{ litres} = 12500\text{cm}^3$$

TOPIC 10: LENGTH, MASS AND CAPACITY



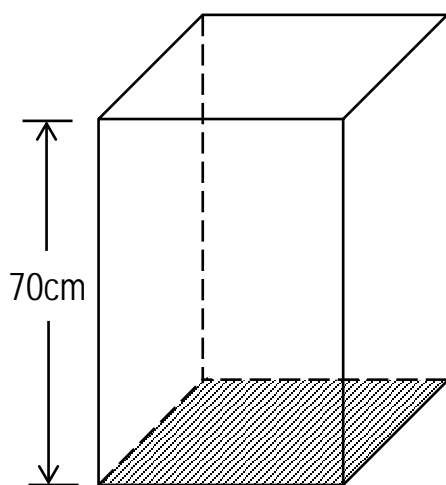
Exercise

- Change to cubic centimetres (cm^3)
 - 6 litres
 - 2 litres
 - 4 litres
 - 12 litres
 - 240 litres
 - 630 litres
 - 7248 litres
 - 15.4 litres
 - 8.8 litres
 - 17.25 litres
 - $6\frac{1}{4}$ litres
 - $26\frac{3}{5}$ litres
- A tank holds 45 litres. Find its volume in cm^3 .
- A tap draws 2.5 litres of water in one minutes. Find in cm^3 , the volume of water it draws in 4 minutes.
- Forty cups of the same size fill a container. Each cup holds 0.75 litres of water. Find in cubic centimetres the volume of the container.

More problems involving changing litres to cubic centimetres

Example 1

The tank below holds 122.5 litres of water when full. Find the area of the shaded part.



Volume of the tank

$$122.5 \times 1000\text{cm}^3 = \frac{1225}{10} \times 1000\text{cm}^3$$

$$= (1225 \times 100)\text{cm}^3$$

$$= 122500\text{cm}^3$$

Base area of the tank

$$\text{Base area} = \frac{\text{Volume}}{\text{Height}}$$

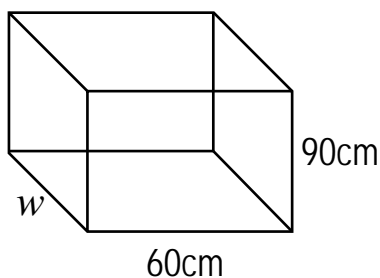
$$\text{Base area} = \frac{122500\text{cm}^3}{70\text{cm}}$$

$$\text{Base area} = \frac{122500\text{cm} \times \text{cm} \times \text{cm}}{70\text{cm}}$$

$$\text{Base area} = 1750\text{cm}^2$$

Example 2

The tank below contains 162 litres of water. Find the value of w .



Volume

$$162 \times 1000\text{cm}^3 = 162000\text{cm}^3$$

Value of w

$$l \times w \times h = V$$

$$60\text{cm} \times w \times 90\text{cm} = 162000\text{cm}^3$$

$$5400\text{cm}^2 \times w = 162000\text{cm}^3$$

$$\frac{5400\text{cm} \times \text{cm} \times w}{5400\text{cm} \times \text{cm}} = \frac{162000\text{cm} \times \text{cm} \times \text{cm}}{5400\text{cm} \times \text{cm}}$$

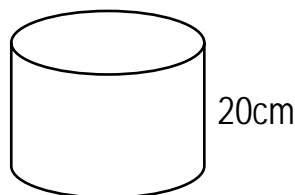
$$w = 30\text{cm}$$

TOPIC 10: LENGTH, MASS AND CAPACITY



Example 3

The tin below holds 3.08 litres. Find the radius of the tin. (Use $\pi = \frac{22}{7}$)



Volume of the tin in cm^3

$$1 \text{ litre} = 1000\text{cm}^3$$

$$6.5 \text{ litres} = \frac{65}{10} \times 1000\text{cm}^3$$

$$6.5 \text{ litres} = (65 \times 100)\text{cm}^3$$

$$6.5 \text{ litres} = 6500\text{cm}^3$$

Radius of the tin

$$\pi r^2 \times h = A$$

$$\frac{22}{7} \times r^2 \times 20\text{cm} = 3080\text{cm}^3$$

$$7 \times \frac{440\text{cm}}{7} r^2 = 3080\text{cm}^3 \times 7$$

$$\frac{440\text{cm} \times r^2}{440\text{cm}} = \frac{3080\text{cm} \times \text{cm} \times \text{cm} \times 7}{440\text{cm}}$$

$$r^2 = 7\text{cm}^2 \times 7$$

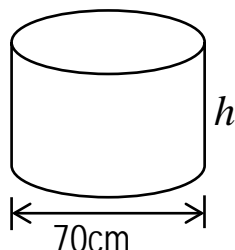
$$r^2 = 49\text{cm}^2$$

$$\sqrt{r^2} = \sqrt{49\text{cm}^2}$$

$$r = 7\text{cm}$$

Example 4

77 small jerry cans of 8 litres each were filled with water. The water was poured in the water tank shown in the figure below. Find the height of water in the tank. (Use $\pi = \frac{22}{7}$)



Radius

$$70\text{cm} \div 2 = 35\text{cm}$$

Height of water in the tank

$$\text{Base area} \times \text{height} = \text{Volume}$$

$$\pi r^2 \times h = \text{Volume}$$

$$\frac{22}{7} \times 35\text{cm} \times 35\text{cm} \times h = 616000\text{cm}^3$$

$$22 \times 5\text{cm} \times 35\text{cm} \times h = 616000\text{cm}^3$$

$$3850\text{cm}^2 \times h = 616000\text{cm}^3$$

$$\frac{3850\text{cm} \times \text{cm} \times h}{3850\text{cm} \times \text{cm}} = \frac{616000\text{cm} \times \text{cm} \times \text{cm}}{3850\text{cm} \times \text{cm}}$$

$$h = 160\text{cm}$$

Volume of the tank in litres

$$77 \times 8 = 616 \text{ litres}$$

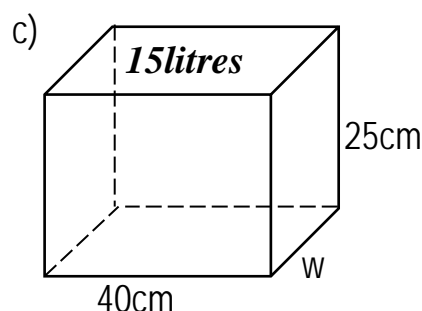
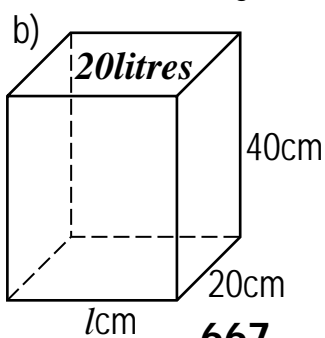
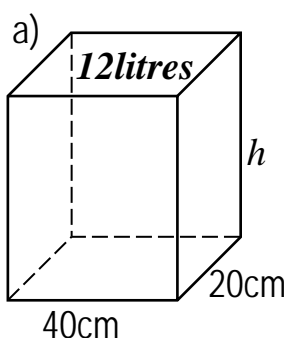
Volume of the tank in cm^3

$$616 \times 1000\text{cm}^3$$

$$616000\text{cm}^3$$

Exercise

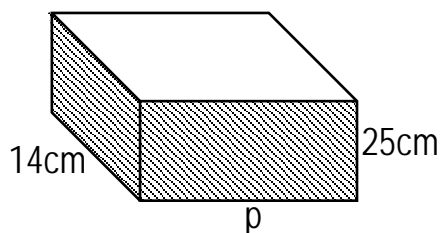
1. The volume in litres of each container is given. Find the unknown side.



TOPIC 10: LENGTH, MASS AND CAPACITY

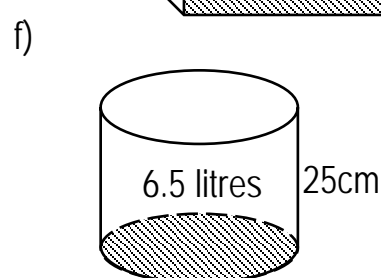
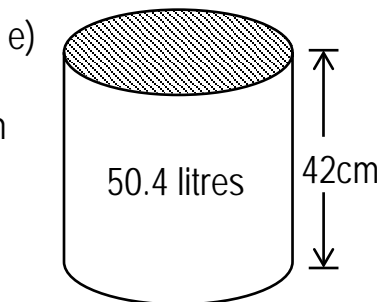
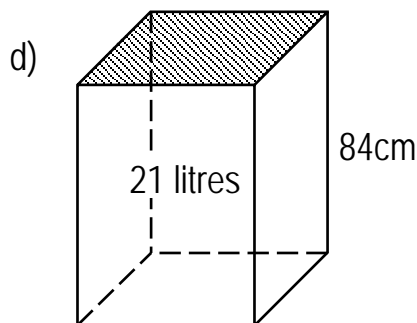
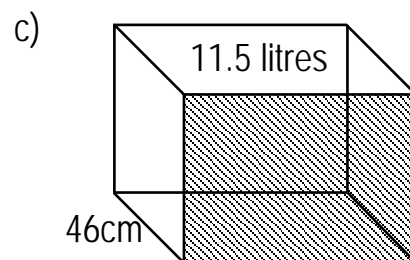
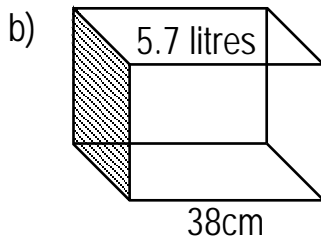
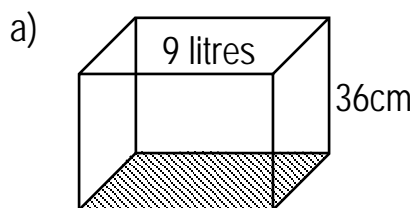


2. The container below holds 10.5 litres of water. Two of its faces are shaded.

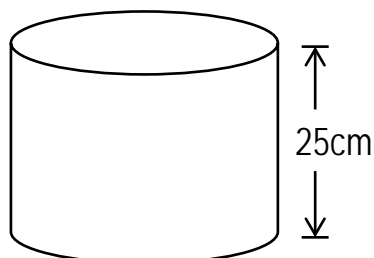


- Find its volume in cubic centimetres.
- Find the value of p .
- Calculate the area of the shaded part.

3. The capacity of each tank is given. Find the area of the shaded part.

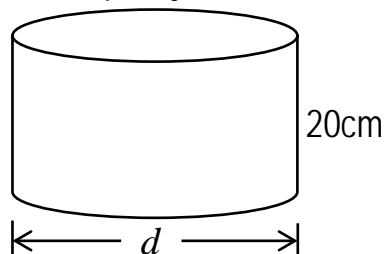


4. The cylindrical tin below holds 15.4 litres of water.



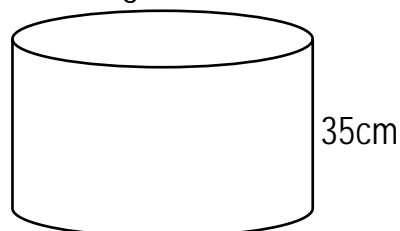
- Find the base area of the tank.
- Find the radius of the tank.

5. The capacity of the container below is 0.77 litres.



- Find its base area.
- Find the value of d .

6. The drum below holds 44 litres when completely full of water. It was cut open to form a rectangular door sheet

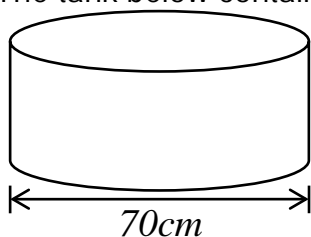


- Find the radius of the drum.
- Calculate the area of the door sheet.

TOPIC 10: LENGTH, MASS AND CAPACITY

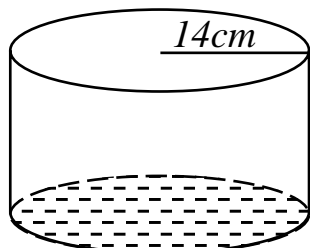


7. The tank below contains 154 litres of water. (Use $\pi = \frac{22}{7}$)



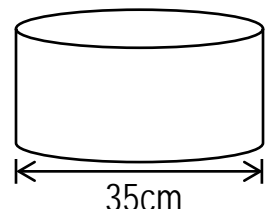
- Calculate the base area of the tank.
- Find the height of water in the tank

8. The tin below contains 30.8 litres of cooking oil. (Use $\pi = \frac{22}{7}$)



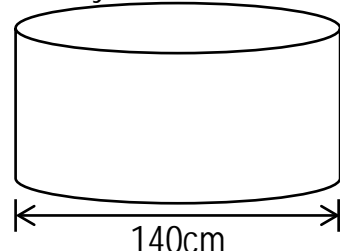
- Find the area of the shaded part
- Find the value of h.

9. The tank below holds 77 litres of milk. (Use $\pi = \frac{22}{7}$)



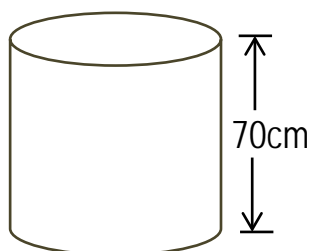
Find the height of the tank .

10. Seventy seven tins of 16 litres each fill the tank below. (Use $\pi = \frac{22}{7}$)



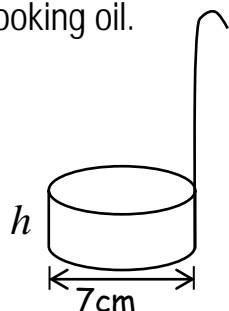
- Find the base area of the tank.
- Find the height of water in the tank .

11. Five full tins fill the tank below with water. Each tin holds 17.6 litres.



Find the radius of the tank. (Use $\pi = \frac{22}{7}$)

12. The diagram below represents a container which a shop keeper uses to sell cooking oil.



On a certain day, the shopkeeper sold 15.4 litres of cooking oil using 20 full containers. Find the height of the container.

(Use $\pi = \frac{22}{7}$)

TOPIC 10: LENGTH, MASS AND CAPACITY



Changing cubic centimetres into litres

Example 1

Change 450cm^3 to litres.

$$1000\text{cm}^3 = 1 \text{ litre}$$

$$450\text{cm}^3 = \frac{450}{1000} \text{ litres}$$

$$450\text{cm}^3 = 0.45 \text{ litres}$$

Example 2

Convert $13,000\text{cm}^3$ into litres.

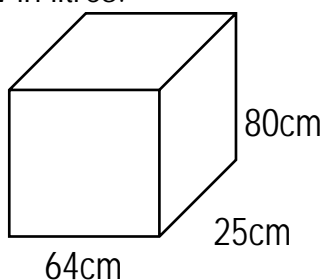
$$1000\text{cm}^3 = 1 \text{ litre}$$

$$13000\text{cm}^3 = \frac{13000}{1000} \text{ litres}$$

$$13000\text{cm}^3 = 13 \text{ litres}$$

Example 3

Calculate the volume of the tank below in litres.



Volume in cm^3

$$V = l \times w \times h$$

$$V = 64\text{cm} \times 25\text{cm} \times 80\text{cm}$$

$$V = 128000\text{cm}^3$$

Volume in litres (Capacity)

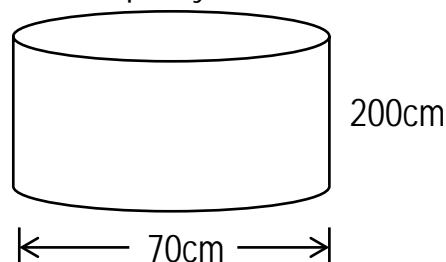
$$1000\text{cm}^3 = 1 \text{ litre}$$

$$128000\text{cm}^3 = \frac{128000}{1000} \text{ litres}$$

$$128000\text{cm}^3 = 128 \text{ litres}$$

Example 4

Calculate the capacity of the tank below.



$$\begin{aligned} \text{Radius} &= 70\text{cm} \div 2 \\ &= 35\text{cm} \end{aligned}$$

$$\text{Volume} = \pi r^2 \times h$$

$$\text{Volume} = \frac{22}{7} \times 35\text{cm} \times 35\text{cm} \times 200\text{cm}$$

$$\text{Volume} = 770000\text{cm}^3$$

Capacity

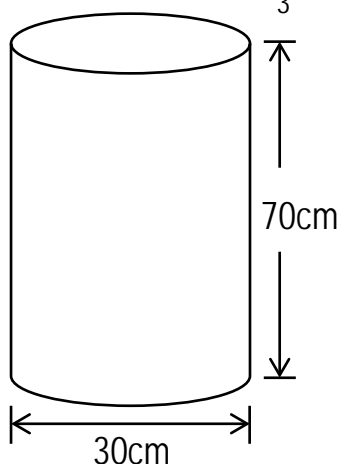
$$1000\text{cm}^3 = 1 \text{ litre}$$

$$770000\text{cm}^3 = \frac{770000}{1000} \text{ litres}$$

$$770000\text{cm}^3 = 770 \text{ litres}$$

Example 5

The tank below is $\frac{2}{3}$ full of water. How many litres of water are in the tank?



$$\begin{aligned} \text{Radius} &= 30\text{cm} \div 2 \\ &= 15\text{cm} \end{aligned}$$

Volume of the tank

$$V = \pi r^2 \times h$$

$$V = \frac{22}{7} \times 15\text{cm} \times 15\text{cm} \times 70\text{cm}$$

$$V = 22 \times 15\text{cm} \times 15\text{cm} \times 10\text{cm}$$

$$V = 49500\text{cm}^3$$

Volume of water in the tank

$$\frac{2}{3} \times 49500\text{cm}^3 = 33000\text{cm}^3$$

Litres of water in the tank

$$1000\text{cm}^3 = 1 \text{ litre}$$

$$33000\text{cm}^3 = \frac{33000}{1000} \text{ litres}$$

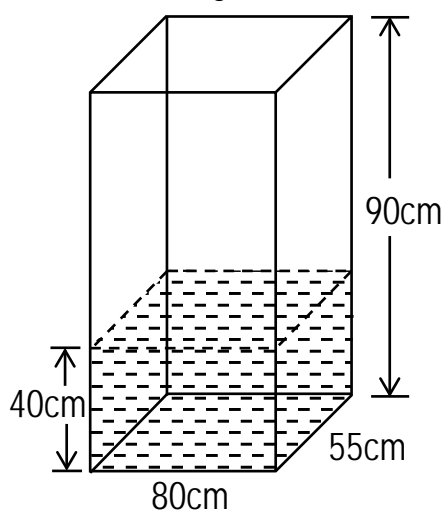
$$33000\text{cm}^3 = 33 \text{ litres}$$

TOPIC 10: LENGTH, MASS AND CAPACITY



Example 6

Below is a rectangular tank. How many litres are needed to fill the tank.



Height of water needed

$$90\text{cm} - 40\text{cm} = 50\text{cm}$$

Volume of water needed to fill the tank

$$V = l \times w \times h$$

$$V = 80\text{cm} \times 55\text{cm} \times 50\text{cm}$$

$$V = 220000\text{cm}^3$$

Litres of water needed to fill the tank

$$1000\text{cm}^3 = 1 \text{ litre}$$

$$220000\text{cm}^3 = \frac{220000}{1000} \text{ litres}$$

$$220000\text{cm}^3 = 220 \text{ litres}$$

Exercise

1. Convert into litres.

a) 6000cm^3

b) 17000cm^3

c) 48900cm^3

d) 20000cm^3

e) 150cm^3

f) 720cm^3

g) 88cm^3

h) 9cm^3

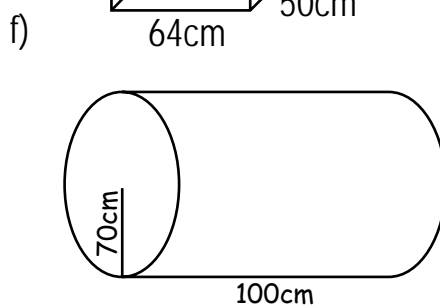
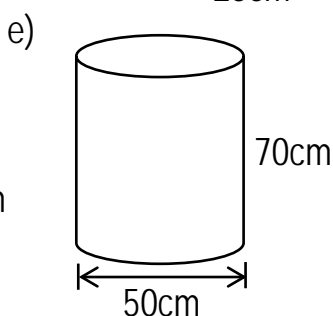
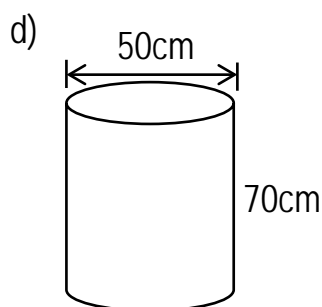
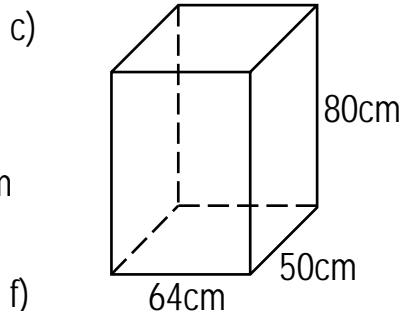
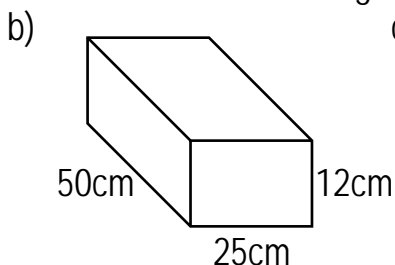
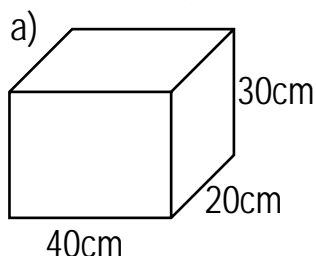
i) 286.5cm^3

j) 76.8cm^3

k) 200.9cm^3

1000.6cm^3

2. Find in litres, the volume of each of the following water tanks.



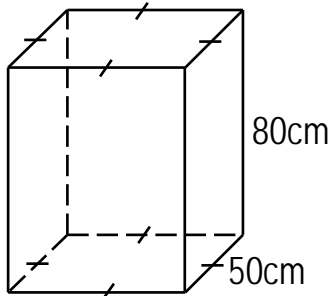
3. Odyeri has three rectangular tanks; A, B, and C. Complete the table below.

Tank	Length	Width	Height	Volume in litres
A	40cm	25cm	20cm	_____
B	_____	30cm	40cm	_____
C	36cm	24cm	_____	64.8
Total capacity				138.8

TOPIC 10: LENGTH, MASS AND CAPACITY

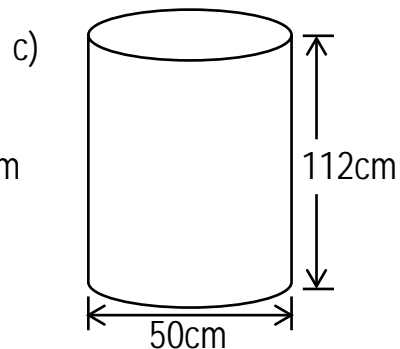
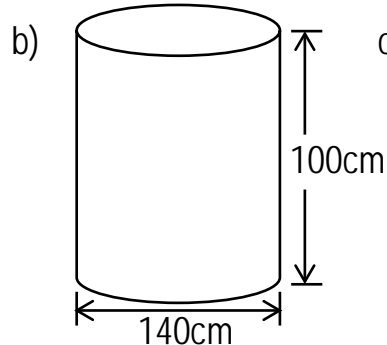
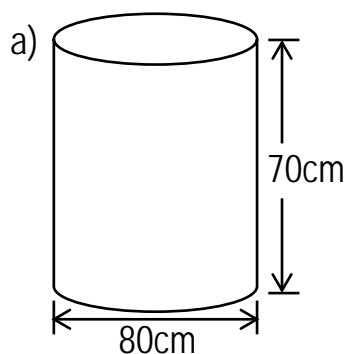


4. A rectangular tank measures 80cm by 75cm by 50cm.
 - a) Calculate its volume in cm^3 .
 - b) How many litres of water does it hold when full?
5. Find the number of litres that can fill a rectangular tank 75cm by 60cm by 90 cm .
6. Below is a water tank.

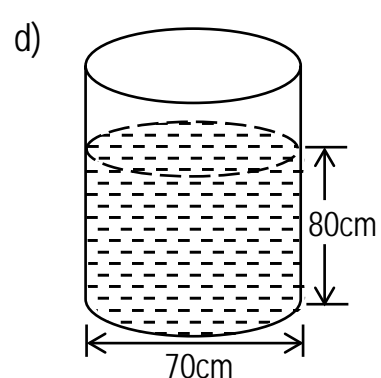
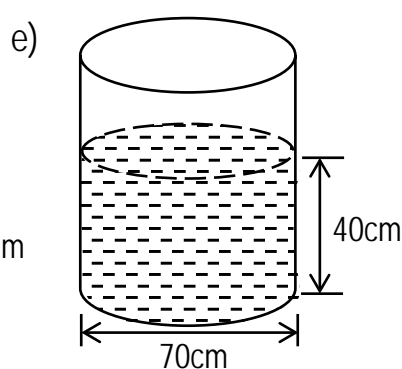
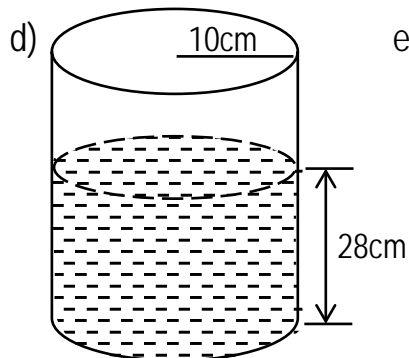
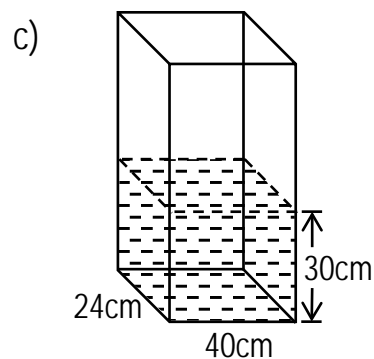
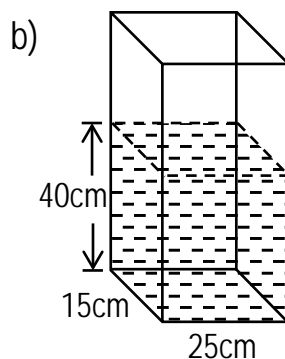
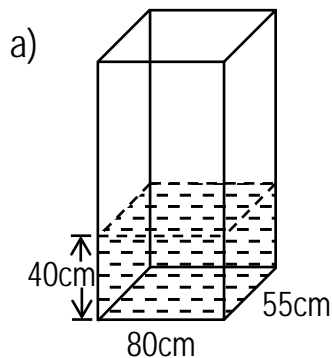


- a) Calculate its base area.
- b) Find in cm^3 , the volume of the tank.
- c) How many litres does it hold when $\frac{3}{4}$ full?

7. Find the capacity of each container in litres.



8. Find the amount of water in each container.

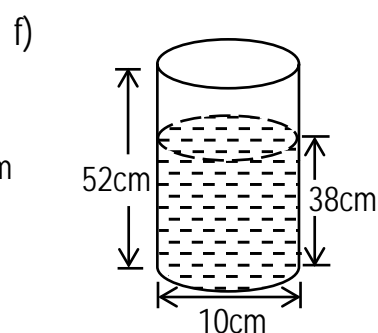
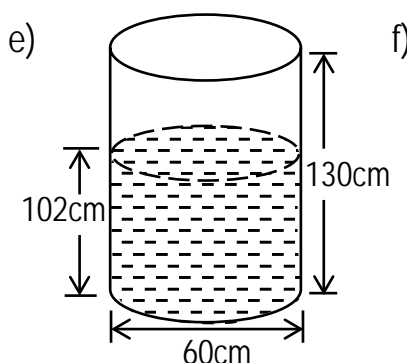
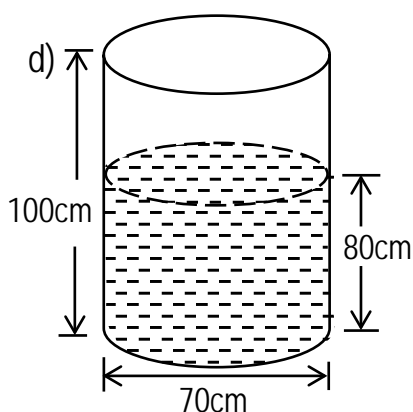
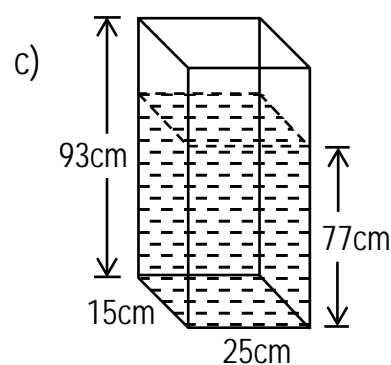
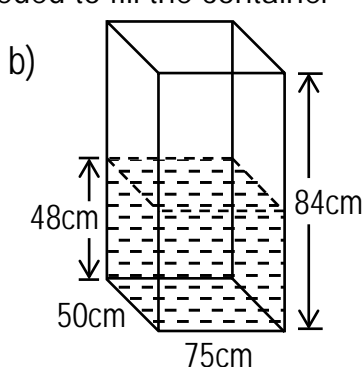
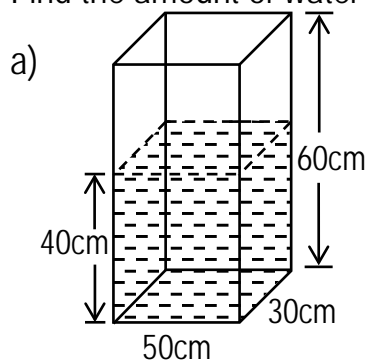


9. A 90cm by 70cm by 150cm rectangular tank is five sixths full of water. Find in litres, the amount of water in the tank.

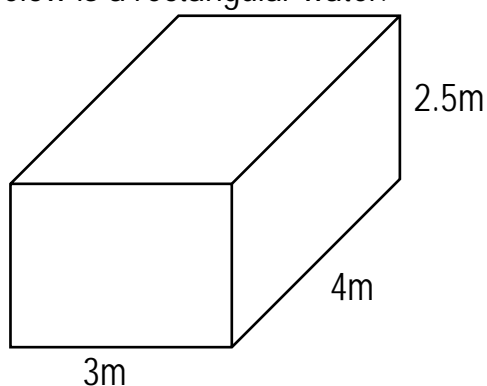
TOPIC 10: LENGTH, MASS AND CAPACITY



10. Find the amount of water needed to fill the container



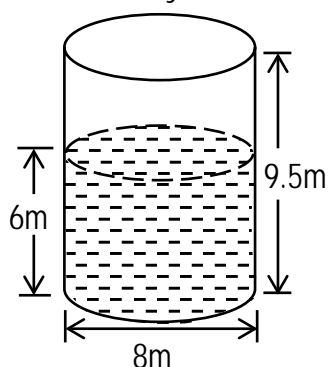
11. Below is a rectangular water.



- Find its volume in cm^3 .
- Calculate its capacity.

12. Find the capacity of a rectangular tank 5m by 4.5m by 6m.

13. Below is a cylindrical water tank.



- Find the radius of the tank in centimetres.
- How many litres of water are needed to fill the tank?

14. A cylindrical fuel tank of radius 120cm and height 280cm is two thirds full of petrol. Find in litres the amount of petrol needed to fill the tank.

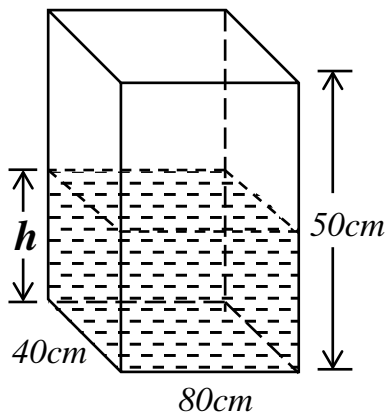
TOPIC 10: LENGTH, MASS AND CAPACITY



Problems involving changing litres to cubic centimetres and vice versa

Example 1

The tank below contains 96 litres of water.



a) Find the value of h .

Volume of water in the tank

$$96 \times 1000\text{cm}^3 = 96000\text{cm}^3$$

Value of h

$$l \times w \times h = V$$

$$80\text{cm} \times 40\text{cm} \times h = 96000\text{cm}^3$$

$$3200\text{cm}^2 \times h = 96000\text{cm}^3$$

$$\frac{3200\text{cm} \times \text{cm} \times h}{3200\text{cm} \times \text{cm}} = \frac{96000\text{cm} \times \text{cm} \times \text{cm}}{3200\text{cm} \times \text{cm}}$$

$$3200\text{cm} \times \text{cm} \quad 3200\text{cm} \times \text{cm}$$

$$h = 30\text{cm}$$

b) How much water is needed to fill the tank?

Height of water needed to fill the tank

$$50\text{cm} - 30\text{cm} = 20\text{cm}$$

Volume of water needed to fill the tank

$$V = l \times w \times h$$

$$V = 80\text{cm} \times 40\text{cm} \times 20\text{cm}$$

$$V = 64000\text{cm}^3$$

Amount of water needed to fill the tank

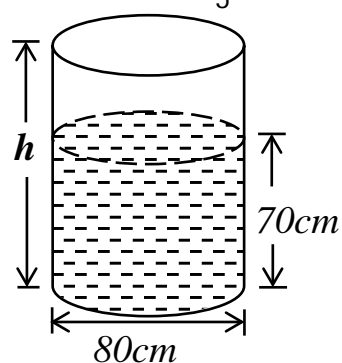
$$1000\text{cm}^3 = 1 \text{ litre}$$

$$64000\text{cm}^3 = \frac{64000}{1000} \text{ litres}$$

$$64000\text{cm}^3 = 64 \text{ litres}$$

Example 2

The tank below is $\frac{2}{3}$ full of water.



a) Find the value of h .

$$\frac{2}{3} \times h = 70\text{cm}$$

$$3 \times \frac{2h}{3} = 70\text{cm} \times 3$$

$$\frac{2h}{2} = \frac{210\text{cm}}{2}$$

$$h = 105\text{cm}$$

b) How much water is needed to fill the tank.

Height of water needed to fill the tank

$$105\text{cm} - 70\text{cm} = 35\text{cm}$$

Volume of water needed to fill the tank

$$V = \pi r^2 h$$

$$V = \frac{22}{7} \times \frac{80\text{cm}}{2} \times \frac{80\text{cm}}{2} \times 35\text{cm}$$

$$V = 22 \times 40\text{cm} \times 40\text{cm} \times 5\text{cm}$$

$$V = 176000\text{cm}^3$$

Amount of water needed to fill the tank

$$1000\text{cm}^3 = 1 \text{ litre}$$

$$176000\text{cm}^3 = \frac{176000}{1000} \text{ litres}$$

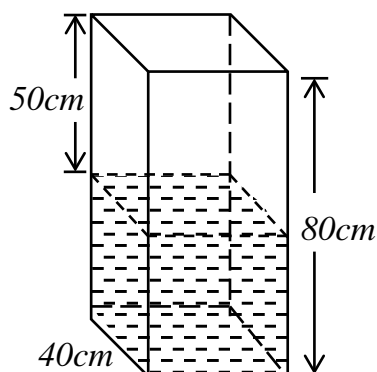
$$176000\text{cm}^3 = 176 \text{ litres}$$

TOPIC 10: LENGTH, MASS AND CAPACITY



Example 3

There are 72 litres of water in the tank below.



a) Find the length of the tank

Volume of water in the tank

$$72 \times 1000\text{cm}^3 = 72000\text{cm}^3$$

Height of water in the tank

$$80\text{cm} - 50\text{cm} = 30\text{cm}$$

Length of the tank

$$l \times w \times h = V$$

$$l \times 40\text{cm} \times 30\text{cm} = 72000\text{cm}^3$$

$$l \times 1200\text{cm}^2 = 72000\text{cm}^3$$

$$\frac{l \times 1200\text{cm}^2}{1200\text{cm}^2} = \frac{72000\text{cm}^3}{1200\text{cm}^2}$$

$$l = 60\text{cm}$$

Length = 60cm

b) Find the capacity of the tank.

Volume of the tank

$$V = l \times w \times h$$

$$V = 60\text{cm} \times 40\text{cm} \times 80\text{cm}$$

$$V = 192000\text{cm}^3$$

Capacity of the tank

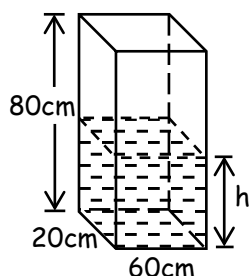
$$1000\text{cm}^3 = 1 \text{ litre}$$

$$192000\text{cm}^3 = \frac{192000}{1000} \text{ litres}$$

$$192000\text{cm}^3 = 192 \text{ litres}$$

Exercise

1. The tank below contains 36 litres of water.

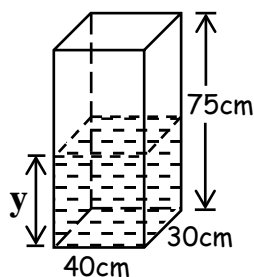


a) Find the value of h.

b) How many litres does the tank hold when completely full?

c) Calculate the amount of water needed to fill the tank.

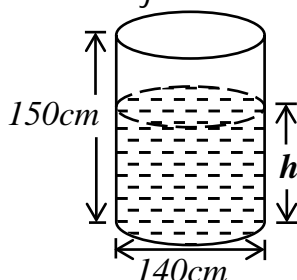
2. The tank below contains 72 litres of water.



a) Find the value of y.

b) How many litres are needed to fill the tank?

3. The cylindrical tank below contains 1540 litres of water.



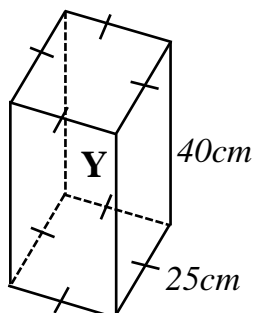
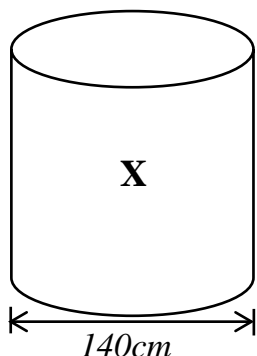
a) Find the value of h.

b) How many litres are needed to fill the tank?

TOPIC 10: LENGTH, MASS AND CAPACITY

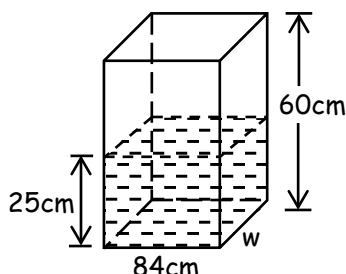


4. Tank X was filled with 1320 litres of petrol. Some petrol was sold using 22 jerry cans of size Y. Study the figures carefully and use them to answer the questions that follows.



Find the height of the remaining petrol in tank X.

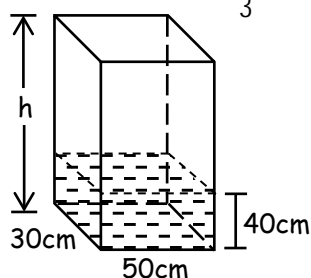
5. The rectangular tank below contains 105 litres of water. Use it to answer questions that follow.



a) Find the value of w.

b) How much water is needed to make the tank $\frac{2}{3}$ full?

6. The tank below is $\frac{1}{3}$ full of water.

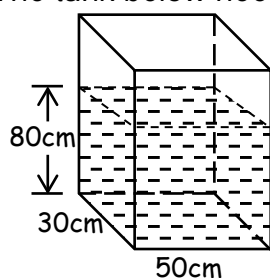


a) How many litres are in the tank?

b) Find the value of h.

c) Calculate the amount of water needed to fill the tank

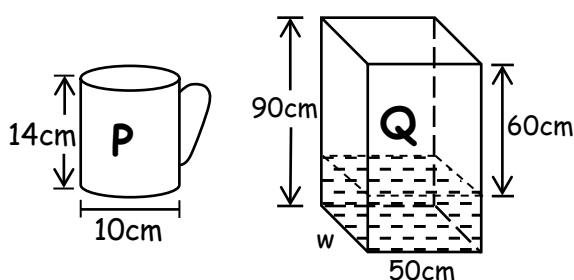
7. The tank below needed 30 litres of water to become full.



a) Find the height of the tank.

b) Calculate the amount of water needed to fill the tank after drawing 16 full five litre jerry cans.

8. Muiyiwa poured 30 full cups of water of size P into rectangular container of size Q. The height of the container not covered by water was 60cm.



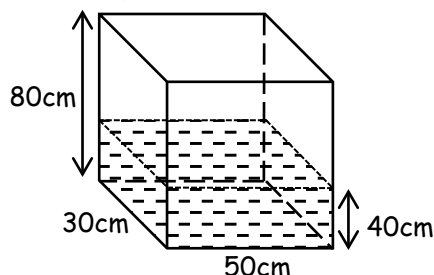
a) Find the width of the tank.

b) Calculate the number of litres that can fill the tank.

TOPIC 10: LENGTH, MASS AND CAPACITY

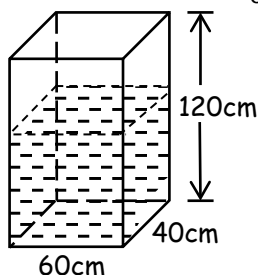


9. The tank below contains water up to the height of 40cm. It is a third full of water.
If Magato pours more water in the tank, only 15 litres will be needed to fill the tank.



Find the new height of water in the tank.

10. The tank below is $\frac{5}{8}$ full of water.



- How many litres of water are in the tank?
- Kadama used 84 litres of water, find the new water level.

Changing cubic metres into litres and vice versa

Example 1

Change 14m^3 into litres.

m^3 to cm^3

$$1\text{m} \times 1\text{m} \times 1\text{m} = 100\text{cm} \times 100\text{cm} \times 100\text{cm}$$

$$1\text{m}^3 = 1000000\text{cm}^3$$

$$14\text{m}^3 = 14 \times 1000000\text{cm}^3$$

$$14\text{m}^3 = 14000000\text{cm}^3$$

cm^3 to litres

$$1000\text{cm}^3 = 1 \text{ litre}$$

$$14000000\text{cm}^3 = \frac{14000000}{1000} \text{ litres}$$

$$14000000\text{cm}^3 = 14000 \text{ litres}$$

Example 2

Change 25 litres into cubic metres.

Litres to cm^3

$$1 \text{ litre} = 1000\text{cm}^3$$

$$25 \text{ litres} = 25 \times 1000\text{cm}^3$$

$$25 \text{ litres} = 25000\text{cm}^3$$

cm^3 to m^3

$$100\text{cm} \times 100\text{cm} \times 100\text{cm} = 1\text{m} \times 1\text{m} \times 1\text{m}$$

$$1000000\text{cm}^3 = 1\text{m}^3$$

$$25000\text{cm}^3 = \frac{25000}{1000000}\text{m}^3$$

$$25000\text{cm}^3 = 0.025\text{m}^3$$

Exercise

1. Change the following into litres.

a) 8m^3

d) 0.75m^3

g) $2\frac{1}{2}\text{m}^3$

b) 7m^3

e) 0.12m^3

h) $\frac{3}{4}\text{m}^3$

c) 16m^3

f) 0.004m^3

i) $1\frac{2}{5}\text{m}^3$

2. A rectangular water tank is 3m by 2.5m by 5m.

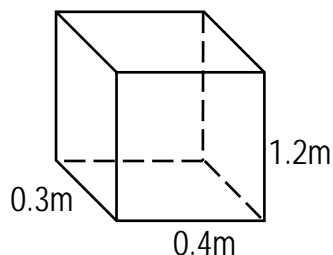
a) Calculate its volume in cubic centimetres.

b) How many litres of water does it hold when full?

TOPIC 10: LENGTH, MASS AND CAPACITY

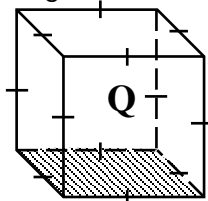


3. Study the figure below and use it to answer questions that follow.



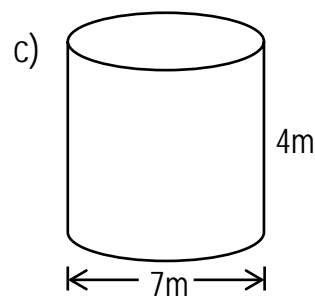
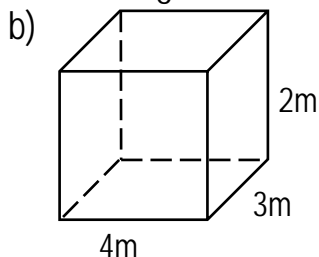
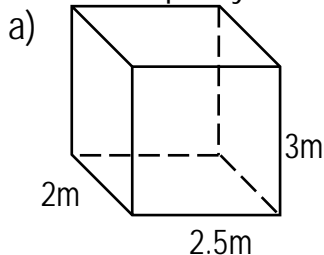
- Find its volume.
- Calculate its capacity.

4. The figure below represents tank Q. The area of the shaded part is 16m^2 .

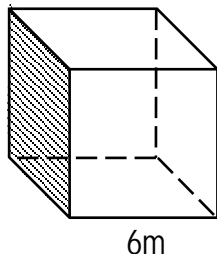


- Find in m^3 , the volume of the tank.
- How much water does it hold when $\frac{3}{4}$ full?

5. Find the capacity of each of the following containers.

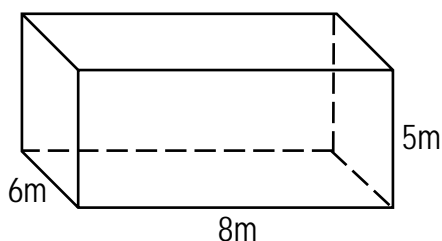


6. The area of the shaded part in the figure below is $2\frac{1}{2}\text{m}^2$.



- Find the volume of the tank.
- Calculate the amount of water the tank holds when $\frac{5}{6}$ full.

7. Below is a rectangular underground tank.



- Find the volume of the tank in m^3 .
- Calculate the capacity of the tank.

8. Change the following into cubic metres.

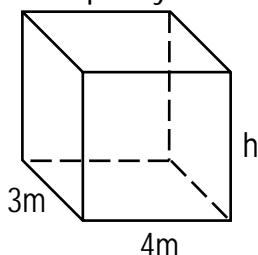
- | | | |
|----------------|---------------|---------------|
| a) 16000litre | d) 250 litres | g) 17 litres |
| b) 9000 litres | e) 731 litres | h) 3 litres |
| c) 5000 litres | f) 900 litres | i) 7.5 litres |

9. Find the cubic metres, the volume of a tank which holds 350 litres of water.

TOPIC 10: LENGTH, MASS AND CAPACITY

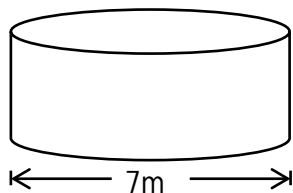


10. The capacity of the tank below is 24000 litres.



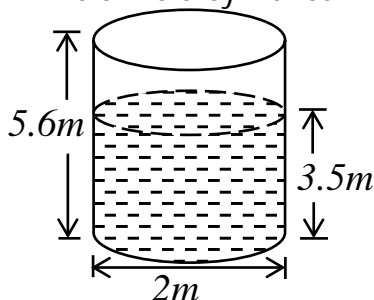
- Find the value of h .
- Calculate its total surface area.

11. The tank below contains 30800 litres of water.



- Find the base area of the tank. (Use $\pi = \frac{22}{7}$)
- Find in metres, the height of the tank.

12. Below is a cylindrical water tank with water 3.5m high.



How much water is needed to fill the tank? (Use $\pi = \frac{22}{7}$)

Comparing capacity by division

Example 1

How many three quarter litre bottle can fill a 15 litre container?

$$15 \div \frac{3}{4}$$

$$15 \times \frac{4}{3}$$

$$5 \times 4$$

$$20 \text{ bottles}$$

Example 2

Akiki sold 9 litres of milk using 750ml containers. How many full containers of milk did she sell?

$$1 \text{ litre} = 1000\text{ml}$$

$$9 \text{ litres} = 9 \times 1000\text{ml}$$

$$9 \text{ litres} = 9000\text{ml}$$

Number of containers

$$9000 \div 750 = 12 \text{ containers}$$

Example 3

Manku has a rectangular container whose base area was 250cm^2 . The height of the juice in the container is 32cm. Find the number of full 500ml bottles that can be obtained from the juice.

$$\text{Volume} = \text{Base area} \times \text{height}$$

$$\text{Volume} = 250\text{cm}^2 \times 32\text{cm}$$

$$\text{Volume} = 8000\text{cm}^3$$

cm³ to ml

$$1\text{cm}^3 = 1\text{ml}$$

$$8000\text{cm}^3 = 8000\text{ml}$$

Number of bottles

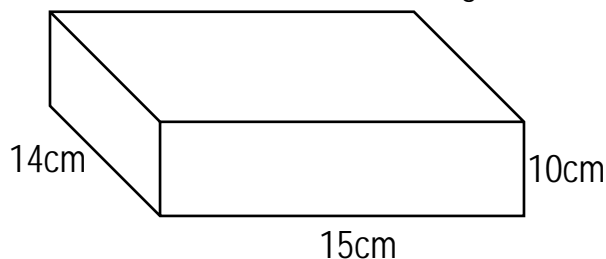
$$8000\text{ml} \div 500\text{ml} = 16 \text{ bottles}$$

TOPIC 10: LENGTH, MASS AND CAPACITY



Example 4

A trader bought 46.2 litres of milk and sold it using the container whose size is shown below.



If she sold each full container at sh. 3400, find the total amount of money she got after selling the milk.

Volume of the milk	Volume of the container	Number of containers
$46.2 \times 1000\text{cm}^3$	$V = l \times w \times h$	$46200\text{cm}^3 \div 2100\text{cm}^3 = 22 \text{ containers}$
$\frac{462}{10} \times 1000\text{cm}^3$	$V = 15\text{cm} \times 14\text{cm} \times 10\text{cm}$	Amount of money
46200cm^3	$V = 2100\text{cm}^3$	$22 \times \text{sh. } 3400 = \text{sh. } 74,800$

Exercise

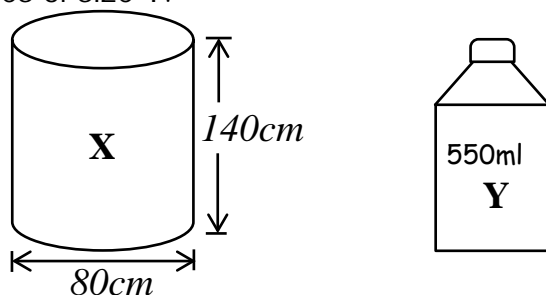
- Find the number of a quarter litre bottles that can fill a twenty litre jerry can.
- How many two third litre containers can be obtained from 12 litres?
- Bontwe's car consumes 250ml of petrol to cover 1 kilometre. How far does it go if it consumes 12 litres of petrol?
- A tap connected to a water tank draws 450ml of water per second. After how many minutes will it draw 54 litres?
- A pen manufacturing factory produced 4.8 litres of ink. The ink was used to make pens of ink 1.2 millilitres
 - How many pens were made altogether ?
 - If a box packs 50 pens, how many boxes were used to pack all the pens?
- Mrs. Muliro prepared 22.5 litres of porridge . She sold all the porridge using cups of 450ml at sh. 500 each.
 - How many full cups of porridge did she sell altogether?
 - How much money did she get?
- Njuki bought 15 litres of honey at sh. 30,000. He later sold the honey using 750 ml bottles at sh. 18750 each . Calculate the profit he got .
- A 12.5 litre bucket of milk was emptied using bottles of 500ml each. How many full bottles were used?
- How many full $\frac{1}{8}$ litre containers of water fill a 32000ml bucket?
- A milk seller has 30.8 litres of milk in her big container. She sells it using a small container of diameter 14cm and height 10cm. Find the number of small containers he obtained from all the milk. (Use $\pi = \frac{22}{7}$)

TOPIC 10: LENGTH, MASS AND CAPACITY



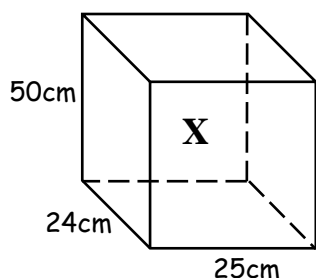
11. A tank had 48,000 litres of water. When some water was sold using 20 litre jerry cans, 12000 litres remained.
- How many full jerry cans were sold
 - If each jerry can was sold at sh. 200. How much money was collected altogether.

12. Container X was filled with drinking water which was later served to guests using bottles of size Y.



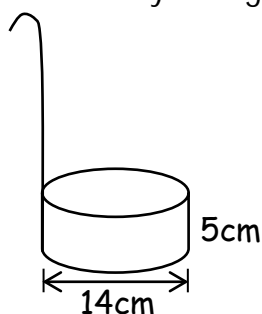
How many full bottles of water were served to guests? (Use $\pi = \frac{22}{7}$)

14. Suzan has container X full of passion fruit juice. She sells the juice using a small container of 600ml at sh. 500 each.



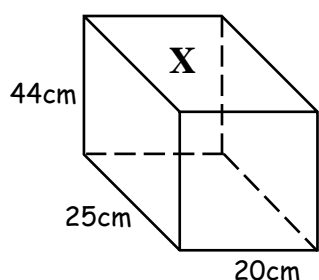
How much will she get if she is to sell all the juice in container X?

15. Mr. Butto had 46.2 litres of cooking oil. He sold the cooking oil using a container represented by the figure below.



- How many containers did he sell? (Use $\pi = \frac{22}{7}$)
- If each container was sold at sh 200, how much money did he get?

16. Eddy spent sh. 25,000 to make liquid soap that fills the container below. He sold all the liquid soap using 550ml bottles at sh. 1000 each.

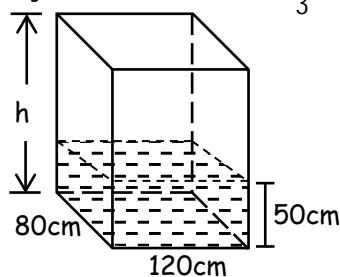


- How many full bottles did he sell?
- Calculate the profit he made.

TOPIC 10: LENGTH, MASS AND CAPACITY

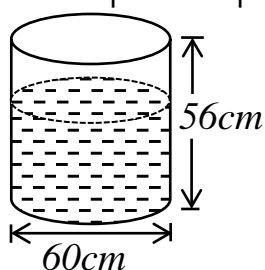


17. The tank below was completely full of water. When some water was sold using 15 litre jerry cans, it became $\frac{1}{3}$ full.



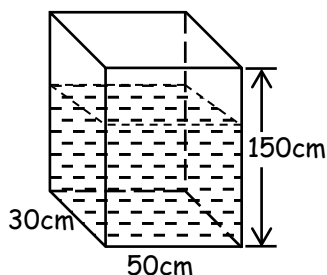
- Find the value of h .
- If each full jerry can was sold at sh 150, how much money was collected altogether?

18. The tank below is $\frac{3}{4}$ full of water. A tap that draws 990ml per minutes is connected to it. If the tap is left open.



- Find the amount of water in the tank after 40 minutes.
- How long will it take to empty the tank?

19. The tank below contains 120 litres of water. Bossa wants to fill it using 350ml bottles.

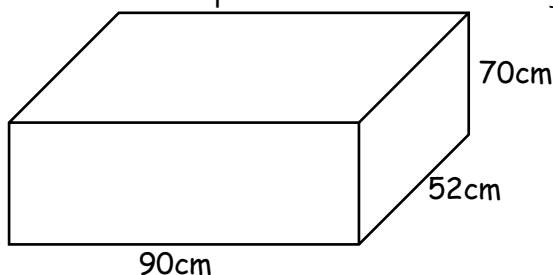
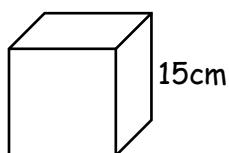


If each full bottle costs sh. 500, how much money will he spend on full bottles of water that are needed to fill the tank?

Packing cuboids or cubes in boxes

Example 1

How many cubes of side 15cm can be packed in a box 70cm by 52cm by 90cm?



$$\begin{aligned} \text{Along length} &- \frac{90\text{cm}}{15\text{cm}} = 6 \text{ cubes} \\ \text{Along width} &- \frac{52\text{cm}}{15\text{cm}} = 3 \text{ cubes} \\ \text{Along height} &- \frac{70\text{cm}}{15\text{cm}} = 4 \text{ layers} \end{aligned}$$

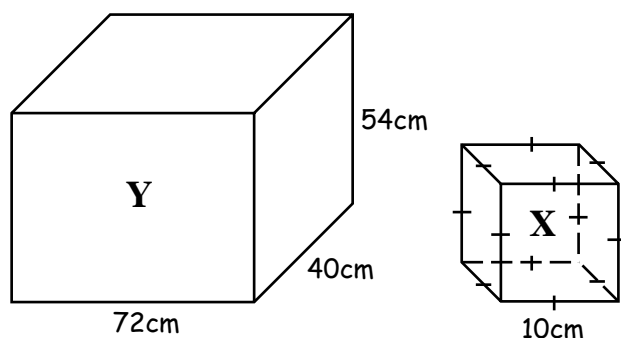
$$\begin{aligned} \text{Total number of cubes} \\ 6 \times 3 \times 4 = 72 \text{ cubes} \end{aligned}$$

TOPIC 10: LENGTH, MASS AND CAPACITY



Example 2

Small boxes of size X were packed in a big box size Y.



- a) How many small boxes were packed on the first layer?

$$\text{Along length} - \frac{72\text{cm}}{10\text{cm}} = 7 \text{ small boxes}$$

$$\text{Along width} - \frac{40\text{cm}}{10\text{cm}} = 4 \text{ small boxes}$$

Small boxes on the first layer

$$7 \times 4 = 28 \text{ small boxes}$$

- b) How many layers filled the box?

$$\frac{54\text{cm}}{10\text{cm}} = 5 \text{ layers}$$

- c) Find the number of small boxes that filled the big box.

$$28 \times 5 = 140 \text{ small boxes}$$

- d) Calculate the space left after packing.

Volume of the big box

$$V = l \times w \times h$$

$$V = 72\text{cm} \times 40\text{cm} \times 54\text{cm}$$

$$V = 155520\text{cm}^3$$

Volume of one small box

$$V = S \times S \times S$$

$$V = 10\text{cm} \times 10\text{cm} \times 10\text{cm}$$

$$V = 1000\text{cm}^3$$

Volume of 140 small boxes

$$140 \times 1000\text{cm}^3$$

$$140,000\text{cm}^3$$

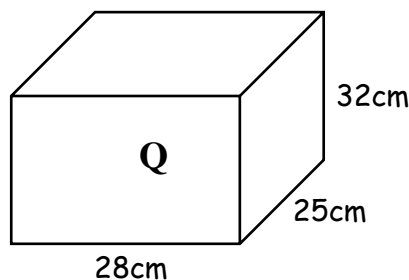
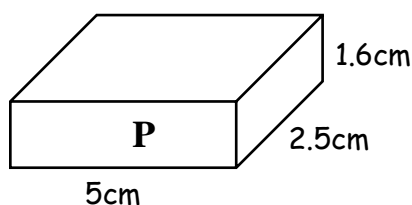
Volume of the space left

$$155520\text{cm}^3 - 140,000\text{cm}^3$$

$$15520\text{cm}^3$$

Example 3

A factory produced match boxes of size P and later packed them in a rectangular box Q.



Calculate in cm^3 , the space left after packing the match boxes into the box.

$$\text{Along length} - \frac{28\text{cm}}{5\text{cm}} = 5 \text{ match boxes}$$

$$\text{Along width} - \frac{25\text{cm} \times 10}{2.5\text{cm} \times 10} = \frac{250\text{cm}}{25\text{cm}} = 10 \text{ match boxes}$$

$$\text{Along height} - \frac{32\text{cm} \times 10}{1.6\text{cm} \times 10} = \frac{320\text{cm}}{16\text{cm}} = 20 \text{ layers}$$

Total number of match boxes

$$5 \times 10 \times 20 = 1000 \text{ match boxes}$$

Volume of each match box

$$V = l \times w \times h$$

$$V = 5\text{cm} \times 2.5\text{cm} \times 1.6\text{cm}$$

$$V = 20\text{cm}^3$$

Volume of the 1000 match boxes

$$20\text{cm}^3 \times 1000 = 20000\text{cm}^3$$

Volume of the big box

$$V = l \times w \times h$$

$$V = 28\text{cm} \times 25\text{cm} \times 32\text{cm}$$

$$V = 22400\text{cm}^3$$

Space

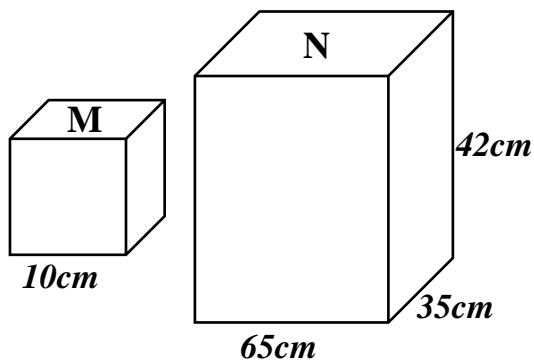
$$22400\text{cm}^3 - 20000\text{cm}^3 = 2400\text{cm}^3$$

TOPIC 10: LENGTH, MASS AND CAPACITY



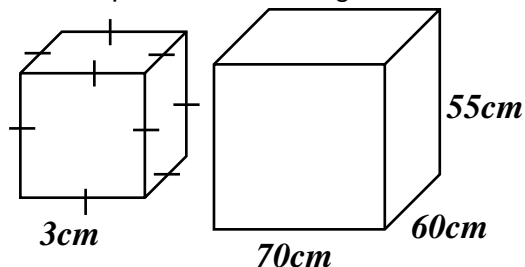
Exercise.

1. Cubes of size M are to be packed in a box of size N.



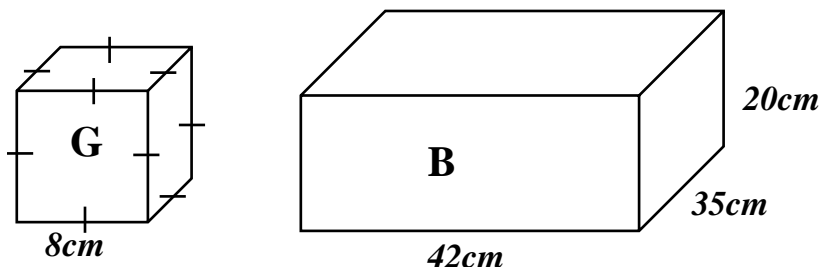
- How many cubes are packed on the first layer?
- Find the maximum number of cubes to be packed in the box.
- Find the volume of box N
- Calculate the space left unoccupied after packing.

2. Below is a big box 70cm long, 60cm wide and 55cm high. Small boxes of side 3cm are packed in the big box.



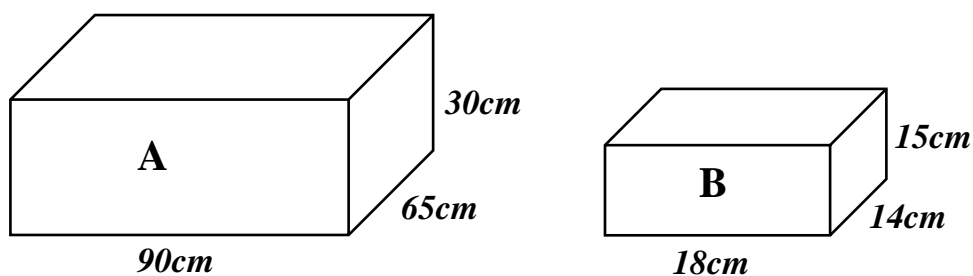
- Find the number of layers that filled the big box
- How many small boxes filled the big box?
- Find the volume of the space left after packing.

3. Below is a packet of glucose (G) and a box B. Otafire packs glucose in packets and packs the packets in a box for export to Congo.



Calculate the space left empty after filling the box with packets of glucose.

4. Small packets B are packed into a rectangular box A

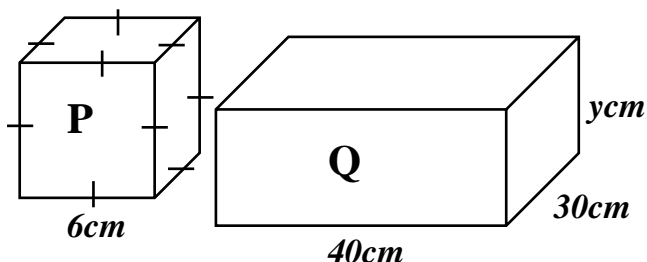


- Find the maximum space occupied by small packets when packed in the rectangular box.
- Calculate the space left after packing.

TOPIC 10: LENGTH, MASS AND CAPACITY

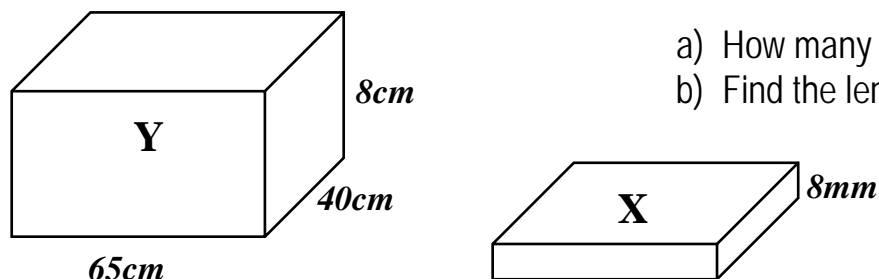


5. Two hundred ten rectangular pieces of bathing soap (P) were packed into a box (Q) measuring 40 cm by 30 cm by y cm. The space left after packing was 8640cm^3 .



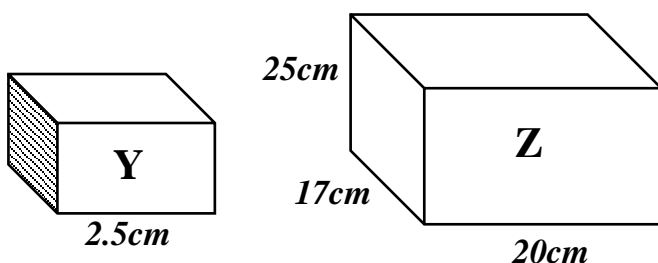
- Find the volume of each piece of soap.
- Find the value of y .
- Find the number of layers that filled the box

6. Sixty square tiles (X) with thickness 8 mm were packed in a box (Y); 65 cm by 40 cm by 8 cm leaving an unoccupied space of 1600cm^3 .



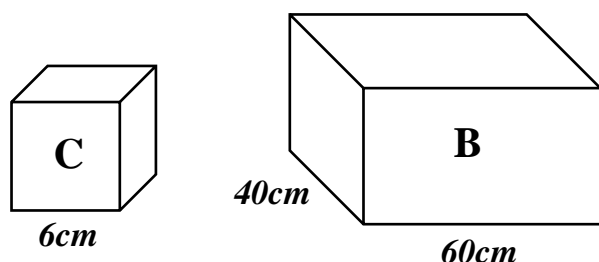
- How many layers filled the box?
- Find the length of each square tile.

7. Otim packed curry powder in 512 packets of size Y which were later packed in a box (Z) leaving a space of 820cm^3 .



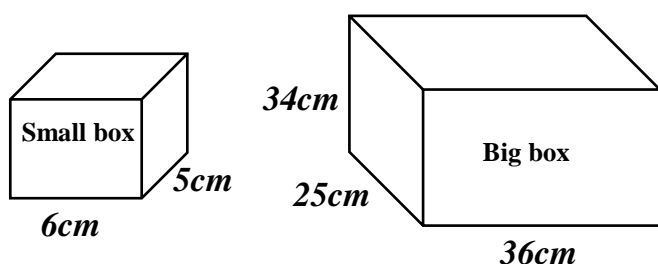
- Find the space occupied by the packets in the box.
- Calculate the area of the shaded part of the packet.

8. Cubes (C) were packed in a box (B) whose volume is 0.132m^3 .



- How many layers filled the box?
- Find the space left after packing cubes in the box.

9. Small boxes of volume 120cm^3 each were packed in a big box.

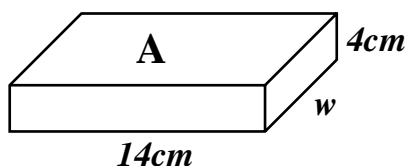
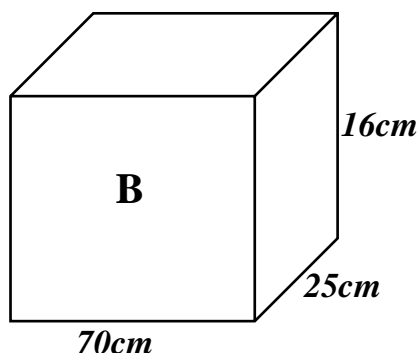


- How many layers filled the box?
- Calculate the space left after packing small boxes into the big box.

TOPIC 10: LENGTH, MASS AND CAPACITY

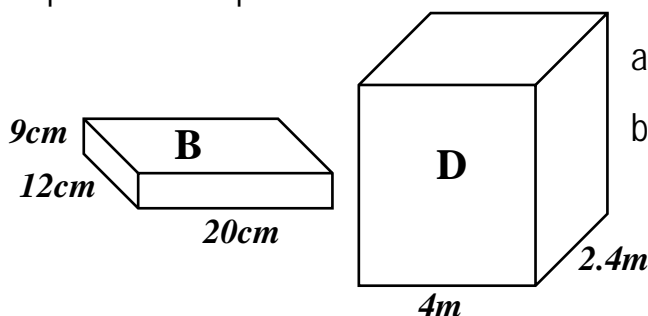


10. Packets of markers (A) are to be packed in a box (B). The volume of the box is 50 times the volume of each packet of markers. Study the figures carefully and use them to answer questions that follow.



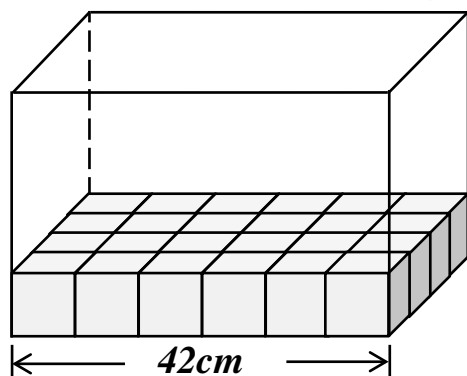
- Find the value of w .
- Find the maximum number of packets of markers needed to fill the box.

11. Four thousand bricks of size B were loaded into a dump box (D) of a truck leaving no space un occupied.



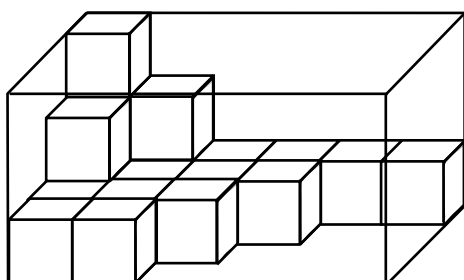
- Find the volume of each brick.
- How many layers filled the dump box of the truck.

12. The figure below shows cubes packed on the first layer of the box. 144 more cubes are needed to fill the box leaving no space.



- Find the height of the box.
- Find the space left after packing 3 layers of cubes in the box.

13. The figure below shows a rectangular glass box filled with unit cubes of 27cm^3 each. Use it to answer questions that follow.



- Find the length of the glass box.
- Calculate the volume of the space left.
- How many more similar cubes are needed to fill the glass box?

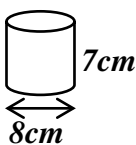
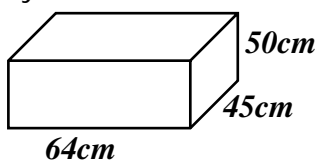
TOPIC 10: LENGTH, MASS AND CAPACITY



Packing cylinder in boxes

Example 1

Cups of diameter 8cm and height 7cm are packed in a large box measuring 64cm by 45cm by 50cm. Calculate the space left unoccupied.



$$\text{Along length} - \frac{64\text{cm}}{8\text{cm}} = 8 \text{ cups}$$

$$\text{Along width} - \frac{45\text{cm}}{8\text{cm}} = 5 \text{ cups}$$

$$\text{Along height} - \frac{50\text{cm}}{7\text{cm}} = 7 \text{ layers}$$

Total number of cups

$$8 \times 5 \times 7 = 280 \text{ cups}$$

Volume of one cup

Volume = Base area \times height

$$\text{Volume} = \pi r^2 \times h$$

$$\text{Volume} = \frac{22}{7} \times \frac{8\text{cm}}{2} \times \frac{8\text{cm}}{2} \times 7\text{cm}$$

$$\text{Volume} = 22 \times 4\text{cm} \times 4\text{cm} \times 1\text{cm}$$

$$\text{Volume} = 352\text{cm}^3$$

Volume of 280 cups

$$280 \times 352\text{cm}^3 = 98560\text{cm}^3$$

Volume of the box

$$V = l \times w \times h$$

$$V = 64\text{cm} \times 45\text{cm} \times 50\text{cm}$$

$$V = 144000\text{cm}^3$$

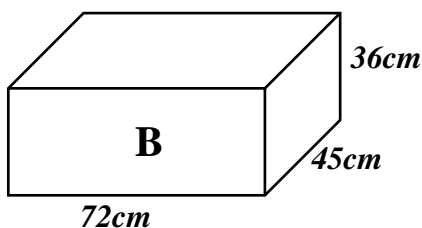
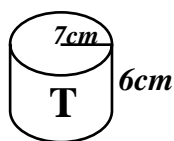
Volume of the space

$$144000\text{cm}^3 - 98560\text{cm}^3$$

$$45440\text{cm}^3$$

Example 2

In a factory, cylindrical tins (T) full of paint are packed in rectangular boxes (B) shown in figure below.



Find the maximum number of tins packed to in each box.

Diameter

$$D = r + r$$

$$D = 7\text{cm} + 7\text{cm}$$

$$D = 14\text{cm}$$

Diameter is 14cm

$$\text{Along length} - \frac{72\text{cm}}{14\text{cm}} = 5 \text{ tins}$$

$$\text{Along width} - \frac{45\text{cm}}{14\text{cm}} = 3 \text{ tins}$$

$$\text{Along height} - \frac{36\text{cm}}{6\text{cm}} = 6 \text{ layers}$$

Total number of tins

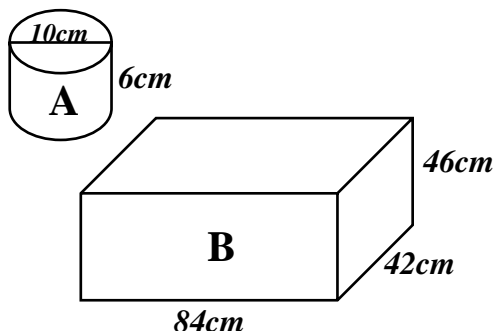
$$5 \times 3 \times 6 = 90 \text{ tins}$$

TOPIC 10: LENGTH, MASS AND CAPACITY



Exercise

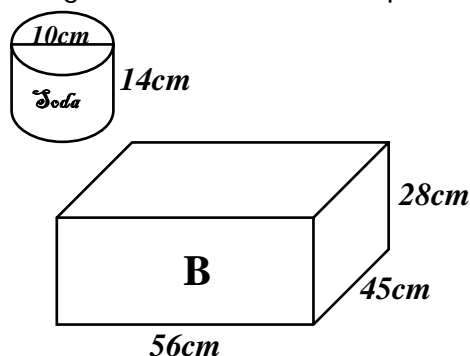
1. Cylindrical of size A are packed in a box size B.



- How many tins are packed on the first layer?
- How many layers make the box full?
- Find the number of tins that fill the box.
- Find the volume of each tin. (Use $\pi = 3.14$)

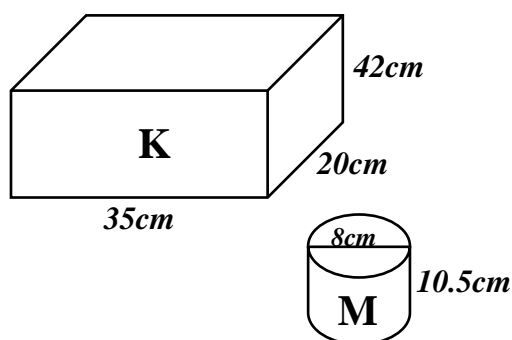
- Calculate the volume of the tins that filled the box.
- Find the volume of the box.
- Calculate the space left un occupied.

2. The coca cola company produced soda in cylindrical tins of diameter 10cm and height 14cm. The tins are packed in boxes of size K as shown in the figure below.



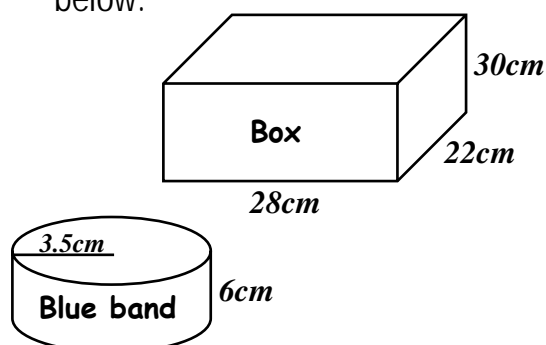
- How many layers fill the box?
- Find the maximum number of tins to fill the box
- Calculate the space left un occupied.

3. Mugs of size M were packed in box of size K.



- Calculate the number of mugs that fill the box.
- Find the volume of the space left after packing the maximum number of mugs in the box
- A trader bought 5 boxes filled with mugs at sh. 45,000. He later sold each mug at sh 3000. Calculate his profit.

4. In a factory, tins of blue band are packed in rectangular boxes shown in the figure below.

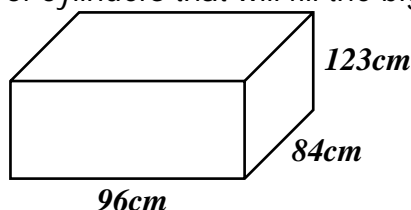
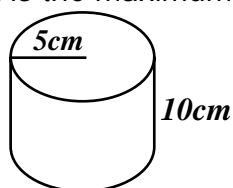


- Calculate the volume occupied by tins packed in the box. (Use $\pi = \frac{22}{7}$)
- Find the volume of the space left after packing the maximum number of tins in the box.

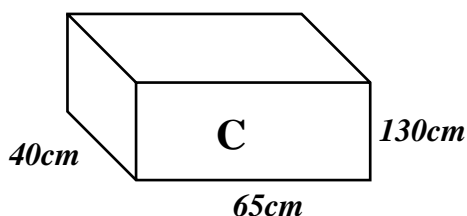
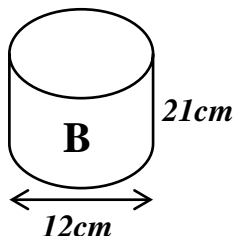
TOPIC 10: LENGTH, MASS AND CAPACITY



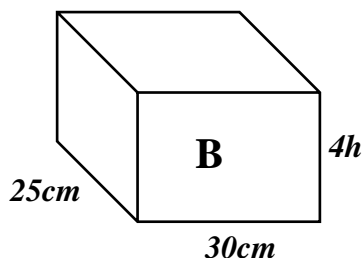
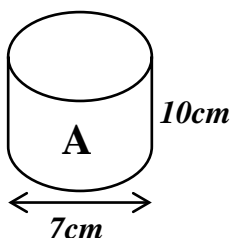
5. What is the maximum number of cylinders that will fill the big box?



6. Calculate the volume of the space left after packing beef tins of size B in a box size C.

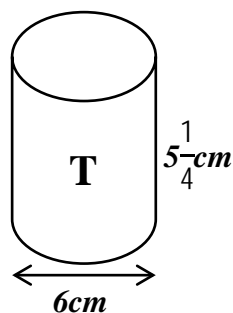
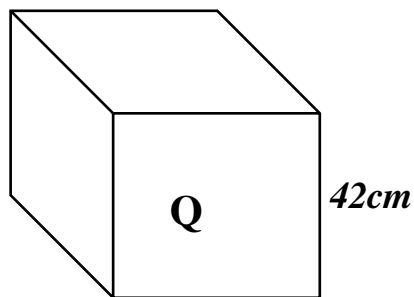


7. Thirty cylindrical tins (A) were packed in a big box (B). The volume of the space left was 17520cm^3 .



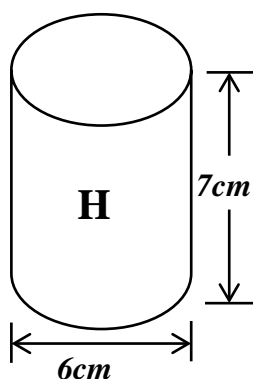
- a) Find
i) the volume of one tin.
ii) the value of h .
b) How many layers filled the box?

8. The volume of the space left after packing 160 tins of size T into a box of size Q is 6480cm^3 .



Calculate the base area of box Q. (Use $\pi = \frac{22}{7}$)

9. Rose packs tins of honey of size H in a box whose volume is 66000cm^3 . The volume of the space left after packing is 2640cm^3 .

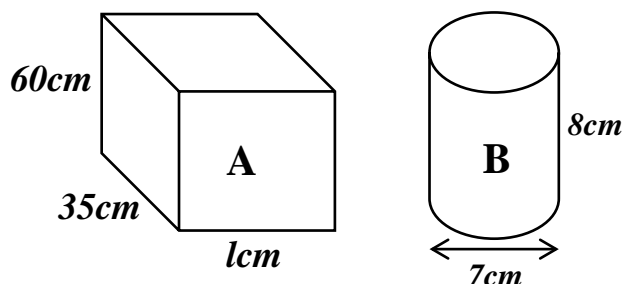


Find the maximum number of tins she packs in the box. (Use $\pi = \frac{22}{7}$)

TOPIC 10: LENGTH, MASS AND CAPACITY

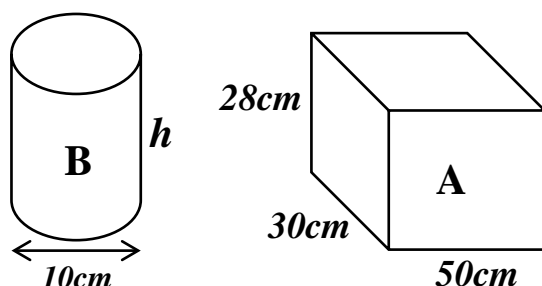


10. Tins of oil (B) are to be packed in box (A) whose volume is 88200cm^3 .



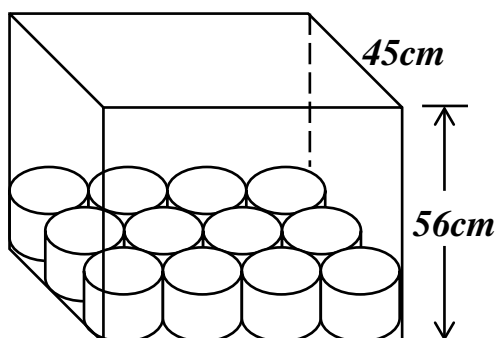
- Find the value of l .
- How many tins can fit in box A?
- What space is left?

11. Thirty tins were packed in a box below leaving a space of 9000cm^3 .



- Calculate the volume of the box.
- Find the value of h .
- How many layers filled the box?

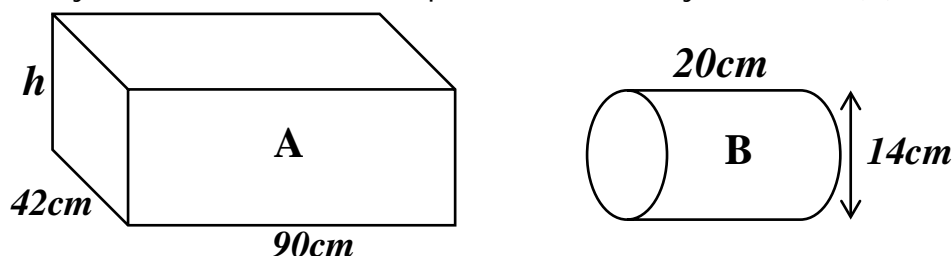
12. The figure below represents a box with tins of yoghurt of height 14cm. Study it carefully and use it to answer question that follow.



- How many more tins of yoghurt are needed to fill the box?
- Calculate the volume of the box.
- Find the space left after filling the box with tins of yoghurt.

14. Find the volume of the space left after packing cups of radius 11.5cm and height 10cm into a 90cm by 84cm by 95cm rectangular box. (Use $\pi = \frac{22}{7}$)

13. Small cylindrical tins B are to be packed horizontally into a box (A).



By packing cylindrical tins into the box, make a maximum of 5 layers.

- Find the height of the box.
- Calculate the volume of the space left after packing cylindrical tins on the first layer. (Use $\pi = \frac{22}{7}$)

TOPIC 10: LENGTH, MASS AND CAPACITY



MASS

Conversion of kilograms (kg) to grams (g)

Example 1

Express 8kg in grams.

$$1\text{kg} = 1000\text{g}$$

$$8\text{kg} = 8 \times 1000\text{g}$$

$$8\text{kg} = 8000\text{g}$$

Exercise

1. Change the following into grams.

a) 6kg

e) $\frac{1}{2}$ kg

l) 0.75kg

b) 5kg

f) $\frac{1}{4}$ kg

j) 0.8kg

c) 17kg

g) $2\frac{2}{5}$ kg

k) 2.4kg

d) 48kg

h) $12\frac{3}{4}$ kg

l) 9.65kg

2. Chris bought 16.25kg of maize floor. What is this mass in grammes?

3. A girl weighs 23kg. What is the weight of the girl in grams?

4. Ssenyama bought 7.5kg of meat. Change into grams, the mass of meat he bought.

5. Kasukaali had 25kg of sugar. He sold $9\frac{1}{2}$ kg. Find in grammes the mass of sugar that remained.

6. The average mass of 8 boys is 20kg. Find their total mass in grams.

7. Petero bought $2\frac{1}{4}$ kg of beef and $3\frac{1}{4}$ kg of goats meat. Find in grams the total mass of meat he bought.

8. The mass of a cake was 4kg. Given that 2.5kg were eaten. Find in grams, the mass of the remaining cake.

9. A jerry can full of water weighs 21.5 kg. Mr. Pipa has 4 similar jerry cans. Find in grams, the total mass of the 4 jerry cans.

10. A television has a gross weight of 12.8 kilograms. Express the net weight of the television if its packed in a box weighing 0.9 kg.

Changing grams into kilograms.

Example 1

Change 6000g to kg

$$1000\text{g} = 1\text{kg}$$

$$6000\text{g} = \frac{6000}{1000}\text{kg}$$

$$6000\text{g} = 6\text{kg}$$

Example 2

Express 740g to kilograms .

$$1000\text{g} = 1\text{kg}$$

$$740\text{g} = \frac{740}{1000}\text{kg}$$

$$= 0.74\text{kg}$$



Exercise

- Change the following into kilograms.

a) 9000g	e) 250g	i) 60g
b) 12000g	f) 750g	j) 45g
c) 4000g	g) 300g	k) 88g
d) 30000g	h) 830g	l) 9g
- Okello went to the shop and bought 750 grammes of rice. Change the quantity he bought into kilogrammes.
- Mondo bought 8 packets of washing powder 750grammes. Find the weight of the washing powder Mondo bought in kilogram .
- One bucket weighs 450g. How many kilograms will 4 dozen buckets weigh?
- A box contains 16 tins of glucose each weighing 250g. How many kilograms of glucose are in 15 such boxes?
- The mass of a packet of coffee is 125g. Find the total mass of 6 such packets in kilograms.
- Joseph bought 4 pine apples of 850g each. He put them in a 600g basket. Find in kilograms the mass of the basket and the pineapples.
- There are 6 pumpkins in a 320 gram bag. The mass of each pumpkin is 800grams. Find in kilograms, the total mass of a bag with pampkins.
- Twelve pawpaws were packed in a 200 gram box. The mass of each pawpaw was 650 grams. Find the total mass of the box of paw paws in kilograms.
- A bottle full of water weighs 3000g. The mass of an empty bottle is 400g. Find the mass of the bottle of water when half full.

Changing tonnes into kilograms

Example 1

Change 6 tonnes into kilograms.

$$\begin{aligned}
 1 \text{ tonne} &= 1000\text{kg} \\
 6 \text{ tonnes} &= 6 \times 1000\text{kg} \\
 &= 6000\text{kg}
 \end{aligned}$$

Example 2.

Express $7\frac{1}{2}$ tonnes as kilograms.

$$\begin{aligned}
 1 \text{ tonne} &= 1000\text{kg} \\
 7\frac{1}{2} \text{ tonnes} &= \frac{15}{2} \times 1000\text{kg} \\
 &= 15 \times 500\text{kg} \\
 &= 7500\text{kg}
 \end{aligned}$$

Exercise

- Change the following tonnes into kilograms.

a) 7 tonnes	e) $2\frac{1}{2}$ tonnes	i) 2.5 tonnes
b) 15 tonnes	f) $6\frac{1}{4}$ tonnes	j) 4.25 tonnes
c) 19 tonnes	g) $3\frac{1}{8}$ tonnes	k) 7.8 tonnes
d) 78 tonnes	h) $4\frac{2}{5}$ tonnes	l) 12.75tonnes

TOPIC 10: LENGTH, MASS AND CAPACITY



2. A car weighs 2.6 tonnes. Find the mass of the car in kilograms.
3. A truck weighs 1.25 tonnes. Sand weighs 2 tonnes. Find the mass of the truck and sand in kilograms.
4. A motorcycle weighs 0.125 tonnes. Find the total mass of 12 similar motorcycles in kilograms.
5. A bull weighs 0.125 tonnes. Find in kilograms, the total mass of 36 similar bulls.
6. A bag of cement weighs 0.05 tonnes. Emma bought 240 bags of cement. Find in kilograms, the total mass of cement he bought.

Changing kilograms into tonnes

Example 1

Change 6500 kilograms into tonnes.

$$1000\text{kg} = 1\text{tonne}$$

$$6000\text{kg} = \frac{6500}{1000} \text{ tonnes}$$

$$6000\text{kg} = 6.5 \text{ tonnes}$$

Example 2

Convert 42kg into tonnes.

$$1000\text{kg} = 1 \text{ tonne}$$

$$740\text{kg} = \frac{42}{1000} \text{ tonnes}$$

$$= 0.042 \text{ tonnes}$$

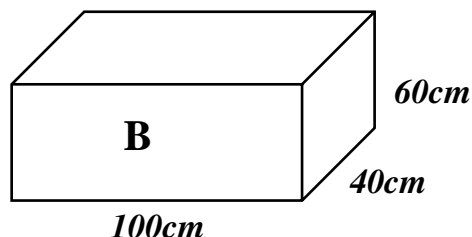
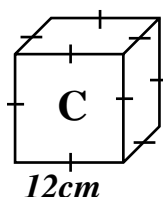
Exercise

1. Express the following as tonnes.
 - a) 4000kg
 - b) 3000kg
 - c) 13000kg
 - d) 35000kg
 - e) 4800kg
 - f) 7300kg
 - g) 9400kg
 - h) 650kg
 - i) 700kg
 - j) 480 kg
 - k) 60kg
 - l) 24kg
2. Kirya bought 4200kg of maize. Express this mass in tonnes.
3. A box contains 144 tins of blue band each weighing 750g.
 - a) Find the total mass of tins of blue band in kilograms.
 - b) Calculate in tonnes, the mass of 250 boxes full of tins of blue band.
4. A carton of papers weighs 16kg. Express as tonnes, the total mass of 250 similar cartons of papers.
5. A bag of cement weighs 50kg. Muto bought 840 bags of cement. Change the total weights of cement in tonnes.
6. The mass of one brick is 4.2kg. A lorry carries 1500 bricks per trip. How many tonnes does it carry in 6 trips?
7. A box contains 25 sachets of rice each weighing 4kg. Express in tonnes, the total mass of 750 similar boxes filled with sachets of rice.
8. One tonne of maize cost sh. 850,000/=. A farmer has 25bags of maize weighing 120kg .Calculate the amount of money the farmer will get after selling the 25 bags of maize.
9. A school consumes 1 tonne of maize flour in 25 days. The school bought 20 bags of maize flour each weighing 150kg. How long will it take for the school to consume the maize flour?

TOPIC 10: LENGTH, MASS AND CAPACITY



10. In a factory, cubes (C) are packed in box (B). Each cubes packed contains 750 grams of salt.



Chumbi bought 150 boxes with cubes packed in them. Find in tonnes, the mass of salt he bought.

Addition of kilograms and grams

Example 1.

Work out : $7\text{kg} + 750\text{g}$.

$$\begin{aligned} 1\text{kg} &= 1000\text{g} \\ 7\text{kg} &= 7 \times 1000\text{g} \\ &= 7000\text{g} \end{aligned}$$

$$\begin{array}{r} 7000\text{g} + 750\text{g} \\ 7750\text{g} \end{array}$$

Example 2

Work out : $8\text{kg } 950\text{g} + 4\text{kg } 169\text{g}$

Kg	g
8	950
+ 4	169
13	119

13kg 119g

Exercise

1. Work out :

a)

Kg	g
4	934
+ 2	267

b)

Kg	g
8	764
+ 2	397

c)

Kg	g
10	349
+ 5	816

d)

Kg	g
23	864
+ 17	999

e)

Kg	g
12	389
+ 10	678

f)

Kg	g
12	867
+ 27	456

2. Work out:

a) $7\text{kg} + 300\text{g}$

d) $15\text{kg} + 40\text{g}$

g) $1\frac{1}{2}\text{kg} + 500\text{g}$

b) $4\text{kg} + 250\text{g}$

e) $3\text{kg} + 923\text{g}$

h) $20\text{kg} + 20\text{g}$

c) $9\text{kg} + 345\text{g}$

f) $4\frac{1}{4}\text{kg} + 750\text{g}$

3. Aine weighs $62\text{kg } 250\text{g}$ and Benja weighs $60\text{kg } 950\text{g}$. How heavy are they altogether.
4. Our father bought $2\text{kg } 250\text{g}$ of meat on Monday and $1\text{kg } 750\text{g}$ of meat on Tuesday. Find in grammes, the mass of meat he bought in the two days?

TOPIC 10: LENGTH, MASS AND CAPACITY



5. Mr. Kase picked 75kg 480g of coffee in the Morning and 93kg 370g of coffee in the evening. How much coffee did he pick?
6. A family uses 8kg 480g of sugar every month. The cost of a kilogram of sugar is sh. 4800. How much money will the family spend on sugar in 4 months?

Subtracting kilograms and grams

Example 1

Subtracting: 6kg – 340g

$$1\text{kg} = 1000\text{g}$$

$$6\text{kg} = 6 \times 1000\text{g}$$

$$= 6000\text{g}$$

$$6000\text{g} - 340\text{g}$$

$$5660\text{g}$$

Example 2

Work out: Kg g

$$\begin{array}{r} 5 \quad 346 \\ - 2 \quad 984 \\ \hline \end{array}$$

$$\begin{array}{r} 5 \quad 346 \\ - 2 \quad 984 \\ \hline \end{array}$$

$$\begin{array}{r} \text{Kg} \quad \text{g} \quad 1000 \\ 4 \quad 5 \quad 346 \\ - 2 \quad 984 \\ \hline 2 \quad 362 \end{array}$$

Exercise

1. Workout :

$$\begin{array}{r} \text{a) Kg} \quad \text{g} \\ 8 \quad 340 \\ - 6 \quad 120 \\ \hline \end{array}$$

$$\begin{array}{r} \text{b) Kg} \quad \text{g} \\ 7 \quad 850 \\ - 2 \quad 460 \\ \hline \end{array}$$

$$\begin{array}{r} \text{c) Kg} \quad \text{g} \\ 10 \quad 345 \\ - 4 \quad 293 \\ \hline \end{array}$$

$$\begin{array}{r} \text{d) Kg} \quad \text{g} \\ 12 \quad 750 \\ - 5 \quad 900 \\ \hline \end{array}$$

$$\begin{array}{r} \text{e) Kg} \quad \text{g} \\ 24 \quad 200 \\ - 16 \quad 197 \\ \hline \end{array}$$

$$\begin{array}{r} \text{f) Kg} \quad \text{g} \\ 15 \quad 384 \\ - 9 \quad 999 \\ \hline \end{array}$$

2. Take away 600g from 2 kilograms.
3. Work out:
 - a) 4kg – 350g
 - b) 9kg – 400g
 - c) 5kg – 750g
 - d) 6kg – 120g
 - e) 10 kg – 680g
 - f) 14kg – 140g
 - g) 8kg – 888g
 - h) 17kg – 434g
4. Namuli bought 9kg 250g meat. She gave 3kg 450g of it to her brother. Express the mass of the meat that remained in grammes.
5. Mulimi harvested 120 kilograms of beans. He sold 48kg 750g. Find in kilograms, the mass of beans that remained.
6. Munana had 85kg 550g of onions. He sold some onions and remained with 36kg 450g. Find the mass of onions Munana sold.
7. The total mass of two boys is 42kg. One boy weighs 19kg 480g. The mass of the other boy.

TOPIC 10: LENGTH, MASS AND CAPACITY



8. A trader bought 12kg 600g of sugar. When some sugar was sold at sh. 4500 per kilogram, $\frac{1}{7}$ of it remained. How much money did he get from the sugar he sold.
9. An empty box weighs 350g. A box full of millet weighs 15kg 250g. If 6kg 750g of millet in the box are sold, find the remaining mass of millet in the box.
10. Pamela prepared 4 cakes for her birth day. The mass of each cake was 2kg 750g. Part of cakes was eaten and only 1kg 500g of the cake remained. Find in kilograms, the mass of the cake that was eaten .

Division of kilograms and grams .

Example 1

Share 42kg of meat among 6 people. How many kilograms does each get?

$$36\text{kg} \div 6 = 7\text{kg}$$

Each person gets 6kg

Example 2

How many $\frac{1}{8}$ kg packets of curry powder can be obtained from 14000g.

Method 1

$$1\text{kg} = 1000\text{g}$$

$$\frac{1}{8}\text{kg} = \frac{1}{8} \times 1000\text{g}$$

$$= 125\text{g}$$

$$\frac{14000\text{g}}{125\text{g}}$$

112 packets

Method 2

$$1000\text{g} = 1\text{kg}$$

$$14000\text{g} = \frac{14000}{1000}\text{kg}$$

$$14000\text{g} = 14\text{kg}$$

$$14\text{kg} \div \frac{1}{8}\text{kg}$$

$$14\text{kg} \times \frac{8}{1\text{kg}}$$

112 packets

Exercise

1. Divide 16kg of rice among 4 people. How many kilograms does each get?
2. How many packets containing 75g of the tea leaves can be got from 12kg of tea leaves?
3. How many $\frac{1}{4}$ kg packets of rice can be obtained from 18000g of rice?
4. A bag of beans weighs 150kg. How many small packets of 25g can be obtained from the bag?
5. A container can carry 100kg maize. How many packets of 800g can be poured into the container?
6. A trader packed 3.5kg of sugar into packets of 250g each. How many packets did he make?
7. How many $\frac{1}{4}$ kg packet of omo can be obtained from a 9000g container of omo?

TOPIC 10: LENGTH, MASS AND CAPACITY



8. Musa has 60kg of sugar to be packed in $\frac{3}{4}$ kg packets. How many packets will he get?
9. How many packets of 400 grammes can be obtained from 3.6 kilogrammes of salt.
10. A farmer harvested 6kg of tea leaves. He packed it in 15g sachets. How many sachets did the farmer make?
11. Lampard bought a sack of 25 kg of salt. He packed the salt in 250g sachets. He sold all the sachets at sh. 45000. How much money did he sell each sachet?
12. Ronnie bought a sack of 60kg of ground nuts at sh.330,000. He then packed the ground nuts into 750g packets. He sold all the packets making a profit of sh. 150,000. Calculate the amount of money he sold each packet.
13. A cake of mass 6kg was served to guests at a party. Each guest got 150g. Find the number of guests who shared the cake.
14. A fruit seller at Nakasero bought a 4.2kg water melon at sh. 4000. He cut the water into equal pieces of mass 350g each. He sold all the pieces making a profit of 50%. How much money did he sell each piece?
15. The total mass of tins of milk in a box is 4.25kg. The mass of each tin is 50g . Find the number of tins in the box.
16. A truck carries 4 tonnes of cement in a trip. The mass of each bag of cement is 50kg . How many bags of cement does it carry in 3 trips?
17. The mass of an empty box is 380 grammes. A box with tins of honey weighs 3.63kg. The mass of each tin is 250g. Find the number of tins in the box.
18. A trader sold 8kg of salt in sachets at sh. 13600. She sold each sachets at sh. 850. Find in grams, the mass of each sachet.
19. A carton of salt contains 40 packets. Each has a mass of 250 grammes.
 - a) Work out in kilograms, the mass of all the packets of salt in the carton.
 - b) A family uses a packet of salt in 1 week. Find the number of days the carton will last the family.
20. A trader bought 10kg of salt at sh. 16,000. The salt was packed in similar sachets. He later sold each sachet at sh. 500 making a profit of sh. 4,000. Find in grams, the mass of salt in each sachet.
21. The list below shows the prices of different items in a certain shop.
 - 2 kg of sugar cost sh 7,800
 - 250 g of rice cost sh 900
 - $1\frac{3}{4}$ kg of beans cost sh. 7,000
 - 3 bars of soap cost sh. 13,500Kizito went shopping with sh 25,000 and bought 3 kg of sugar, 500 g of beans, a bar of soap and rice. He remained with sh 1,400. Find in kilograms, the mass of rice Kizito bought.
22. The total mass of tins of honey in a box is 3.25 kg. A trader bought 2 boxes of tins of honey at sh 800 per tin. He later sold all the tins at sh 26,000 making a profit of 25%. Find in grams, the mass of each tin of honey in the box.