CAPACITY

- Capacity is the amount of liquid (water) an object can hold when full.
- Capacity is measured in Litres (L).
- 1 litre = $1000cm^3$

Changing volume (cm^3) into litres

Examples.

1. Given that 1 litre = $1000cm^3$, express $76000cm^3$ as litres.

$1000cm^3$ = 1 litre

$76000cm3 = \left(\frac{76000}{1000}\right)$ litres.

76000cm3 = 76 litres

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2. The volume a rectangular tank is $608000cm^3$**.** Calculate its capacity.

$1000cm^3$ = 1 litre

$608000cm^3 = \left(\frac{608000}{1000}\right)$ litres.

$608000cm^3$ = 608 litres

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3. The volume of a cylindrical tank is 4500cm3. How many litres of water does it hold when full?

$1000cm^3$ = 1 litre

$4500cm^3 = \left(\frac{4500}{1000}\right)$ litres.

$4500cm^3$ = 4.5 litres

Exercise

1. Express the following as litres.

a) $34000cm^3$ b) $800cm^3$

2. The volume of a cylindrical tank is 9000cm^3. How many litres of water does it hold when full?

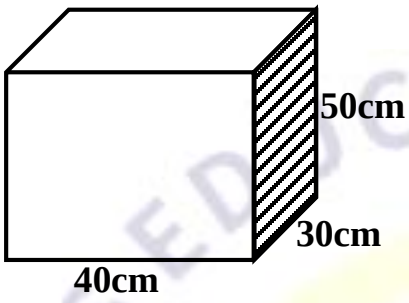
3. The volume a rectangular tank is 98000cm^3**.** Calculate its capacity.

4. Given that 1 litre = 1000cm^3, express 75400cm^3 as litres.

MORE ABOUT FINDING CAPACITY.

Examples.

1. The figure below shows a rectangular tank. Study it carefully and answer the questions that may follow.

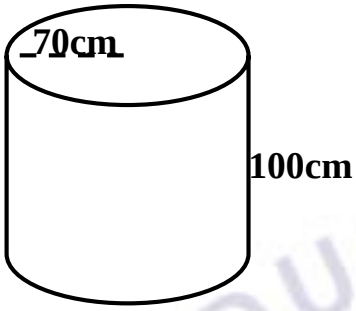


a) Calculate the area of the shaded part.

b) Workout the capacity of the above tank in litres.

Volume of the tank	Capacity in litres
V = L **X** W **X** H V = 40cm **X** 30cm **X** 50cm V = 1200cm^2 **X** 50cm V = 60000cm^3	**1000cm^3 = 1 litre** **60000cm^3 = $\left(\frac{60000}{1000}\right)$ litres.** **60000cm^3 = 60 litres**

2. The figure below shows a cylindrical tank. Study it carefully and answer the question that may follow.

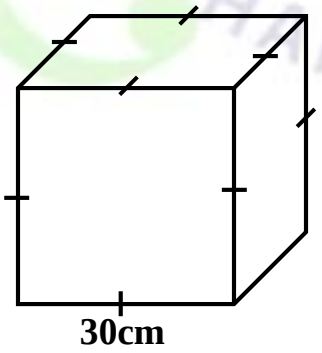


How many litres of water does it hold when completely full?

$V = \frac{22}{7}$ **X** R **X** R **X** H $V = \frac{22}{7}$ **X** 70cm **X** 70cm **X** 100cm V = 22 **X** 10cm **X** 70cm **X** 100cm V = 220cm **X** $7000cm^2$ V = $1540000cm^3$	Capacity = $\frac{volume}{1000}$ Capacity = $\left(\frac{1540000}{1000}\right)$**litres** Capacity = **1540 litres**

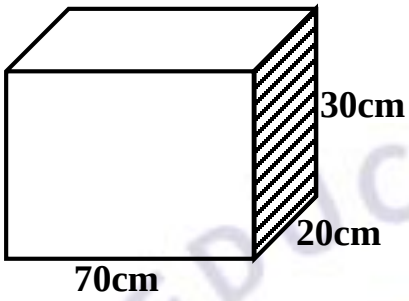
Trial number

3. Workout the capacity of the tank below.



Exercise

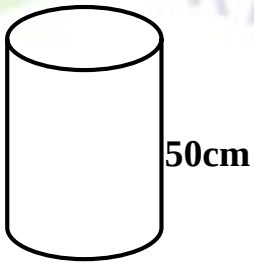
1. The figure below shows a rectangular tank. Study it carefully and answer the questions that may follow.



a) Calculate the area of the shaded part.

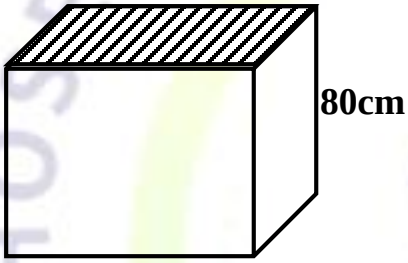
b) Workout the capacity of the above tank in litres.

2. The base area of the cylinder below is 120cm^2**.** Workout its capacity in litres.



3. The **base area** and the **volume** of a tank are in the ratio of 1: 5 respectively. Given that the base area of the tank is 800cm^2, calculate the capacity of the tank.

4. The area of the shaded part in figure below is 1200cm^2**.**



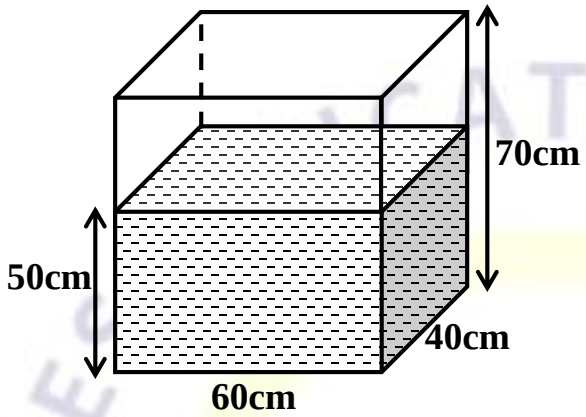
a) Calculate the volume of the tank.

b) How many litres of water does it hold when completely full?

Capacity (litres) needed to fill the tank.

Examples

1. The figure below shows a rectangular tank with some water. Study it carefully and answer the questions that may follow.



a) Calculate the capacity of the tank when it's full.

Volume of the tank. V = L **X** W **X** H V = 60cm **X** 40cm **X** 70cm V = 2400cm^2 **X** 70cm V = 168000cm^3	Capacity = $\frac{volume}{1000}$ Capacity = $\left(\frac{168000}{1000}\right)$**litres** Capacity = **168 litres**

b) Calculate the amount of water in the tank in litres.

Volume of water in the tank. V = L **X** W **X** H V = 60cm **X** 40cm **X** 50cm V = 2400cm^2 **X** 50cm V = 120000cm^3	Capacity = $\frac{volume}{1000}$ Capacity = $\left(\frac{120000}{1000}\right)$**litres** Capacity = **120 litres**

c) How many more litres are needed to fill the tank?

(168 – 120) litres

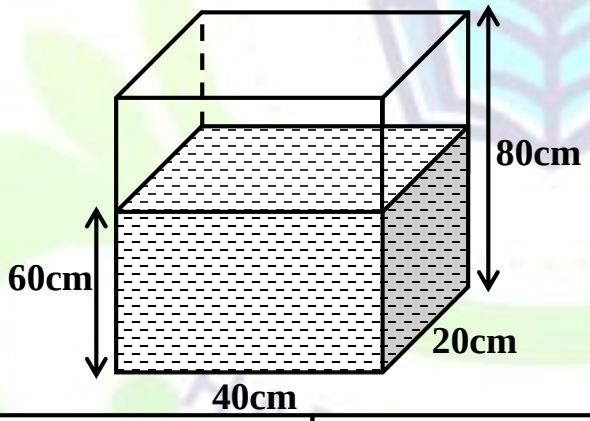
48 more litres of water are needed to fill the tank

Or; height of the water needed = (70 – 50) cm.

= 20 cm.

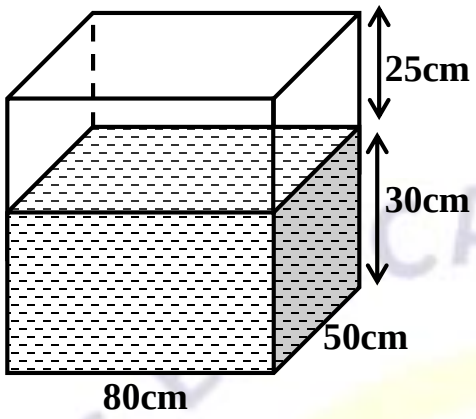
Volume of water needed to fill the tank. V = L **X** W **X** H V = 60cm **X** 40cm **X** 20cm V = 2400cm^2 **X** 20cm V = 48000cm^3	Capacity = $\frac{volume}{1000}$ Capacity = $\left(\frac{48000}{1000}\right)$**litres** Capacity **= 48 litres**

2. The figure below shows a rectangular tank with some water. **Study it carefully and find the amount of water needed to fill the tank.**



Height (water) needed	**Volume (water) need**	***Litres (water) needed***
80cm – 60cm **20cm**	V = L **X** W **X** H V = (40 **X** 20 **X** 20)cm^3 V = (800 **X** 20) cm^3 V = 16 000cm^{3}ed	Capacity = $\frac{volume}{1000}$ Capacity = $\left(\frac{16000}{1000}\right)$**litres** Capacity **= 16 litres**

3. The figure below shows a rectangular fuel tank with some fuel. Study it carefully and answer the questions that may follow.



a) How many litres of fuel are in the tank?

Volume of fuel in the tank. V = L **X** W **X** H V = 80cm **X** 50cm **X** 30cm V = 4000cm^2 **X** 30cm V = 120000cm^3	Capacity = $\frac{volume}{1000}$ Capacity = $\left(\frac{120000}{1000}\right)$**litres** Capacity = **120 litres**

b) Find the number of litres of fuel that can fit in the empty space in the tank.

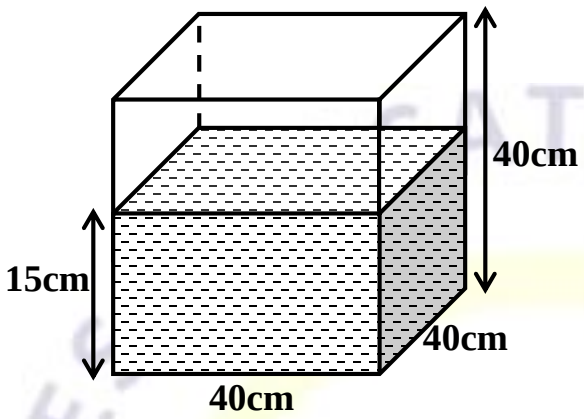
Volume of fuel needed to fill the tank. V = L **X** W **X** H V = 80cm **X** 50cm **X** 25cm V = 4000cm^2 **X** 25cm V = 100000cm^3	Capacity = $\frac{volume}{1000}$ Capacity = $\left(\frac{100000}{1000}\right)$**litres** Capacity = **100 litres**

c) How many litres does the above tank hold when full?

_____

Exercise

1. The figure below shows a rectangular tank with some water. Study it carefully and answer the questions that may follow.

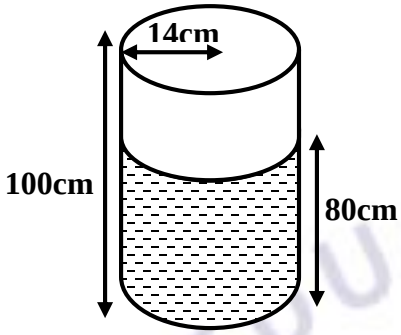


a) Calculate the amount of water in the tank.

b) Calculate the amount of water needed to feel the tank.

c) How many litres of water does the tank hold when it is full?

2. The figure below shows a cylindrical tank with some fuel. Study it carefully and answer the questions that may follow.

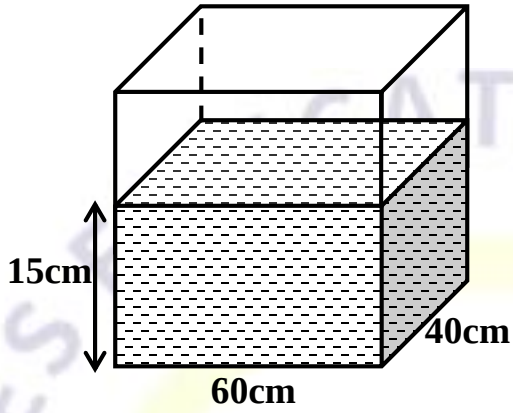


a) Calculate the capacity of the tank when full.

b) How many litres of water are needed to fill the tank?

More about litres needed (fractions).

1. The tank below is a third $\left(\frac{1}{3}\right)$full of water. Study it carefully and answer the questions that may follow.



a) How many litres of water are in the tank?

Volume of water in the tank. V = L **X** W **X** H V = 60cm **X** 40cm **X** 15cm V = 2400cm^2 **X** 15cm V = 36000cm^3	Capacity = $\frac{volume}{1000}$ Capacity = $\left(\frac{36000}{1000}\right)$**litres** Capacity = **36 litres**

b) Calculate the capacity of the tank when full.

Let the capacity of the tank be y

$\frac{1}{3}$ of y = 36 litres.

$\frac{1}{3}$ **X** y = 36 litres.

$\frac{1}{3}y$ = 36 litres.

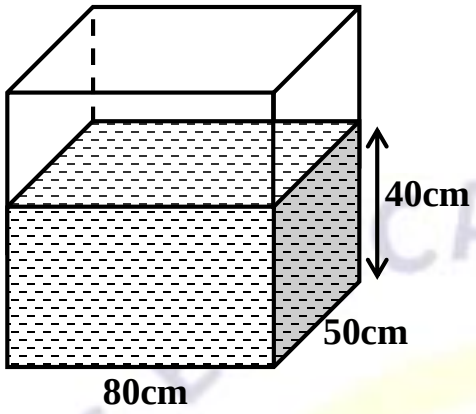
$\frac{3}{1}$ **X** $\frac{1}{3}y$ =(36 **X** $\frac{3}{1}$) litres

y =108 litres

c) How many litres of water are needed to fill the tank?

_____

2. The figure below shows a rectangular fuel tank with some fuel. Study it carefully and answer the questions that may follow.



a) How many litres of fuel are in the tank?

Volume of fuel in the tank. V = L **X** W **X** H V = 80cm **X** 50cm **X 40**cm V = 4000cm^2 **X** 40cm V = 160000cm^3	Capacity = $\frac{volume}{1000}$ Capacity = $\left(\frac{160000}{1000}\right)$**litres** Capacity **= 160 litres**

b) Given that the tank is $\frac{2}{5}$ full, how many litres does it hold when full?

Let the capacity of the tank be y

$\frac{2}{5}$ of y = 160 litres.

$\frac{2}{5}$ **X** y = 160 litres.

$\frac{2}{5}y$ = 160 litres.

$\frac{5}{2}$ **X** $\frac{2}{5}y$ =(160 **X** $\frac{5}{2}$) litres

y = (80 **X** 5) litres

y = 400 litres

c) How many litres of water are needed to fill the tank?

Changing capacity (litres) into volume (cm^3)

Remember that **1 litre = 1000cm^3**

Examples

1. Express 5 litres as cubic centimetres (cm^3).

   1 litre = 1000cm^3

   5 litres = (5 **X**1000) **cm^3.**

   5 litres = 5 000 **cm^3.**

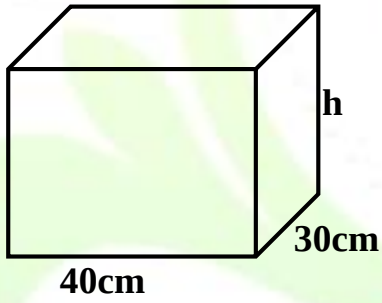
2. An object holds 27 litres of water when full. Calculate its volume.

   1 litre = 1000cm^3

   27 litres = (27 **X**1000) **cm^3.**

   27 litres = 27000 **cm^3.**

3. The capacity of the tank below is 120 litres. Study it carefully and answer the question that follows.

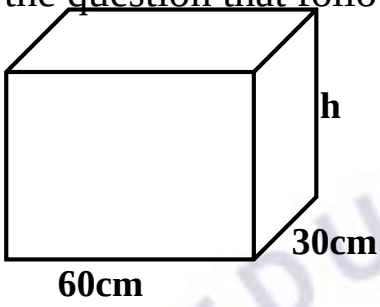


Calculate the value of **h** in centimetres.

Volume 1 litre = 1000cm^3 120 litres = 120 **X** 1000cm^3 120 litres = 120000cm^3	L **X** W **X** H = volume 40cm **X** 30cm **X** h = 120000cm^3 1200cm^2 h = 120000cm^3 $\left(\frac{1200cm2h}{1200cm2}\right) = \left(\frac{120000cm3}{\mathbf{1200cm2}}\right)$ h = 100cm

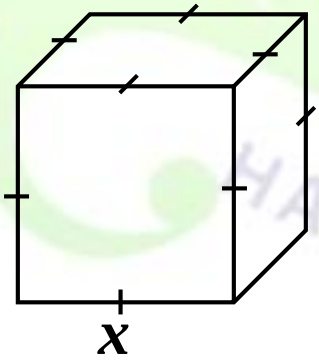
Exercise

1. The capacity of the tank below is 27 litres. Study it carefully and answer the question that follows.



Calculate the value of **h** in centimetres.

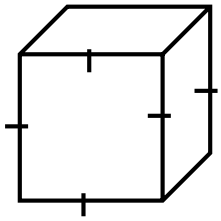
2. The figure below shows a square tank which holds 64 litres of water when full.



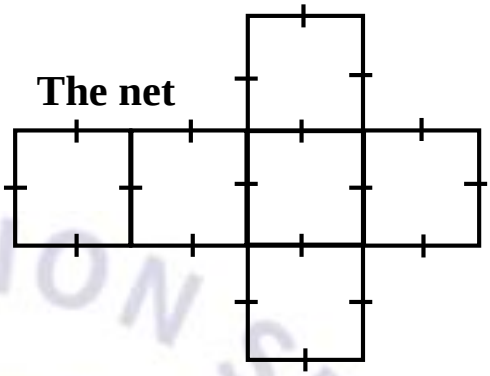
Workout the value of ***x*.**

NETS OF THREE DIMENSION FIGURES.

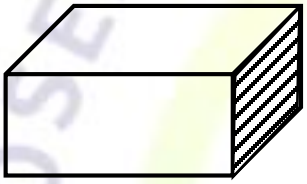
A cube

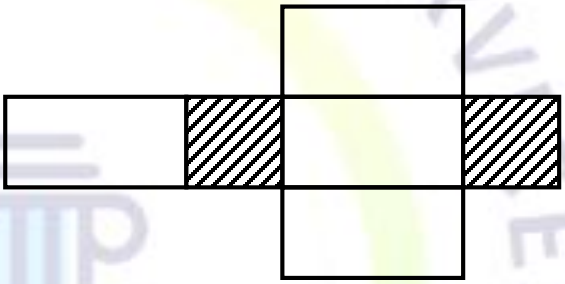


The net

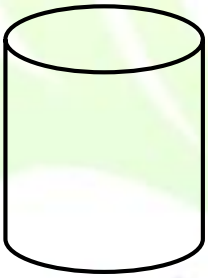


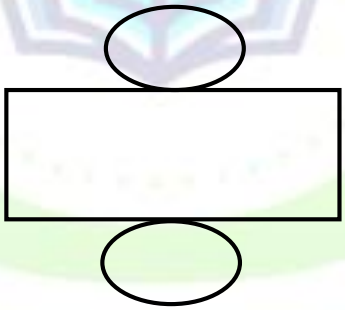
A cuboid

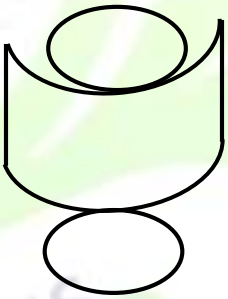




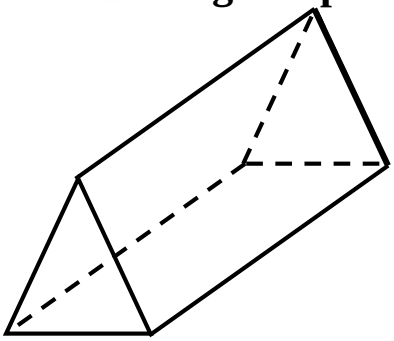
A cylinder

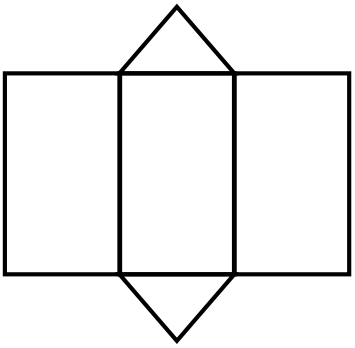




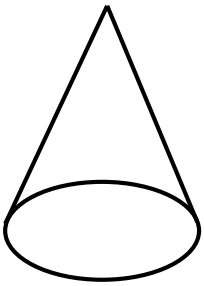


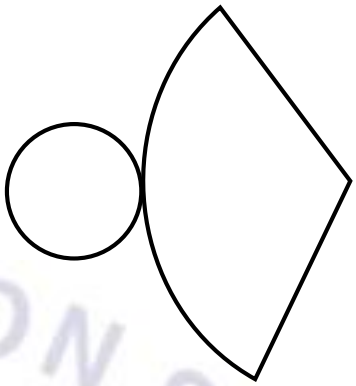
A triangular prism





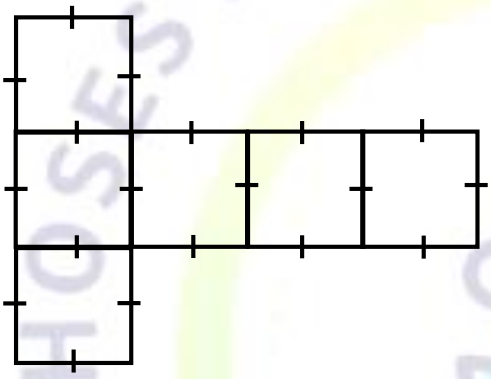
A cone





ACTIVITY.

1. Draw and name the solid shape whose net is drawn below.



2. Draw a net of a **tetrahedron** (triangular pyramid) in the space provided below.

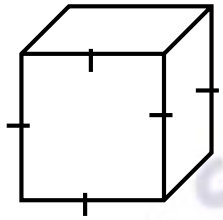
3. Draw a net of a **cylinder** open at the top in the space provided below.

SUM OF THE EDGES

- This the total of all edges the figure has.
- It is given in units like cm, m, dm, and others.
- It is described as "**length of the wire used to make the flame**"

Sum of edges in a cube.

A cube



It has **6** faces.

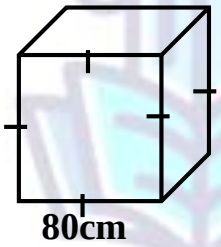
It has **8** vertices.

It has **12** edges.

The 12 edges a cube has are all equal therefore, the sum of all its edges = 12s

Examples

The figure below shows a square tank. Study it carefully and answer the questions that may follow.



a) Calculate the length of the wire used to make its flame.

Length of the wire = 12s

Length of the wire = 12 **X** s

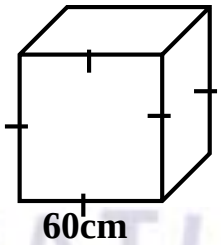
Length of the wire = 12 **X** 40cm

Length of the wire = 960cm

b) Calculate the capacity of the tank when it is full.

Activity.

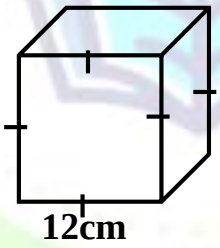
1. The figure below shows a square tank. Study it carefully and answer the questions that may follow.



a) Calculate the length of the wire used to make its flame.

c) Calculate the capacity of the tank when it is full.

The figure below shows a cube. Study it carefully and answer the questions that may follow.

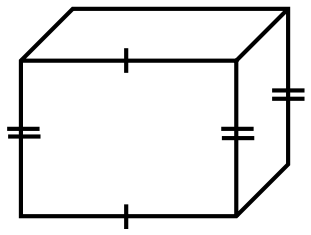


a) Workout the sum of all its edges.

b) Calculate the volume of the above cube.

Sum of all edges of a cuboid.

A cuboid



It has **6** faces **(planes).**

It has **8** vertices **(corners).**

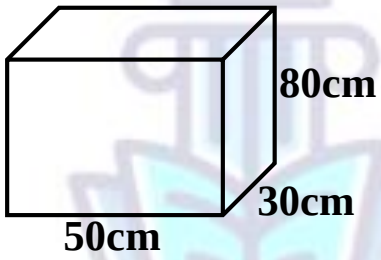
It has **12** edges.

Summarized in the word **FIVE** as **F_6 Ⓘ V_8 E_{12}**

- **The cuboid has 4 lengths (4L), 4 widths (4W), and 4 heights (4H).**
- Therefore, sum of the edges **= 4L + 4W+ 4H. Or 4(L + W + H)**

Examples

The figure below shows a rectangular tank. Study it carefully and answer the questions that may follow.



a) Calculate the length of the wire used to make its flame.

Length of the wire = **4L + 4W+ 4H**

Length of the wire = (4 **X** L) + (4 **X** W) + (4 **X** H)

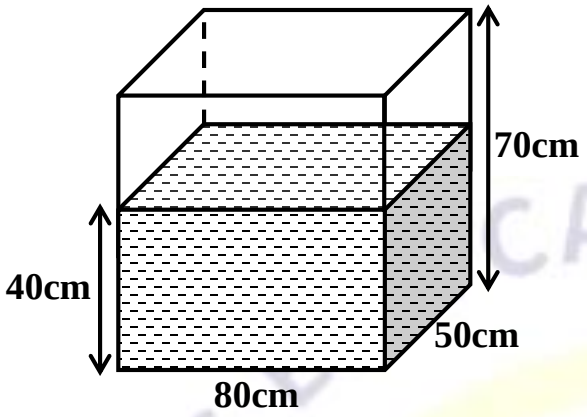
Length of the wire = (4 **X** 50cm) + (4 **X** 30cm) + (4 **X** 80cm)

Length of the wire = 200cm + 120cm + 320cm

Length of the wire = 640cm

b) How many litres of water does it hold when it is full?

2. The figure below shows a rectangular fuel tank with some fuel. Study it carefully and answer the questions that may follow.



a) Calculate the sum of all its edges.

Sum of edges = 4(L + W + H)

Sum of edges = 4(80cm + 50cm + 70cm)

Sum of edges = 4(130cm + 70cm)

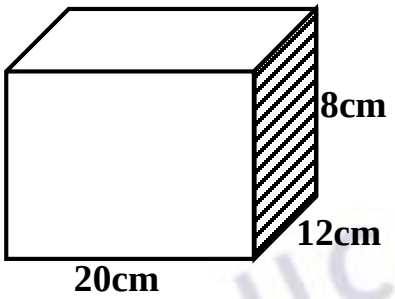
Sum of edges = 4 **X** 200cm

Sum of edges = **800cm**

b) How many litres of water are needed to fill the tank?

Exercise

Study the figure below and answer the questions that may follow.



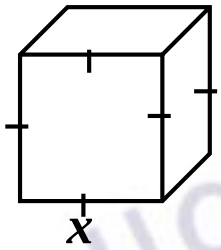
a) Workout the area of the shaded part in the figure.

b) Calculate the volume of the figure above.

c) Workout the sum of all its edges (length of the wire used to make its flame)

Application of sum of edges.

The figure below shows a cube. Study it carefully and answer the questions that may follow.



a) Given that the sum of all its edges is 72cm, calculate the value of x.

Sum of edges = 72cm

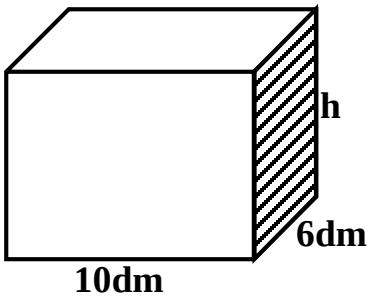
12s = 72cm

$$\frac{12s}{12} = \frac{72cm}{12}$$

S = 6cm / x = 6cm

b) Calculate the volume of the above cube.

Study the figure below and answer the questions that may follow.



a) If the length of the wire used to make the flame is 80dm, calculate the value of h.

Length of the wire = 80 dm

4L + 4W+ 4H = 80dm

(4 **X** L) + (4 **X** W) + (4 **X** H) = 80dm

(4 **X** 10dm) + (4 **X** 6dm) + (4 **X** h) = 80dm

40 dm + 24dm + 4h = 80dm

64dm + 4h = 80dm

64dm – 64dm + 4h = 80dm – 64dm

4h = 16dm

$\frac{\mathbf{4h}}{\mathbf{4}} = \frac{\mathbf{16dm}}{\mathbf{4}}$

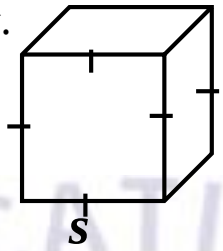
h = 4 dm

b) Calculate the area of the **shaded part** in the above cuboid.

c) Workout the volume of the cuboid.

Exercise

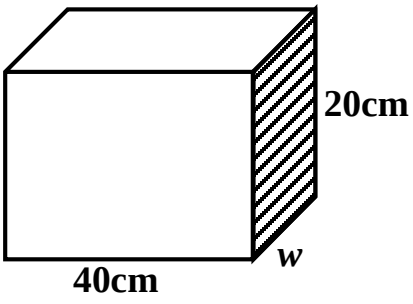
1. The figure below shows a cube. Study it carefully and answer the questions that may follow.



a) Given that the sum of all its edges is 96cm, calculate the value of ***X***.

b) Calculate the volume of the cube.

The sum of edges in the figure below is 280cm. find the value of ***w***.



TOTAL SURFACE AREA

This is the sum of the area of all faces the figure has.

Since it is area, it is given in square units like;

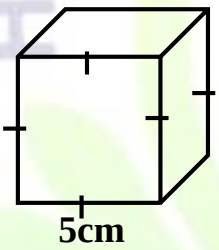
- ❖ Square centimetres (cm^2)
- ❖ Square metres (m^2)
- ❖ Square decimetres (dm^2) and many more.

i) <u>Total surface area of a cube</u>

- ✓ A cube has 6 square faces.
- ✓ Area of one square face = S **X** S or S^2
- ✓ Area of the 6 square faces = 6(S **X** S) or $6S^2$
- ✓ Total surface area of a cube = $6S^2$

Examples.

1. **Workout the total surface area of the cube below.**



T. S. A = $6S^2$

T. S. A = 6(S **X** S)

T. S. A = 6(5cm **X** 5cm)

T. S. A = 6 **X** $25cm^2$

T. S. A = $130cm^2$

2. Calculate the **total surface area** of the cube whose side is 20cm long**.**

T. S. A = $6S^2$

T. S. A = 6(S **X** S)

T. S. A = 6(20cm **X** 20cm)

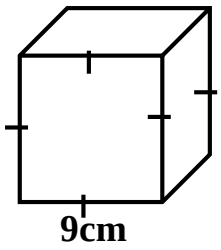
T. S. A = 6 **X** $400cm^2$

T. S. A = $2400cm^2$

3. Calculate the **total surface area** of the square tank whose side is 50cm**.**

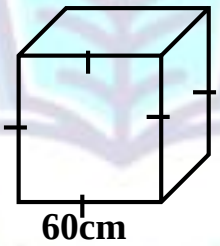
Exercise

1) Workout the total surface area of the cube below.



2) Calculate the **total surface area** of the cube whose side is 15cm long**.**

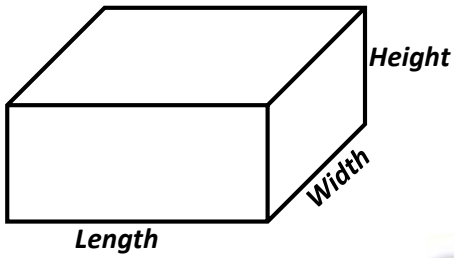
3. The figure below shows a square tank. Study it carefully and answer the questions that may follow.



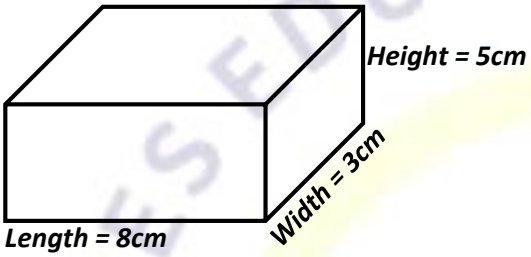
a) Calculate the length of the wire used to make its flame.

b) Calculate the total surface area of the tank.

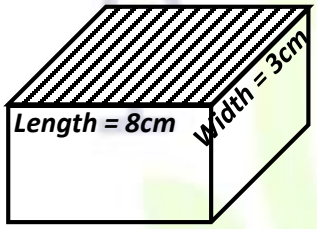
ii) Total surface area of a cuboid.



Calculate the total surface area of the cuboid below.

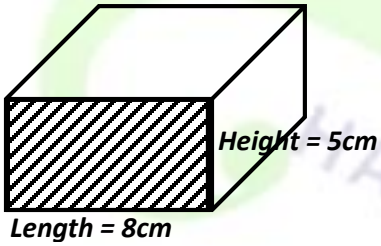


Area of the 2 similar faces (top and bottom)



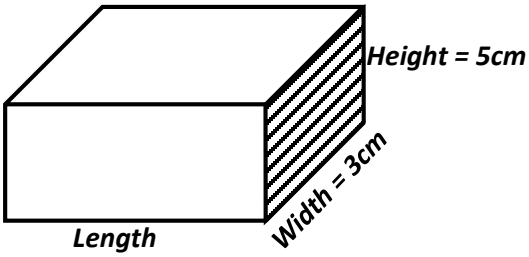
A = 2 (L X W)
A = 2 X L X W
A = 2 X 8cm X 3cm
A = 2 X 24cm^2
A = 48cm^2

Area of the 2 similar faces (in front and back sides)



A = 2 (L **X** H)
A = 2 (8cm **X** 5cm)
A = 2 **X** 40cm^2
A = 80cm^2

Area of the 2 similar faces (in left and right corners)



A = 2 (W **X** H)
A = 2 (3cm **X** 5cm)
A = 2 **X** 15cm^2
A = 30cm^2

AREA OF THE 6 FACES (T. S. A) = $48cm^2 + 30cm^2 + 80cm^2$

(T. S. A) = $78cm^2 + 80cm^2$

(T. S. A) = $158cm^2$

Then, the above can be simplified as;

T.S.A = 2 (L X W) + 2 (L X H) + 2 (W X H)

T.S.A =2 (8cm **X** 3cm) + 2 (8cm **X** 5cm) + 2 (3cm **X** 5cm)

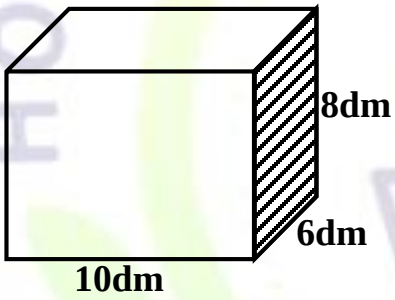
T.S.A = (2 X $24cm^2$**)** + **(**2 X $40cm^2$**)** + **(**2 X $15cm^2$**)**

T.S.A= $48cm^2 + 30cm^2 + 80cm^2$

T.S.A = $78cm^2 + 80cm^2$

T.S.A = $158cm^2$

2. Study the figure below and answer the questions that may follow.



a) Workout the total-surface area of the above figure.

T.S.A = 2 (L X W) + 2 (L X H) + 2 (W X H)

T.S.A =2 (10dm **X** 6dm) + 2 (10dm **X** 8dm) + 2 (6dm **X** 8dm)

T.S.A = (2 X $60dm^2$**)** + **(**2 X $80dm^2$**)** + **(**2 X $48dm^2$**)**

T.S.A= $120dm^2 + 160dm^2 + 96dm^2$

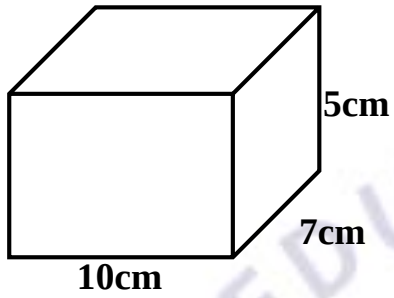
T.S.A = $280dm^2 + 96dm^2$

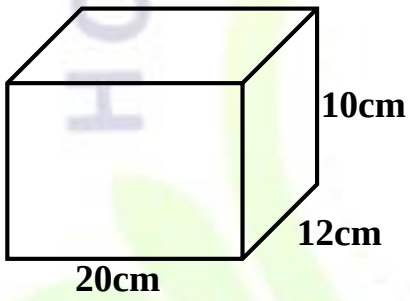
T.S.A = $376dm^2$

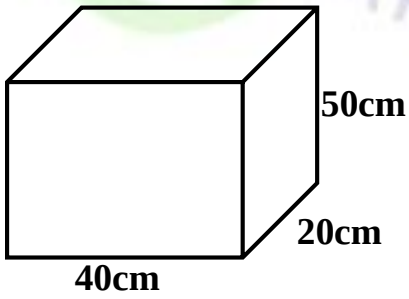
b) Calculate the length of the wire used to make its flame.

Exercise

1. Calculate the total surface area of each of the following cuboids.

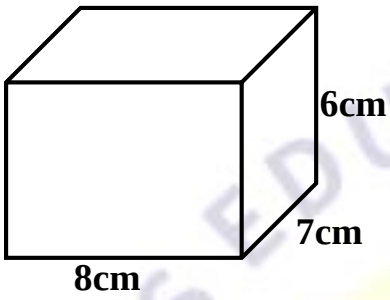




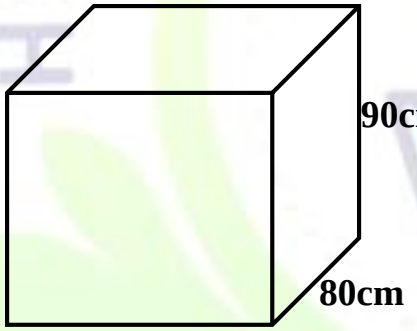


Total surface area can also be described as **area of the plate used to make** the cuboid or cube.

2. Calculate the area of the plate **(T.S.A)** used to make the rectangular box below.



3. The figure below shows a new rectangular water tank made for a home. Study it carefully and answer the questions that may follow.

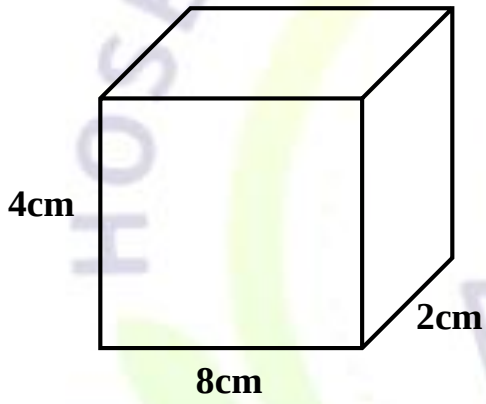


a) Calculate the length of the wire used to make its flame.

b) How many litres of water will the tank hold when full?

c) Calculate the area of the plate used to make the tank.

4. The figure below shows a rectangular box. Study it carefully and answer the questions that may follow.



a) Find the number of edges, vertices and faces the box has.
   i. Edges:.....
   ii. Vertices:.....
   iii. Faces:.....

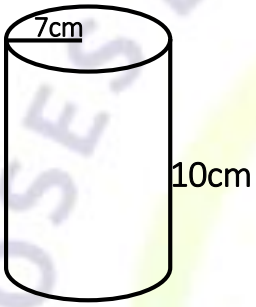
b) Calculate the **area of the plate** used to make the box.

iii) Total surface area of a cylinder.

$$T.S.A = 2\pi r\,(r+h)$$

Examples

1. Calculate the total surface area of the cylinder below. (Take $\pi = \frac{22}{7}$)



$T.S.A = 2\pi r\,(r+h)$

$T.S.A = 2 \times \pi \times r\,(r + h)$

$T.S.A = 2 \times \frac{22}{7} \times 7cm\,(\,7cm + 10cm)$

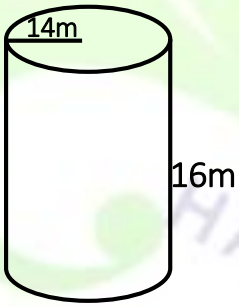
$T.S.A = 2 \times 22 \times 1cm\,(\,17cm)$

$T.S.A = 44\ cm \times 17cm$

$T.S.A = 748cm^2$

---

2. Workout the total-surface area of the figure below. (Take $\pi = \frac{22}{7}$)



$T.S.A = 2\pi r\,(r+h)$

$T.S.A = 2 \times \pi \times r\,(r + h)$

$T.S.A = 2 \times \frac{22}{7} \times 14m\,(\,14m + 16m)$

$T.S.A = 2 \times 22 \times 2m\,(\,30m)$

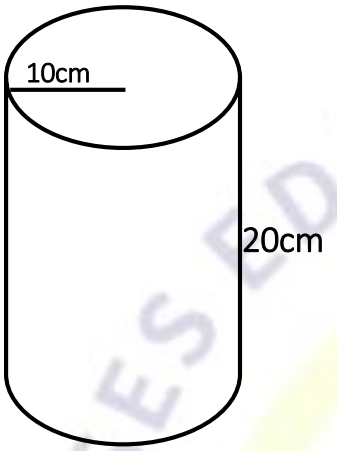
$T.S.A = 88m \times 30m$

$T.S.A = 2640\ m^2$

---

3. Workout the total-surface area of a cylinder whose radius is 21cm and the height is 8cm.

4. Calculate the total surface area of a cylinder whose radius is 10cm and the height is 20cm. (Take π = 3.14**)**



$T.S.A = 2\pi r\,(r+h)$

T.S.A = 2 X π X r (r + h)

T.S.A = 2 **X** 3.14 **X** 10cm (10cm + 20cm)

T.S.A = 2 **X** $\frac{\mathbf{314}}{\mathbf{100}}$ **X** 10cm (10cm + 20cm)

T.S.A = 2 **X** $\frac{\mathbf{314}}{\mathbf{10}}$ **X** 1cm (30cm)

T.S.A = 2 **X** $\frac{\mathbf{314}}{\mathbf{10}}$ **X** 1cm **X** 30cm)

T.S.A = 2 **X** 314 **X** 1cm **X** 3cm

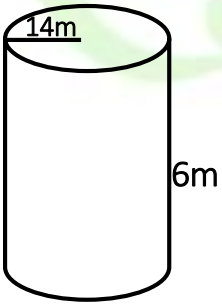
T.S.A = 628cm **X** 3cm

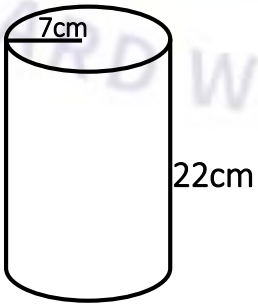
T.S.A = 1884cm^2

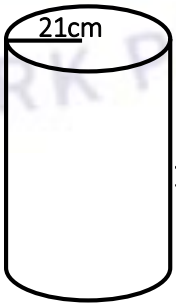
Exercise

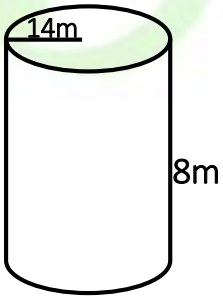
Calculate the total surface area of each of the following cylinders.

(Take $\pi = \frac{\mathbf{22}}{\mathbf{7}}$**)**



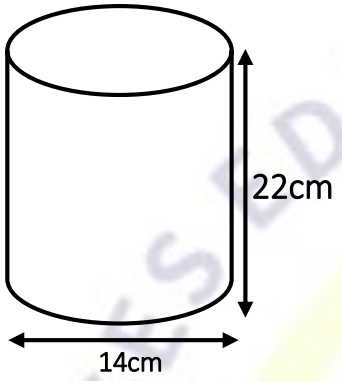






When given diameter instead of the radius.

Calculate the total-surface area of a cylinder whose diameter is 14cm and the height is 12cm. (Take $\pi = \frac{22}{7}$)



$T.S.A = 2\pi r\,(r+h)$

$T.S.A = 2 \times \pi \times r\,(r + h)$

$T.S.A = 2 \times \frac{22}{7} \times \frac{14cm}{2} \left(\frac{14cm}{2} + 22cm\right)$

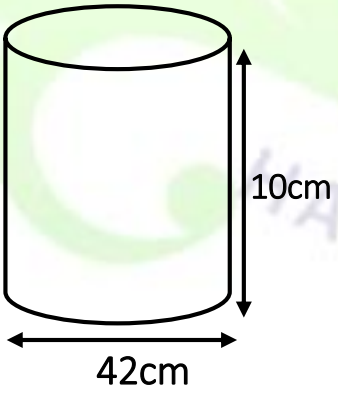
$T.S.A = 2 \times \frac{22}{7} \times 7cm\ (7cm + 22cm)$

$T.S.A = 2 \times 22 \times 1cm\ (29cm)$

$T.S.A = 44cm \times 29cm$

$T.S.A = 1276\ cm^2$

Calculate the total-surface area of a cylinder whose diameter is 42cm and the height is 10cm. (Take $\pi = \frac{22}{7}$)

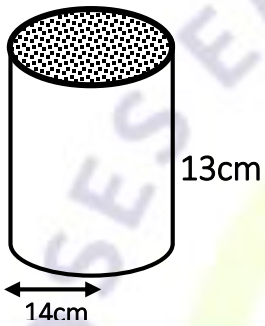


Total-surface area of a cylinder when open at the top,

$$\mathbf{T.S.A = \pi r\,(r + 2h)}$$

Examples

1. The figure below shows an open cylinder at its top. Workout its total surface area. (Take $\pi = \frac{22}{7}$)



$\mathbf{T.S.A = \pi r\,(r + 2h)}$

$T.S.A = \pi \mathbf{X}\ r\ (r + 2\ \mathbf{X}\ h)$

$T.S.A = \frac{22}{7}\ \mathbf{X}\ 14cm\ (14cm + 2\ \mathbf{X}\ 13cm)$

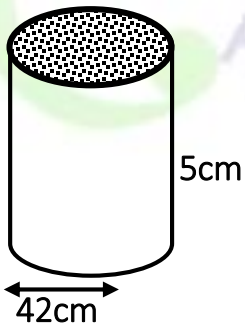
$T.S.A = \frac{22}{7}\ \mathbf{X}\ 14cm\ (14cm + 26cm)$

$T.S.A = 22\ \mathbf{X}\ 2cm\ (40cm)$

$T.S.A = 44cm\ \mathbf{X}\ 40cm$

$T.S.A = 1760cm^2$

2. The figure below shows cylinder when its cover at thetop has been removed. Workout its totala surface area. (Take $\pi = \frac{22}{7}$)



$\mathbf{T.S.A = \pi r\,(r + 2h)}$

$T.S.A = \pi \mathbf{X}\ r\ (r + 2\ \mathbf{X}\ h)$

$T.S.A = \frac{22}{7}\ \mathbf{X}\ 42cm\ (42cm + 2\ \mathbf{X}\ 5cm)$

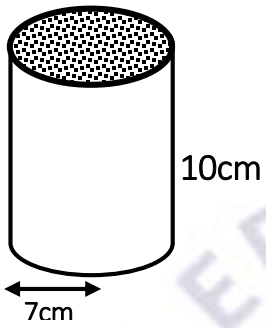
$T.S.A = 22\ \mathbf{X}\ 6cm\ (42cm + 10cm)$

$T.S.A = 132cm\ \mathbf{X}\ 52cm$

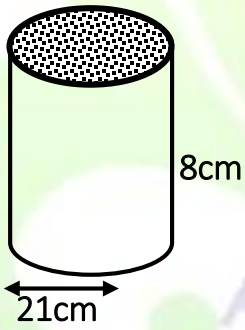
$T.S.A = 6864cm^2$

Exercise

1. The figure below shows an open cylinder at its top. Workout its total surface area. (Take $\pi = \frac{22}{7}$)



2. The figure below shows cylinder when its cover at thetop has been removed. Workout its totala surface area. (Take $\pi = \frac{22}{7}$)



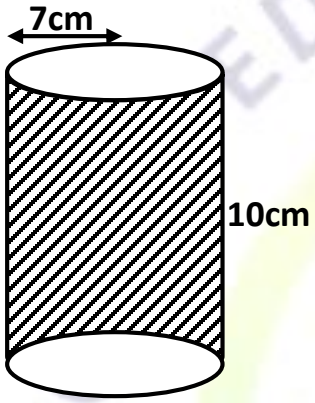
Area of the curved-surface.

When the cylinder is opened both at the bottom and the top, it remains with only **the curved surface.**

$$A = 2\pi r h$$

Examples.

1. Calculate the area of the shaded part in the cylinder below.



$A = 2\pi r h$

$A = 2 \times \pi \times r \times h$

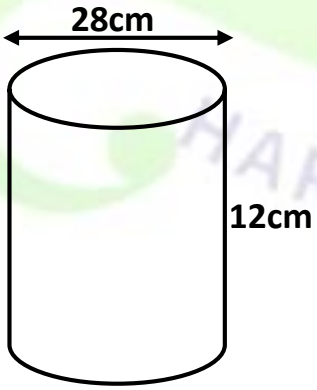
$A = 2 \times \frac{22}{7} \times 7cm \times 10cm$

$A = 2 \times 22 \times 1cm \times 10cm$

$A = 44cm \times 10cm$

$A = 440cm^2$

2. Workout the area of curved surface on a cylinder whose diameter is 28cm and the height is 12cm. (Take $\pi = \frac{22}{7}$)



$A = 2\pi r h$

$A = 2 \times \pi \times r \times h$

$A = 2 \times \frac{22}{7} \times \frac{28cm}{2} \times 12cm$

$A = 2 \times \frac{22}{7} \times 14cm \times 12cm$

$A = 2 \times 22 \times 2cm \times 12cm$

$A = 88cm \times 12cm$

$A = 1056cm^2$

When given the circumference of the cylinder.

✓ Area of the curved surface = C **X** h

3. Calculate the area of the **curved surface** on a cylinder whose circumference is 40dm and height is 15dm.

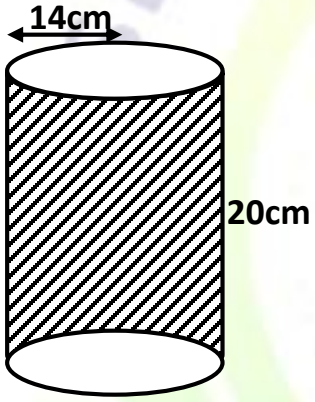
Area **(curved surface) =** C **X** h

Area **(curved surface) =** 40dm **X** 15dm

Area **(curved surface) =** 600dm^2

Exercise

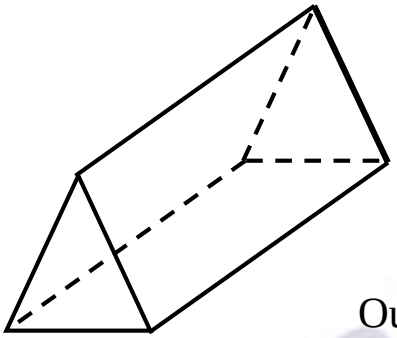
1. Calculate the area of the shaded part in the cylinder below.



2. The circumference of a cylinder is 45cm. workout the area of its curved surface given that its height is 20cm.

3. The circumference of a cylinder is 80cm. workout the area of its curved surface given that its height is 9cm

TRIANGULAR PRISM



It has; 5 faces.

6 vertices

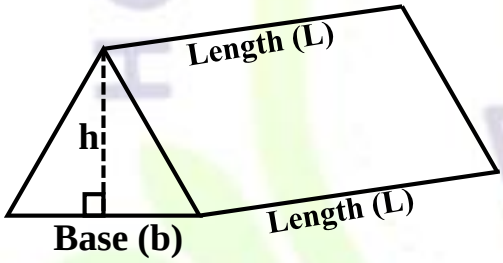
9 edges.

Out of the five faces, 3 are rectangular and 2 are triangular faces.

Volume of a triangular prism

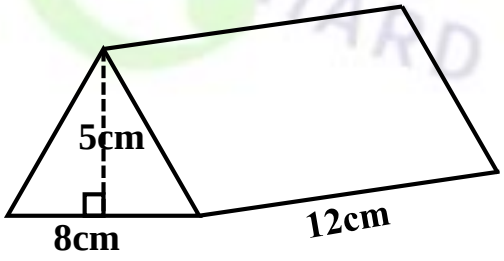
Volume = area of a triangle **X** length

Volume is given in cubic units like cm^3, m^3, dm^3 and many others



Examples

1. Calculate the volume of the triangular prism below.



Volume = area of a triangle **X** length

Volume = $\frac{1}{2}$ **X** b **X** h **X** L

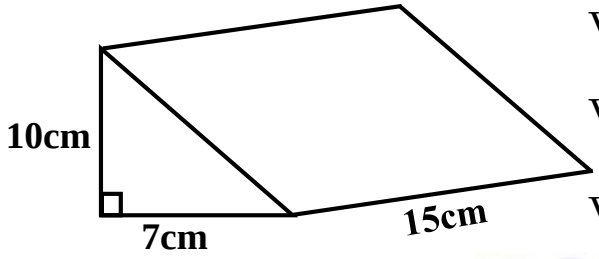
Volume = $\frac{1}{2}$ **X** 8cm **X** 5cm **X** 12cm

Volume = 1 **X** 4cm **X** 5cm **X** 12cm

Volume = $20cm^2$ **X** 12cm

Volume = $240cm^3$

2. Calculate the volume of the figure below.



Volume = area of a triangle **X** length

Volume = $\frac{1}{2}$ **X** b **X** h **X** L

Volume = $\frac{1}{2}$ **X** 7cm **X** 10cm **X** 15cm

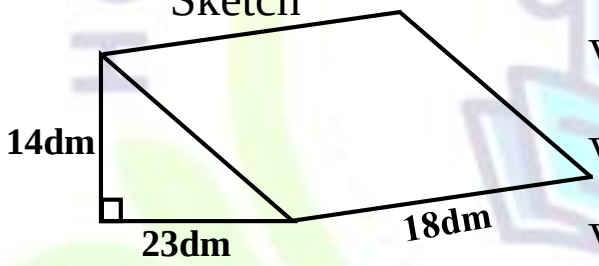
Volume = 1 **X** 7cm **X** 5cm **X** 15cm

Volume = 35cm^2 **X** 15cm

Volume = 525cm^3

3. Calculate the volume of the triangular prism whose base is 23dm and height is 14dm given that it is 18dm long.

Sketch



Volume = area of a triangle **X** length

Volume = $\frac{1}{2}$ **X** b **X** h **X** L

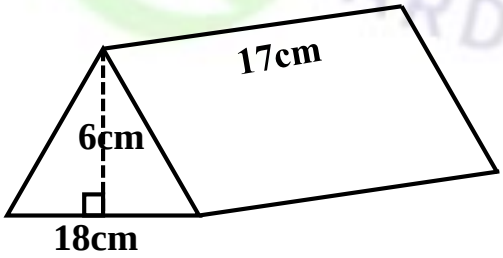
Volume = $\frac{1}{2}$ **X** 23dm **X** 14dm **X** 18dm

Volume = 1 **X** 23dm **X** 7dm **X** 18dm

Volume = 161dm^2 **X** 18dm

Volume = 2898dm^3

4. Workout the volume of the triangular prism below.



Volume = $\frac{1}{2}$ **X** b **X** h **X** L

Volume = $\frac{1}{2}$ **X** 18cm **X** 6cm **X** 17cm

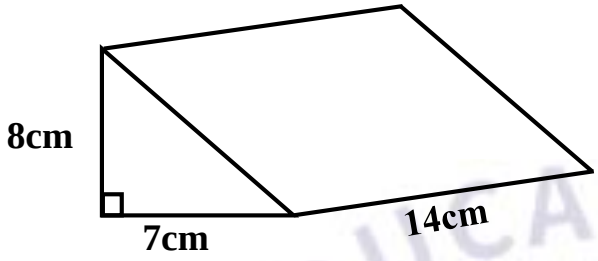
Volume = 1 **X** 9cm **X** 6cm **X** 17cm

Volume = 54cm^2 **X** 17cm

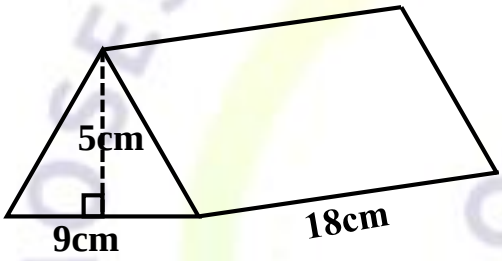
Volume = 918cm^3

Activity

1. Calculate the volume of the triangular prism below.

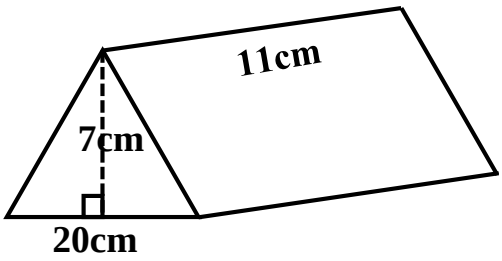


2. Calculate the volume of the figure below.



3. Calculate the volume of the triangular prism whose base is 22cm and height is 8cm given that it is 12cm long.

4. Workout the volume of the triangular prism below.



Total surface area of a triangular prism

Total surface area = BH + L(perimeter of the triangle)

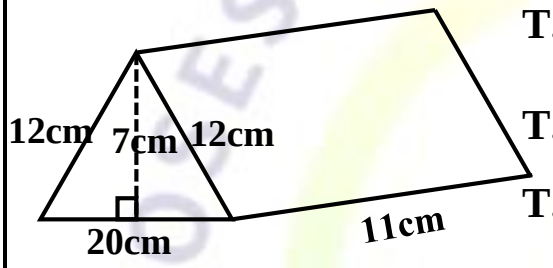
Where, **B** is the **base** of the triangle.

H is the **height** of the triangle

L is the **length** of the prism

Examples

1. Workout the total surface area **(T.S.A)** of the triangular prism below.



T.S.A = BH + L(perimeter of the triangle)

T.S.A = **(**B **X** H) + L(perimeter of the triangle)

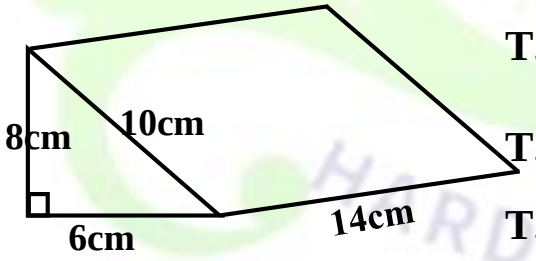
T.S.A = **(**20cm **X** 7cm) + 11cm(20 +12 + 12)cm

T.S.A = $140cm^2$ + 11cm X 44cm

T.S.A = $140cm^2$ + $484cm^2$

T.S.A = $624cm^2$

2. Calculate the volume of the triangular prism below.



T.S.A = BH + L(**perimeter of the triangle**)

T.S.A = **(**B **X** H) + L(perimeter of the triangle)

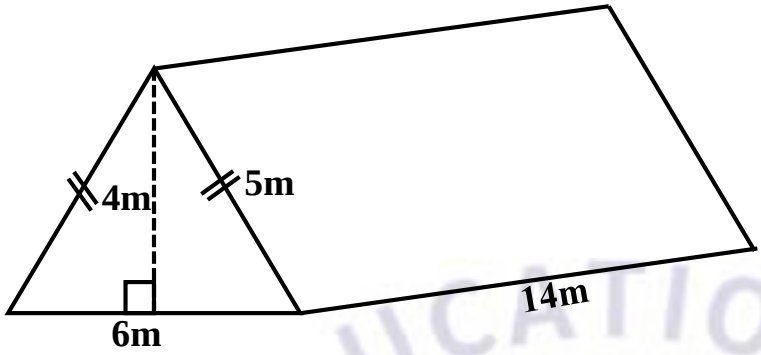
T.S.A = **(**6cm **X** 8cm) + 14cm(6 +8 + 10)cm

T.S.A = $48cm^2$ + (14cm X 24cm)

T.S.A = $48cm^2$ + $336cm^2$

T.S.A = $384cm^2$

3. Study the figure below and answer the questions that may follow.



a) Draw the net of the solid-shape above.

b) Find the volume of the solid-shape above.

c) Workout the total surface area of the solid shape above.

T.S.A = BH + L(**perimeter of the triangle**)

T.S.A = **(**B **X** H) + L(perimeter of the triangle)

T.S.A = **(**6cm **X** 4m) + 14m(6 + 5 + 5)m

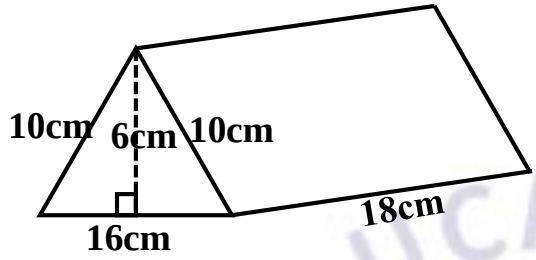
T.S.A = $24m^2$ + (14m X 16m)

T.S.A = $24m^2$ + $224m^2$

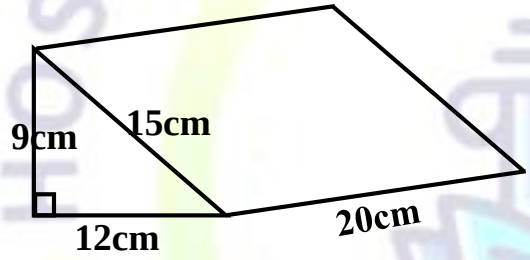
T.S.A = $248m^2$

ACTIVITY

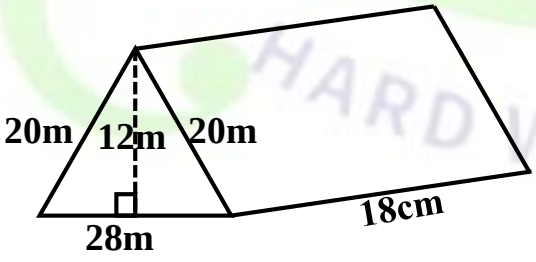
1. Workout the total surface area **(T.S.A)** of the triangular prism below.



2. Calculate the volume of the triangular prism below.



3. Workout the total surface area **(T.S.A)** of the triangular prism below.



Conversion of units.

i. Changing km into m.
ii. Changing m into km.
iii. Changing m into cm.
iv. Changing cm into m.

v. Changing square metres (m^2) into square centimetres (cm^2)

Examples.

1. Change $24m^2$ into cm^2**.**

1m = 100cm

1m **X** 1m = 100cm **X** 100cm

$1m^2 = 10000cm^2$

$24m^2 = 24$ **X** $10000cm^2$

$24m^2 = 240000cm^2$**.**

---

2. The area of a triangle is $9m^2$. Calculate its area in cm^2 **.**

1m = 100cm

1m **X** 1m = 100cm **X** 100cm

$1m^2 = 10000cm^2$

$9m^2 = 9$ **X** $10000cm^2$

$9m^2 = 90000cm^2$**.**

---

3. The area of a rectangle is $0.25m^2$. Calculate its area in cm^2.

1m = 100cm **$0.25m^2 = 2500cm^2$.**

1m **X** 1m = 100cm **X** 100cm

$1m^2 = 10000cm^2$

$0.25m^2 = 0.25$ **X** $10000cm^2$

Activity

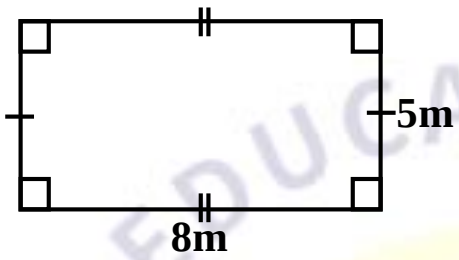
1. Express the following as square centimetres (cm^2).

a) $65m^2$	d) $0.6m^2$
b) $89m^2$	e) $12m^2$
c) $8m^2$	f) $70m^2$

2. The area of a circle is $15.4m^2$. Express its area as square centimetres.

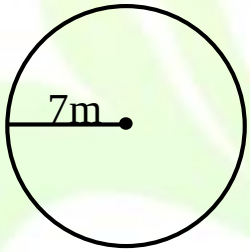
More about changing m^2 into cm^2. Examples.

1. Find the area of the rectangle below in cm^2.



A = L **X** W A = 8m **X** 5m A = $40m^2$	1m = 100cm $1m^2 = 10000cm^2$ $40m^2 = 40$ **X** $10000cm^2$ $40m^2 = 400000cm^2$

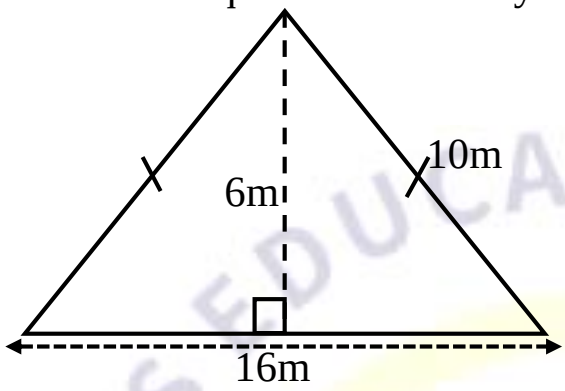
2. Calculate the area of the figure below in cm^2.



A = πr^2 A = π **X** r **X** r A = $\frac{22}{7}$ **X** 7m **X** 7m A = 22m **X** 7m A = $154m^2$	1m = 100cm 1m **X** 1m = 100cm **X** 100cm $1m^2 = 10000cm^2$ $154m^2 = 154$ x $10000cm^2$ $154m^2 = 15400000cm^2$

Activity

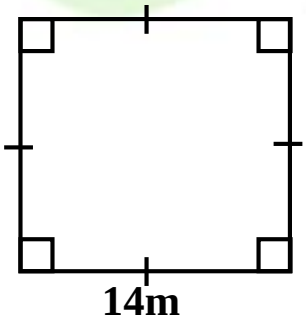
1. The figure below shows a triangular garden. Study it carefully and answer the questions that may follow.



a) Calculate the distance around the garden.

b) Calculate the area of the garden in square centimetres (cm^2).

2. Find the area of the figure below in cm^2.



vi. Changing cubic metres (m^3) into cubic centimetres (cm^3)

Examples.

1. Change $27m^3$ into cubic centimetres (cm^3).

1m = 100cm

1m **X** 1m **X** 1m = 100cm **X** 100cm **X** 100cm

$1m^3 = 1\ 000{,}000cm^3$

$27m^3 = 27$ **X** $1000{,}000cm^3$

$27m^3 = 27000{,}000cm^3$.

2. Express $0.04m^3$ as cubic centimetres (cm^3).

1m = 100cm

1m **X** 1m **X** 1m = 100cm **X** 100cm **X** 100cm

$1m^3 = 1\ 000{,}000cm^3$

$0.04m^3 = 0.04$ **X** $1000{,}000cm^3$

$0.04m^3 = 40{,}000cm^3$.

Activity

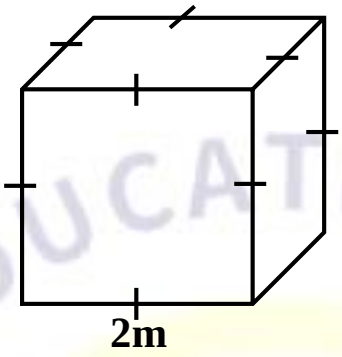
Express the following cubic metres as cm^3**.**

a) $32m^3$

b) $0.0008m^3$

More about changing m^3 into cm^3.

1. The figure below shows a square tank. Study it and answer the questions that may follow.



a) Calculate the volume of the tank.

V = S **X** S **X** S

V = 2m **X** 2m **X** 2m

V = $4m^2$ **X** 2m

V = $8m^3$

b) Find the capacity of the tank when full.

1m = 100cm

1m **X** 1m **X** 1m = 100cm **X** 100cm **X** 100cm

$1m^3$ = 1 000,000cm^3

$8m^3$ = 8 **X** 1000,000cm^3

$8m^3$ = 8000, 000cm3.

Then,

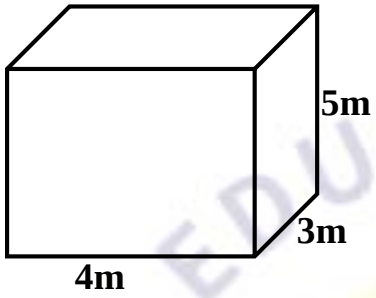
Capacity = $\frac{volume}{1000cm3}$

Capacity = $\left(\frac{8000,000}{1000}\right) litres$

Capacity = 8000 litres

Activity.

1. The figure below shows a rectangular tank. Study it carefully and answer the questions that may follow.



a) Calculate the length of the wire used to make its flame.

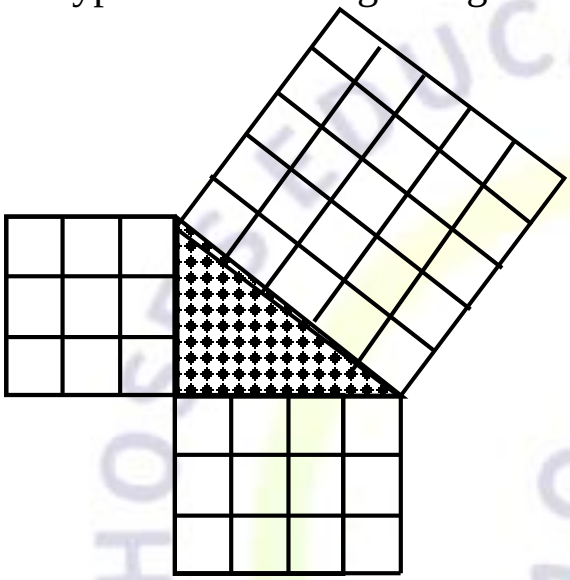
b) Find the volume of the tank.

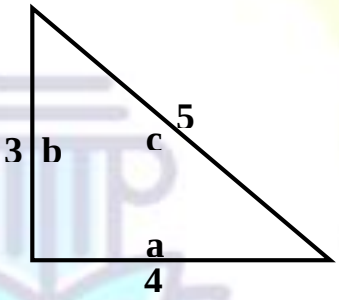
c) How much water does it hold when completely full?

Pythagoras theorem.

It states that;

0The sum of the number of squares drawn along the base and the number of squares drawn along the height is equal to the number of squares drawn along the hypotenuse of a right-angled triangle.





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

$4^2 + 3^2 = 5^2$

(4 **X** 4) + (3 **X** 3) = 5 **X** 5

16 + 9 = 25

The theorem is used to find the unknown side in a right-angled triangle. (When the other two sides of the triangle are given or known).

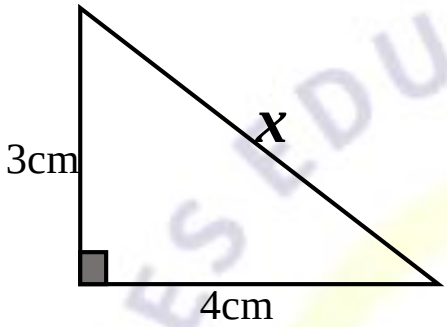
When using the theorem, make sure that;

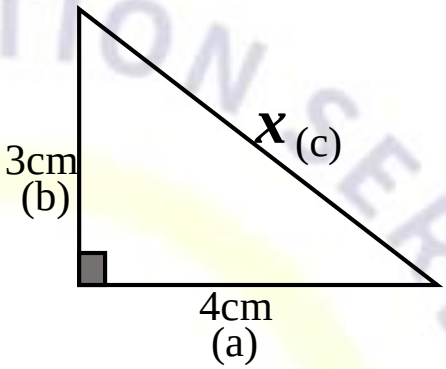
- ✓ The base of the triangle is labelled (**a**).
- ✓ The height of the triangle is labelled (**b**)
- ✓ The hypotenuse of the triangle is labelled (**c**)

Finding the missing side of a right-angled triangle using Pythagoras theorem.

Examples.

1. Find the value of ***X*** in the figure below.





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

$4^2 + 3^2 = x^2$

$(4 \mathbf{X} 4) + (3 \mathbf{X} 3) = x^2$

$16 + 9 = x^2$

$25 = x^2$

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

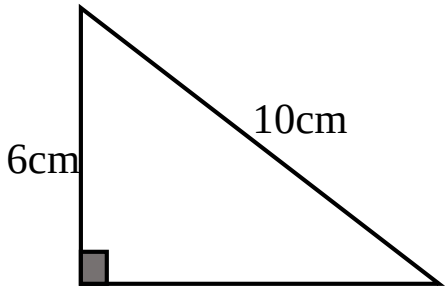
$5 = x$

x = 5cm

÷	25
5	5
5	1

5

2. Find the base of the triangle below



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

$a^2 + 6^2 = \mathbf{10^2}$

$a^2 + (6 \mathbf{X} 6) = \mathbf{10 X 10}$

$a^2 + 36 = \mathbf{100}$

$a^2 + 36 - 36 = \mathbf{100 - 36}$

$a^2 = \mathbf{64}$

$\sqrt{a^2} = \sqrt{\mathbf{64}}$

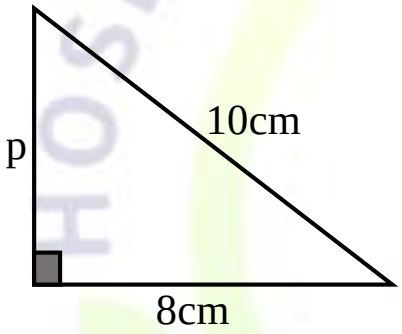
$\mathbf{a} = 2 \mathbf{X} 2 \mathbf{X} 2$

$\mathbf{a} = 8$

The base = 8cm

÷	64
2	32
2	16
2	8
2	4
2	2
2	1

3. Calculate the value of p in the figure below.



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

$\mathbf{8^2} + p^2 = \mathbf{10^2}$

$(8 \mathbf{X} 8) + p^2 = \mathbf{10 X 10}$

$64 + p^2 = \mathbf{100}$

$64 - 64 + p^2 = \mathbf{100 - 64}$

$p^2 = \mathbf{36}$

$\sqrt{p^2} = \sqrt{\mathbf{36}}$

$\mathbf{p} = 2 \mathbf{X} 3$

$\mathbf{p} = 6$

$\mathbf{p} = 6\text{cm}$

÷	36
2	18
2	9
3	3
3	1

b) Calculate the perimeter of the triangle.

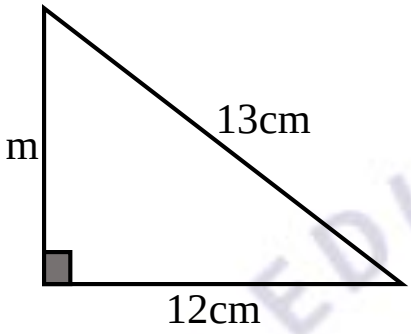
Perimeter = **S + S + S**

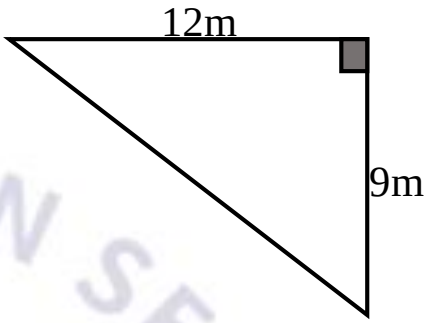
Perimeter = **8cm + 10cm + 6cm**

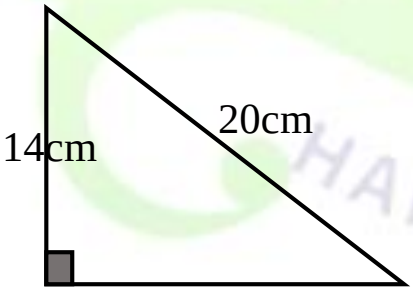
Perimeter = 24**cm**

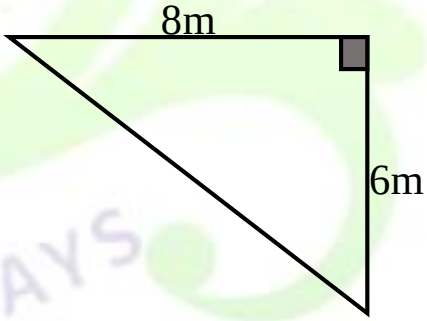
Activity

Find the unknown side of each of the following triangles.



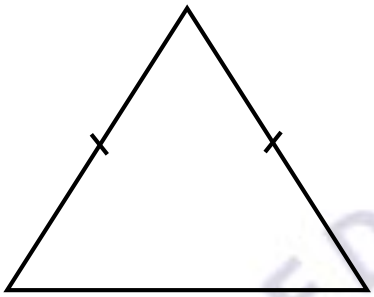


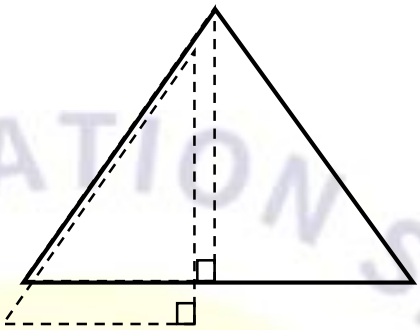




Pythagoras theorem in an isosceles triangle.

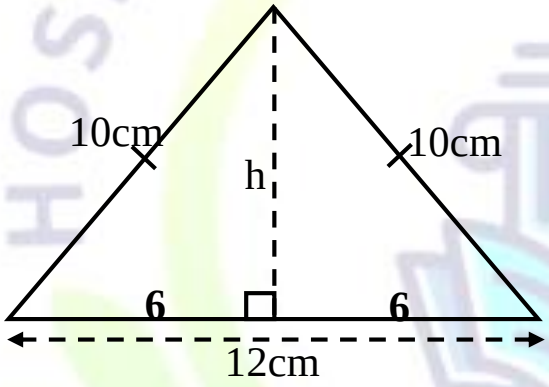
- ✓ The triangle is first divided into two equal right-angled triangles.
- ✓ One of the two triangles formed is used to find the missing length.



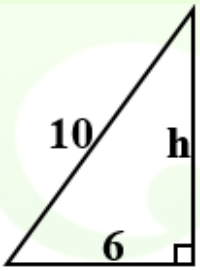


Examples

1. Study the figure below and answer the questions that may follow.



a) Calculate the height (h) of the triangle.



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

$$6^2 + h^2 = 10^2$$

$$(6 \times 6) + h^2 = 10 \times 10$$

$$36 + h^2 = 100$$

$$36 - 36 + h^2 = 100 - 36$$

$$h^2 = 64$$

$$\sqrt{h^2} = \sqrt{64}$$

$$h = 8$$

h = 8cm

÷	64
2	32
2	16
2	8
2	4
2	2
2	1

2, 2, 2

b) Calculate the area of the triangle.

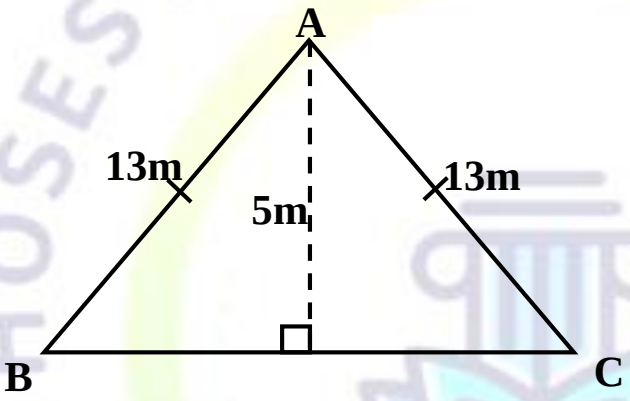
Area = $\frac{1}{2}$ **X** b **X** h

Area = $\frac{1}{2}$ **X** 12cm **X** 8cm

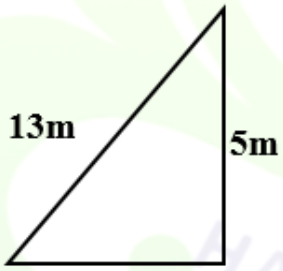
Area = 1 **X** 6cm **X** 8cm

Area = $48cm^2$

2. The figure below shows a triangular flower-garden. Study it carefully and answer the questions that may follow.



a) Calculate the length of **BC**



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

$a^2 + 5^2 = 13^2$

$a^2 + (5 \times 5) = (13 \times 13)$

$a^2 + 25 = 169$

$a^2 + 25 - 25 = 169 - 25$

$a^2 = 144$

$\sqrt{a^2} = \sqrt{144}$

$a = 12$

$BC = (12 + 12)\,m$

$BC = 24\,m$

2	2	144
2	2	72
	2	36
2	2	18
	3	9
3	3	3
		1

b) Calculate the distance around the garden (perimeter).

Perimeter = $S_1 + S_2 + S_3$

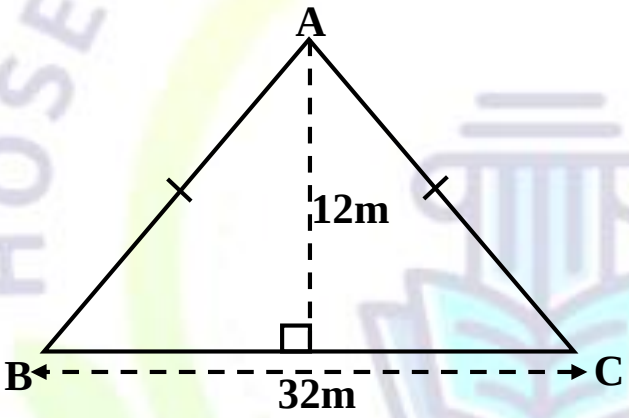
Perimeter = 24m + 13m + 13m

Perimeter = 24m + 26m

Perimeter = 50m

Trial number.

The figure below shows a triangular flower-garden. Study it carefully and answer the questions that may follow.

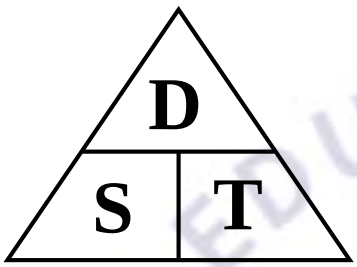


a) Calculate the length of **AB**.

b) Find the area of the garden in cm^2.

Distance, speed and time.

From the triangle below, **D** is distance, **S** is speed, and T is time.



- Distance = S **X** T
- Speed = $\frac{\textbf{Distance}}{\textbf{Time}}$
- Time = $\frac{\textbf{Distance}}{\textbf{Speed}}$

(i) Finding speed.

Speed = $\frac{\textbf{Distance}}{\textbf{Time}}$

Speed is given units like km/hr. or m/s.

Examples

1. A man covered a distance of 120km in 2hours. Calculate his speed he was travelling.

Speed = $\frac{\textbf{Distance}}{\textbf{Time}}$

Speed = $\frac{\textbf{120km}}{\textbf{2hrs}}$

Speed = 60km/hr.

2. Muhammad covered 90 metres in only 18 seconds. Calculate his speed.

Speed = $\frac{\textbf{Distance}}{\textbf{Time}}$

Speed = $\frac{\textbf{90m}}{\textbf{18s}}$

Speed = 5m/s.

Activity

1. Calculate the motorist's speed if he covers 200km in 4 hours.

2. Sulaiman covered 180km in 6 hours. Find the speed at which he travelled.

3. Find the speed if ;

D = 80m and T = 5seconds	D = 90km and T = 6hours
D = 80km and T = 2hrs	D = 150km and T = 5hours

More about finding speed.

(When time involves a fraction or minutes)

Examples.

1.) Ahmadah covered a distance of 120km in 2 $\frac{1}{2}$ hours. Calculate his speed he was travelling. **Speed =** $\frac{Distance}{Time}$

Speed = D ÷ T

Speed = 120km ÷ 2 $\frac{1}{2}$ hrs.

Speed = 120km ÷ $\frac{5}{2}$ hrs.

Speed = 120km X $\frac{2}{5}$ hrs.

Speed = (24 X 2) km/hr.

Speed = 48 km/hr.

2.) A motorist drove from Mubende to Nabingoola which is 30km away in 15 minutes only. Calculate the motorist's speed for the journey.

Speed = D ÷ T

Speed = 30km ÷ 15minutes.

Speed = 30km ÷ $\frac{15}{60}$ hrs.

Speed = 30km X $\frac{60}{15}$ hrs.

Speed = (2 X 60) km/hr.

Speed = 120 km/hr.

3.) Salapio covered a distance of 60km in only 1hour and 30 minutes. Find the speed at which he travelled.

Speed = D ÷ T

Speed = 60km ÷ 1hr and 30 minutes.

Speed = 60km ÷ 1 $\frac{30}{60}$ hrs.

Speed = 60km ÷ 1 $\frac{1}{2}$ hrs.

Speed = 60km ÷ $\frac{3}{2}$ hrs.

Speed = 60km X $\frac{2}{3}$ hrs.

Speed = (20 X 2) km/hr.

Speed = 40 km/hr.

Trial numbers

(1) Ali covered a distance of 180km in 2 $\frac{1}{2}$ hours. Calculate his speed he was travelling.

(2) A motorist drove from Kampala to Masaka which is 140km away in 1hour and 45 minutes. Calculate the motorist's speed for the journey.

Finding speed involving finding duration first.

Examples

(1) A motorist left Kampala for Jinja at 8:30am and reached at 11:00am. Given that jinja is 200km away from Kampala, calculate the motorist's speed for the whole journey.

Duration (time) = $\begin{array}{r} \overset{10}{\cancel{11}} : \overset{60}{\cancel{00}} \text{ am} \\ - \quad 8 : 30 \text{ am} \\ \hline 2 : 30 \end{array}$

T = 2 hours and 30 minutes.

Speed = D ÷ T

Speed = 200km ÷ 2hr and 30 min.

Speed = 200km ÷ 2 $\frac{30}{60}$ hrs.

Speed = 200km ÷ 2 $\frac{1}{2}$ hrs.

Speed = 200km ÷ $\frac{5}{2}$ hrs.

Speed = 200km X $\frac{2}{5}$ hrs.

Speed = (40 X 2) km/hr.

Speed = 80 km/hr.

(2) A man started his journey at 10:00am and finished it 1:00pm. If he covered a distance of 135km, (i) calculate the time taken while travelling.

1: 00 pm in 24-hr clock system

$\begin{array}{r} 1 : 00 \text{ pm} \\ + \; 12 \quad 00 \text{ hrs.} \\ \hline 13 \quad 00 \text{ hrs.} \end{array}$

Duration = 13 00 hrs.

$\begin{array}{r} - \quad 10 \quad 00 \text{ hrs.} \\ \hline 3 \quad 00 \text{ hrs.} \end{array}$

The man took 3 hours while travelling.

(ii) Calculate the speed at which the man covered the distance.

Speed = $\frac{Distance}{Time}$

Speed = $\frac{135km}{3hrs}$

Speed = 45km/hr.

Activity

(1) A motorist left town A for town B 8:00am and reached at 9:15am. Given that is town B 90km away from town A, calculate the motorist's speed for the whole journey.

(2) A man left town K for town L 2:20pm and reached at 6:50pm. If town L 210km away from town K, calculate the motorist's speed for the whole journey.

(ii) Finding time.

- Time = $\frac{\text{Distance}}{\text{Speed}}$
- Time = $\frac{D}{S}$
- Time is given in hours or seconds.

Examples

(1) A motorist travelling at a speed of 40km/hr covered a distance of 120km. Calculate the time taken for the whole journey.

Time = $\frac{\text{Distance}}{\text{Speed}}$

Time = $\frac{120\text{km}}{40\text{km/hr}}$

Time = $\left(\frac{120}{40}\right)\ hrs$

Time = $3\ hrs$

(2) Calculate the time taken to cover a distance of 150km at 60km/hr.

Time = $\frac{\text{Distance}}{\text{Speed}}$

Time = $\frac{150\text{km}}{60\text{km/hr}}$

Time = $\left(\frac{150}{60}\right)\ hrs$

Time = $\left(\frac{15}{6}\right)\ hrs$

Time = $\left(\frac{15}{6}\right)\ hrs$

Time = $\left(\frac{5}{2}\right)\ hrs$

Time = $2\frac{1}{2}\ hrs$

(3) An athlete covered 200 metres at a speed of 5m/s. calculate the time taken to cover the distance.

Time = $\frac{\text{Distance}}{\text{Speed}}$

Time = $\frac{200\text{m}}{5\text{m/s}}$

Time = $\left(\frac{200}{5}\right)\ s$

Time = 40 $seconds$

Activity

(1) A motorist moving at a speed of 60km/hr covered a distance of 120km. Calculate the time taken for the whole journey.

(2) Calculate the time taken to cover a distance of 90m at 15m/s.

(3) How long will a driver take to cover a distance of 300km at a speed of 60km/hr?

Finding distance covered.

- Distance = speed **X** time
- Distance is given in either metres (M) or Kilometres (km).
- **Examples**

(1) A motorist travelled at a constant speed of 45km/hr for two hours. Calculate the distance covered.

Distance = speed **X** time

Distance = 45km/hr **X** 2hrs

Distance = $\frac{45\text{km}}{\text{hr}}$ **X** 2hrs

Distance = 45km **X** 2

Distance = 90km

(2) A driver drove at an average speed of 28m/s for 20 seconds. Find the distance covered.

Distance = speed **X** time

Distance = 28m/s **X** 20s

Distance = $\frac{28\text{m}}{\text{s}}$ **X** 20s

Distance = 28m **X** 20

Distance = 560m

Activity

Calculate the distance moved travelling at;

(a) Speed of 60km/hr for 3 hours	(b) Speed of 18m/s for 5 seconds.

More about finding distance covered

(When time involves minutes).

- Time (minutes) is expressed as **hours** if the speed is given in km/**hr**.
- Time (minutes) is expressed as **seconds** if the speed is given in m/**s**.

Examples

(1) A motorist drove at constant speed of 40km/hr for 1 hour and 30minutes. Calculate the distance covered by the motorist.

Distance = speed **X** time

Distance = 40km/hr **X** $1\frac{30}{60}$ hr *(The 30 mins will be expressed as hours)*

Distance = $\frac{40\text{km}}{\text{hr}}$ **X** $1\frac{1}{2}$ hr

Distance = $\frac{40\text{km}}{\text{hr}}$ **X** $\frac{3}{2}$ hr

Distance = 20km **X** 3

Distance = 60km

(2) Calculate the distance covered travelling at 100km/hr for 15 minutes only.

Distance = speed **X** time

Distance = 100km/hr **X** $\frac{15}{60}$ hr *(The 15 mins will be expressed as hours)*

Distance = $\frac{100\text{km}}{\text{hr}}$ **X** $\frac{1}{4}$ hr

Distance = 25km **X** 1

Distance = 25km

(3) Find the distance covered at 15m/s for 2 minutes.

1 minute = 60 sec
2 mins = (2 X 60) sec
2 mins = 120 sec

Distance = speed **X** time

Distance = 15m/s **X** 120s

Distance = 15m **X** 120

Distance = 1800m

Activity

(1) A driver drove from Kampala to Kyenjojo at a speed of 90km/hr 2 hours and 20 minutes. Calculate the distance from Kampala to Kyenjojo.

(2) Calculate the distance covered at 120km/hr in 30 minutes.

(3) A man travelled for 1 hour and 45 minutes at a uniform speed of 80km/hr. Calculate the distance he covered.

Expressing **km/hr** as **m/s**

- Speed has two major parts i.e. the distance (km) and time (hrs.)
- The distance (km) should be expressed as metres.
- The time should also be expressed as seconds.
- Then find the speed again.
- 1km = 1000 m
- 1 hour = 3600 seconds.

Examples

(1) Change **36km/hr** into m/s.

Distance = 36km 1 km = 1000 m 36 km = (36 **X**1000) m 36 km = 36000 m	**Time = 1 hour** 1 hr = 3600 s
$S = \frac{D}{T}$ $S = \frac{36000m}{3600s}$ S = 10 m/s	**METHOD II** $\mathbf{S = \frac{D\ X\ 1000m}{3600\ s}}$ $S = \frac{36\ X\ 1000m}{3600\ s}$ S = (1 X 10) m/s S = 10 m/s

(2) Express 72km/hr as metres per second.

$$\mathbf{S = \frac{D\ X\ 1000m}{3600\ s}}$$

$$S = \frac{72\ X\ 1000m}{3600\ s}$$

S = (2 X 10) m/s

S = 20 m/s

(3) A man covered a distance at a speed of 18km/hr. calculate the man's speed in metres per second (**m/s**).

$$\mathbf{S = \frac{D \text{ X } 1000m}{3600\ s}}$$

$$S = \frac{18 \text{ X } 1000m}{3600\ s}$$

$$S = \frac{1 \text{ X } 10m}{2\ s}$$

S = (1 X 5) m/s

S = 5 m/s

Activity

(1) A driver drove from Kampala to Jinja at a speed 108km/hr. Express the driver's speed as metres per second (m/s).

(2) Change each of the following into metres per second.

(a) 90 km/hr	(b) 144 km/hr

More about changing **km/hr** into **m/s.**

(1) Muhamed drove from Mubende to Kampala in 2 hours. If it is 180km from Mubende to Kampala, calculate Muhamed's speed for the journey in metres per second (m/s).

Speed = $\frac{D}{T}$ Speed = $\frac{180km}{2hrs}$ Speed = 90km/hr	Speed = $\frac{D \text{ X } 1000m}{3600 \text{ S}}$ Speed = $\frac{90 \text{ X } 1000m}{3600 \text{ S}}$ Speed = $\frac{10 \text{ X } 10m}{4 \text{ S}}$ Speed = (5 X 5) m/s Speed = 25 m/s

(2) A motorist covered 72km in only 30 minutes. Calculate his speed in m/s.

S = D ÷ T S = 72km ÷ $\frac{30}{60}$ hrs. S = 72km X $\frac{60}{30}$ hrs. S = (72 X 2) km/ hrs. S = 144 km/hr	Speed = $\frac{D \text{ X } 1000m}{3600 \text{ S}}$ Speed = $\frac{144 \text{ X } 1000m}{3600 \text{ S}}$ Speed = $\frac{4 \text{ X } 10m}{1 \text{ S}}$ Speed = (4 X 10) m/s Speed = 40 m/s

(3) A cyclist drove from Nabingoola to Myanzi which is 72km away in 2 hours. Calculate his speed in m/s.

Changing **m/s** into km/hr.

- 1m = $\frac{1}{1000}$ km
- 1sec = $\frac{1}{3600}$ hrs.
- Speed = $\frac{D}{T}$
- Speed = $\left(\frac{1}{1000} \div \frac{1}{3600}\right)$ km/hr
- Speed = $\left(\frac{1}{1000} \mathbf{X} \frac{3600}{1}\right)$ km/hr
- Speed = $\left(\frac{3600}{1000}\right)$ km/hr

Examples

(1) Express 10m/s as kilometres per hour (km/hr).

Speed = $\left(\frac{m}{s} X \frac{3600}{1000}\right)$ km/hr.

Speed = $\left(\frac{10}{1} X \frac{3600}{1000}\right)$ km/hr.

Speed = $(1 X 36)$ km/hr.

Speed = 36 km/hr.

(2) A man drove from jinja to Mpererwe at a speed of 20m/s. calculate his speed in km/hr.

Speed = $\left(\frac{m}{s} X \frac{3600}{1000}\right)$ km/hr.

Speed = $\left(\frac{20}{1} X \frac{3600}{1000}\right)$ km/hr.

Speed = $(2 X 36)$ km/hr.

Speed = 72 km/hr.

Exercise

(1) Express 5m/s as kilometres per hour (km/hr).

(2) Change 15m/s into km/hr.

(3) Change each of the following into metres per second.

(b) 40 m/s	(b) 30m/s

More about changing **m/s** into **km/hr.**

(1) A motorist covers 30 metres in only 2 seconds. Calculate his speed in kilometres per second.

Speed in m/s	**Speed in km/hr**
S = $\frac{d}{t}$ S = $\frac{30\ m}{2\ sec}$ S = $15\ m/s$	Speed = $\left(\frac{m}{s}\ X \frac{3600}{1000}\right)$ km/hr. Speed = $\left(\frac{15}{1}\ X \frac{3600}{1000}\right)$ km/hr. Speed = $\left(\frac{15}{1}\ X \frac{36}{10}\right)$ km/hr. Speed = $\left(\frac{3}{1}\ X \frac{36}{2}\right)$ km/hr. Speed = 3 X 18 km/hr. Speed = 54 km/hr.

(2) Calculate the driver's speed in km/hr who covers 800m in 40 seconds.

Speed in m/s	**Speed in km/hr**
S = $\frac{d}{t}$ S = $\frac{800\ m}{40\ sec}$ S = $20m/s$	Speed = $\left(\frac{m}{s}\ X \frac{3600}{1000}\right)$ km/hr. Speed = $\left(\frac{20}{1}\ X \frac{3600}{1000}\right)$ km/hr. Speed = $\left(\frac{20}{1}\ X \frac{36}{10}\right)$ km/hr. Speed = $\left(\frac{2}{1}\ X \frac{36}{1}\right)$ km/hr. Speed = 2 X 36 km/hr. Speed = 72 km/hr.

Average speed.

☞ This involves two or more distances covered and their respective time (durations) to cover the distances.

☞ Average speed = $\frac{\text{Total distance}}{\text{Total time}}$

☞ Average speed is also given in **km/hr** or m/s

Examples

(1) A man drove from Kampala to mityana which is 80km away in 2 hours. He then continued for Mubende which is 100km away in 3 hours. Calculate his **average speed** for the whole journey.

A.S = $\frac{\text{TD}}{\text{T.T}}$

A.S = $\frac{(80+100)\text{Km}}{(2+3)\text{hrs}}$

A.S = $\frac{180\text{Km}}{5\text{hrs}}$

A.S = 36km/hr.

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(2) A motorist covered 50km in $1\frac{1}{2}$ hours and another same distance in $2\frac{1}{2}$ hours. Calculate his average speed for the whole journey.

A.S = T.D ÷ T.T

A.S = (50 + 50) km ÷ ($1\frac{1}{2}$ + $2\frac{1}{2}$) hrs.

A.S = 100 km ÷ (1 + 2 + $\frac{1}{2}$ +$\frac{1}{2}$) hrs.

A.S = 100 km ÷ (1 + 2 + 1)hrs.

A.S = 100 km ÷ 4hrs.

A.S = 25 km/hr.

Activity

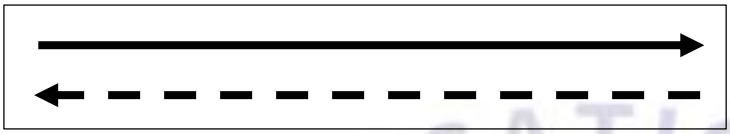
(1) A man drove from Fort portal to Mubende which is 150km away in 3 hours. He then continued for Kampala which is 130km away in 4 hours. Calculate his average speed for the whole journey.

(2) A cyclist covered 80km in 2 hours and another same distance in 3 hours. Calculate his average speed for the whole journey.

(3) Calculate the average speed when 90km and 70km are covered in 3hrs and 2hrs respectively.

Average speed involving **returns** (coming back).

☞ The distance covered when going is equal (the same) distance covered when coming back. This is when using the same route.

☞ 

Examples

(1) Lubwama left Mubende for Mityana which is 80km away and took 3hours. Given that he used the same route and returned in only 2 hours, calculate his average speed for the whole journey.

$A.S = \frac{TD}{T.T}$

$A.S = \frac{(80+80)Km}{(3+2)hrs}$

$A.S = \frac{160Km}{5hrs}$

A.S = 32km/hr.

(2) A man drove from town **A** to town **B** in which is 90km away in $1\frac{1}{2}$ hours and then went back taking $2\frac{1}{2}$ hours. Calculate the average speed for the journey.

A.S = T.D ÷ T.T

A.S = (90 + 90) km ÷ $(1\frac{1}{2} + 2\frac{1}{2})$ hrs.

A.S = 180 km ÷ $(1 + 2 + \frac{1}{2} + \frac{1}{2})$ hrs.

A.S = 180 km ÷ (1 + 2 + 1)hrs.

A.S = 180 km ÷ 4hrs.

A.S = 45 km/hr.

Activity

(1) Sulaiman left Nabingoola for Kasambya which is 45km away and took 2hours. Given that he used the same route and returned in only 1 hour, calculate his average speed for the whole journey.

(2) A man drove from town **K** to town **L** in which is 85km away in 3 hours and then went back taking 2 hours. Calculate the average speed for the journey.

(3) A motorist drove from town **P** to town **Q** which is 120km away in 3 hours and then went back taking the same time. Calculate the average speed for the journey.

Average speed involving **stoppages (resting time)**

- The driver may stop to rest or to repair the vehicle.
- The time taken while resting is also added to the time for the whole journey.
- Examples.

(1) A motorist drove from Mubende to Kampala via Mityana. He drove from Mubende for 3 hours and reached Mityana which is 125km away. At Mityana**, he rested for 1 hour** and then continued with his journey to Kampala which is 115km away in 2 hours.

(a) Calculate the distance from Mubende to Kampala.

D = 125km + 115km

D = 240km

(b) Calculate his average speed for the whole journey.

$$A.S = \frac{TD}{T.T}$$

$$A.S = \frac{240Km}{(3+\mathbf{1}+2)hrs}$$

$$A.S = \frac{240Km}{6hrs}$$

A.S = 40km/hr.

(2) A driver drove from Mbarara for 3 hours and reached Masaka which is 140km away. At Masaka**, he repaired the vehicle for 30 minutes** and then continued with his journey to Kampala which is 160km away in $2\frac{1}{2}$ hours. Calculate the driver's speed for the whole journey.

A.S = Total distance ÷ Total time.

$$A.S = \frac{(140 + 160)Km}{3hrs + \mathbf{30min} + 2\frac{1}{2}hrs}$$

$$A.S = \frac{300Km}{3 + \frac{1}{2} + 2\frac{1}{2}hrs}$$

$$A.S = \frac{300\text{Km}}{3+2+\frac{1}{2}+\frac{1}{2}\text{hrs}}$$

$$A.S = \frac{300Km}{(3+2+1)\text{hrs}}$$

$$A.S = \frac{300Km}{6\text{hrs}}$$

A.S = 60km/hr.

(3) Muhamed left Lwegula for Mpigi which is 200km away. After covering 120km in 2 hours, he slept for 45minutes and then covered the remaining distance in 1 hour and 15 minutes.

(a) Calculate the time taken for the whole journey.

2 hrs + 45mins + 1hr + 15mins

$(2 + \frac{45}{60} + 1\frac{15}{60})$ hrs

$(2 + \frac{3}{4} + 1\frac{1}{4})$ hrs

$(2 + 1 + \frac{1}{4} + \frac{3}{4})$ hrs

(2 + 1 + 1) hrs

4 hrs

(b) Calculate Muhamed's average speed for the whole journey.

$$A.S = \frac{TD}{T.T}$$

$$A.S = \frac{200\text{Km}}{4\text{ hrs}}$$

A.S = 50km/hr.

(c) What distance had he remained with before resting?

Finding average speed involving finding distance first. (Application)

(1) A man drove at 45km/hr for 2 hours and changed his speed to 50km/hr and drove 3 hours.

(a) Calculate the total distance covered by the man.

Part I	Part II	**TOTAL DISTANCE**
D = S X T D = 45km/hr X 2hrs D = (45 X 2) km D = 90 km	D = S X T D = 50km/hr X 3hrs D = (50 X 3) km D = 150 km	1 5 0 Km + 9 0 Km 2 4 0 Km

(b) Calculate his average speed for the whole journey.

$A.S = \frac{TD}{T.T}$

$A.S = \frac{240Km}{(2+3)\ hrs}$

$A.S = \frac{240Km}{5\ hrs}$

A.S = 48km/hr.

(2) Asiimwe left home travelling at 60km/hr. After travelling for 2 hours, he used the same route and returned home taking 4 hours. Calculate his average speed for the whole journey.

Distance	Average speed
D = S X T D = 60km/hr X 2hrs D = (60X 2) km D = 120 km	$A.S = \frac{T.D}{T.T}$ $A.S = \frac{(120+120)Km}{(2+4)hrs}$ $A.S = \frac{240Km}{6hrs}$ A.S = 40km/hr

(3) Kato left town **A** driving at 75km/hr. After 2 hours, his car got a puncture and delayed for 45 minutes. He the continued at 60km/hr for 2 hours and 15 minutes to town **B**.

(a) What distance did he cover before his car got a puncture?

Distance (before the puncture) = S X T

D = 75km/hr X 2 hrs.

D = (75 X 2) Km.

D = 150 Km.

(b) How far is Town B from Town A?

Distance (after)	**Total distance**
D = S X T D = 60km/hr X $2\frac{1}{4}$hrs D = (60 X $\frac{9}{4}$) km D = (15 X 9) km D = 135 km	1 5 0 km + 1 3 5 km 2 8 5 km

(c) Workout Kato's average speed for the whole journey.

$$A.S = \frac{\text{T.distance}}{\text{T.time}}$$

$$A.S = \frac{285\text{km}}{\left(2+\frac{45}{60}+2\frac{15}{60}\right)\text{hrs}}$$

$$A.S = \frac{285\text{km}}{\left(2+\frac{3}{4}+2\frac{1}{4}\right)\text{hrs}}$$

$$A.S = \frac{285\text{km}}{\left(2+2+\frac{3}{4}+\frac{1}{4}\right)\text{hrs}}$$

$$A.S = \frac{285\text{km}}{(2+2+1)\text{hrs}}$$

$$A.S = \frac{285\text{km}}{5\text{hrs}}$$

A.S = 57km/hr.

Exercise

(1) A Gaso bus travelling from Kampala to Lyantonde at a speed of 60km/hr broke down after a $2\frac{1}{2}$ hour drive. The repairs took 30 minutes. The bus continued with the journey at a speed of 50km/hr for an hour.

(a) Find the total distance covered by the bus.

(b) Find the average speed of the bus for the whole journey.

Speed involving **points of time**

Points of time are the starting and the ending time.

Time taken = ending time – starting time.

Examples.

(2) A motorist leaves his home at 9:00am for Kisoro town which 45km is away riding at 16 km per hour. At 9:15am, he gets a puncture and delays for 15 minutes.

(a) At what speed must he cover the remaining journey in order to reach Kisoro town at 10:00am?

Before the puncture		***After the puncture***
Time taken	**Distance covered**	Distance left = (45 – 4)km Distance left = 41 km **Starting time;** 9 : 1 5 am + 1 5 9 : 3 0 am **Time to take;** 1 0 : 0 0 am – 9 : 3 0 am 0 : 3 0
9 : 1 5 am – 9 : 0 0 am 0 : 1 5 T. taken = 15 mins.	D = S **X** T D = 16km/hr **X** 15min D = 16km/hr **X** $\frac{15}{60}$ hrs D = 16km **X** $\frac{1}{4}$ D = 4km	

S = $\frac{D}{T}$

S = 41km ÷ 30 mins

S = 41km ÷ $\frac{30}{60}$ hrs

S = 41km ÷ $\frac{1}{2}$ hrs

S = (41 X $\frac{2}{1}$)km/hr.

S = (41km X 2) km/hr

S = 82 km/hr

(2) Town **R** is 120km away from Town **S**. Ali drove from town **R** starting at 8:00am and arrived at **S** at 9:30am where he stayed for 30 minutes and then returned to town **R** through the same route at a speed of 60km/hr.

(a) At what time did Ali arrive at town **R**?

Time he left town S = **9 : 3 0 am**

$$\begin{array}{r} + \quad 3\,0 \\ \hline 10{:}\,0\,0\text{am} \end{array}$$

Time from S to R $= \frac{D}{S}$

$$= \frac{120\text{km}}{60\text{km/hr}}$$

$$= \left(\frac{120}{60}\right)\text{hrs}$$

$$= 2\text{hrs.}$$

Arrival time at R

$$\begin{array}{r} 1\,0{:}\,0\,0\ \text{am} \\ + \quad 2{:}\,0\,0 \\ \hline 1\,2{:}\,0\,0\ \text{noon} \end{array}$$

(b) Calculate Ali's average speed for the whole journey**.**

Time from **R** to **S**	Average speed
$\begin{array}{r} 9{:}\,3\,0\ \text{am} \\ - \quad 8{:}\,0\,0\ \text{am} \\ \hline 1{:}\,3\,0 \end{array}$ 1hr and 30 mins	$\text{A.S} = \frac{\text{T. Distance}}{\text{T.T ime}}$ $\text{A.S} = \frac{(120+120)\text{km}}{\left(1\frac{30}{60}+\frac{30}{60}+2\right)\text{hrs}}$ $\text{A.S} = \frac{(120+120)\text{km}}{\left(1\frac{1}{2}+\frac{1}{2}+2\right)\text{hrs}}$ $\text{A.S} = \frac{240\text{km}}{4\text{hrs}}$ A.S = 60km/hr.

Trial number

(1) Town **A** is 150km away from Town **B**. Muhamed drove from town **A** starting at 9:00am and arrived at **B** at 11:30am where he stayed for 30 minutes and then returned to town **A** through the same route at a speed of 60km/hr.

(a) At what time did Muhamed arrive at town B?

(b) Calculate Muhamed's average speed for the whole journey.

(c) At what time did he arrive at town A from town B?