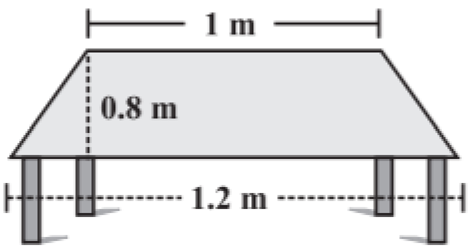
mensuration

Chapter 9

Exercise 9.1

1. The shape of the top surface of a table is a trapezium. Find its area if its parallel sides are 1m **and** 1.2m **and perpendicular distance between them is** 0.8m **.**



Ans: Area of Trapezium = $\frac{1}{2}$ (Sum of parallel sides) x (Distances between parallel sides)

$$= \frac{1}{2}[(1m+1.2m) \text{ x } 0.8m]$$

$$= \frac{1}{2}(1.76m^2) = 0.88m^2$$

2. The area of a trapezium is $34cm^2$ **and the length of one of the parallel sides is** 10cm **and its height is** 4cm **. Find the length of the other parallel side.**

Ans: It is given that Area of Trapezium = $34cm^2$.

Length of one parallel side = $10cm$

Height = $4cm$

Now, let length of other parallel side = ‘ a ’ cm

Therefore, Area of Trapezium =

$\frac{1}{2}$ (Sum of parallel sides) x (Distances between parallel sides)

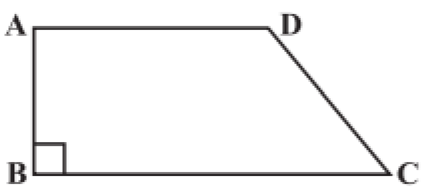
$34cm^2 = \frac{1}{2}[(10+a)x4]cm$

$34cm^2 = (20 + 2a)cm$

$\frac{14}{2}cm = a$ cm

Thus, Length of other parallel side (a) = $7cm$.

3. Length of the fence of a trapezium shaped field ABCD is $120m$. If BC = $48m$, CD = $17m$ and AD = $40m$, find the area of this field. Side AB is perpendicular to the parallel sides AD and BC.



Ans: Length of the fence of Trapezium ABCD = AB+BC+CD+DA

$120m = (AB + 48 + 17 + 40)m$

$120m = AB + 105m$

Therefore, AB = $15m$

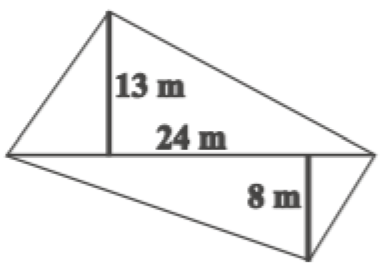
Area of the field ABCD = $\frac{1}{2}(AD + BC) \text{ x } AB$

$$= \frac{1}{2}(40 + 48) \times 15$$

$$= \frac{1}{2}(88) \times 15$$

$$= 660m^2$$

4. The diagonal of a quadrilateral shaped field is $24m$ and the perpendiculars dropped on it from the remaining opposite vertices are $8m$ and $13m$. Find the area of the field.



Ans: It is given that Length of diagonal = $24m$

Length of the perpendiculars h_1 and h_2 from the opposite vertices to the diagonal are

$h_1 = 8m$ and $h_2 = 13m$

Area of Quadrilateral = $\frac{1}{2}d(h_1 + h_2)$

$$= \frac{1}{2}(24m) \times (13m + 8cm)$$

$$= \frac{1}{2}(24m)(21m)$$

$$= 252m^2$$

Thus, Area of field = $252m^2$

5. The diagonals of a rhombus are 7.5cm and 12cm. Find its area.

Ans: Area of Rhombus = $\frac{1}{2}$ (Product of its diagonals)

$$= \frac{1}{2} \text{ x } 7.5\text{cm x } 12\text{cm}$$

$$= 45\text{cm}^2$$

6. Find the area of a rhombus whose side is 5cm and whose altitude is 4.8cm. If one of its diagonals is 8cm long, find the length of the other diagonal.

Ans: Let the length of other diagonal of Rhombus be 'x'

A Rhombus is a special case of Parallelogram

The area of Parallelogram is given by its base and height

Thus, Area of Rhombus = Base x Height

$$= 6\text{cm x } 4\text{cm} = 24\text{cm}^2$$

So,

Area of Rhombus = $\frac{1}{2}$ (Product of its diagonals)

$$24\text{cm}^2 = \frac{1}{2}(8\text{cm x x})$$

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

Therefore, Length of other diagonal of Rhombus = 6cm

7. The floor of a building consists of 3000tiles which are rhombus shaped and each of its diagonals are 45cm and 30cm in length. Find the total cost of polishing the floor, if the cost per m^2 is Rs 4.

Ans: Given that each diagonals of Rhombus are 45cm and 30cm

Area of Rhombus = $\frac{1}{2}$ (Product of its diagonals)

$$= \left(\frac{1}{2} \text{ x } 45 \text{ x } 30\right)\text{cm}^2$$

$$= 675\text{cm}^2$$

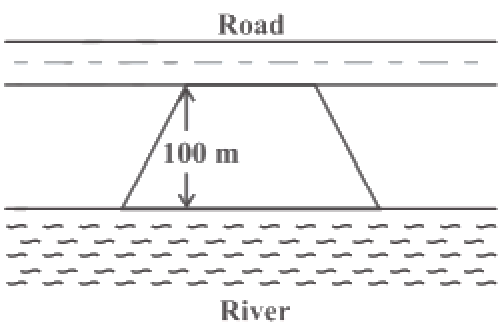
So, Area of 3000 tiles = $(675 \times 3000)\text{cm}^2 = 2025000 \text{ cm}^2 = 202.5 \text{ m}^2$

Now, it is given that cost of polishing is $\text{Rs. } 4 \text{ per m}^2$

So, Cost of Polishing 202.5m^2 area = $\text{Rs}(4 \text{ x } 202.5)$ = $\text{Rs } 810$

Hence, Cost of polishing the floor is $\text{Rs. } 810$

8. Mohan wants to buy a trapezium shaped field. Its side along the river is parallel to and twice the side along the road. It the area of this field is 10500m^2 and the perpendicular distance between the two parallel sides is 100m, find the length of the side along the river.



Ans: Let the length of the side along the road = 'l'

And Let the length of the side along the river = '$2l$'

It is given that distance between two parallel sides = 100m and Area of Trapezium = 10500m^2

Area of Trapezium = $\frac{1}{2}$ (Sum of parallel sides) (Distance between the parallel sides)

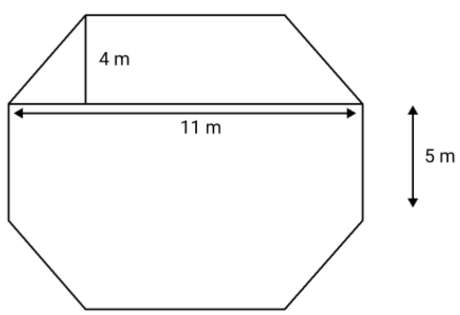
$$10500m^2 = \frac{1}{2}(l + 2l) \times (100m)$$

$$3l = \left(\frac{2 \times 10500}{100}\right)m = 210m$$

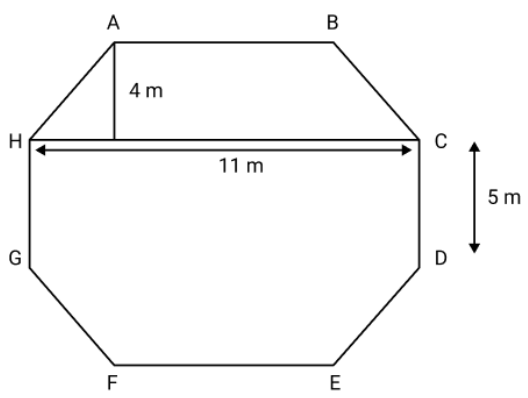
$$l = \frac{210}{3}m = 70m$$

Therefore, Length of the side along the river ' 2l ' =140m

9. Top surface of a raised platform is in the shape of a regular octagon as shown in the figure. Find the area of the octagonal surface.



Ans:



It is given in the figure that side of octagon = 5cm

Area of Trapezium ABCH = Area of Trapezium DEFG

Area of Trapezium = $\frac{1}{2}$ (Sum of parallel sides) (Distance between the parallel sides)

$$= \left[\frac{1}{2}(4)(11+5)\right]m^2$$

$$= \left(\frac{1}{2} \text{ x } 4 \text{ x } 16\right)m^2 = 32m^2$$

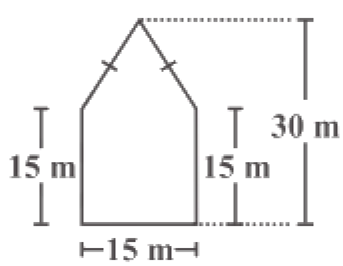
In rectangle HCDG, Length(l) = 11m and Breadth(b) = 5m

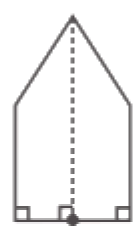
So, Area of rectangle = $(11 \text{ x } 5)m^2 = 55m^2$

Therefore, Area of octagon = Area of Trapezium ABCH + Area of Trapezium DEFG +

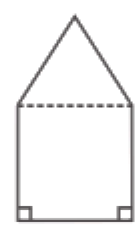
Area of Rectangle= $(32 + 32 + 55)m^2 = 119m^2$

10. There is a pentagonal shaped park as shown in the figure. For finding its area Jyoti and Kavita divided it in two different ways. Find the area of this park using both ways. Can you suggest some other way of finding its area?



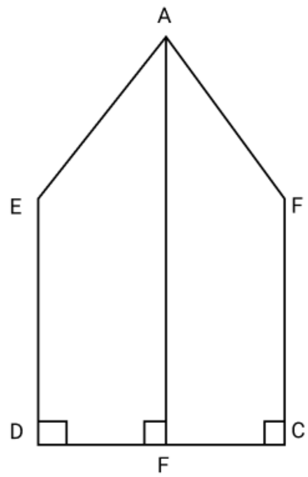


Joyti's diagram



Kavita's diagram

Ans: From Jyoti's Way of finding area ,



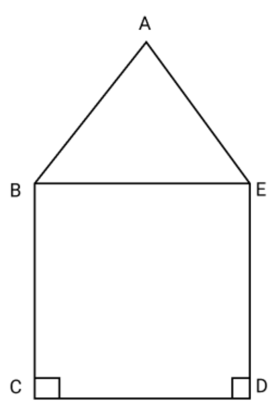
Area of Pentagon = 2 (Area of Trapezium ABCF)

$= 2\left[\frac{1}{2}\text{(Sum of parallel sides) (Distance between the parallel sides)}\right]$

$= \left[2 \text{ x } \frac{1}{2}(15 + 30)\left(\frac{15}{2}\right)\right] m^2$

$= 337.5 m^2$

From Kavita's Way of finding area ,



Area of Pentagon = Area of Triangle ABE + Area of Square BCDE

$= \left[\frac{1}{2}\text{(base x height)}\right] + \text{(sidexside)}$

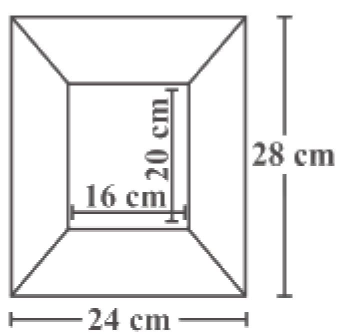
$$= \left[\frac{1}{2} \text{ x } 15 \text{ x } (30 - 15) + (15)^2\right] m^2$$

$$= \left(\frac{1}{2} \text{ x } 15 \text{ x } 15 + 225\right) m^2$$

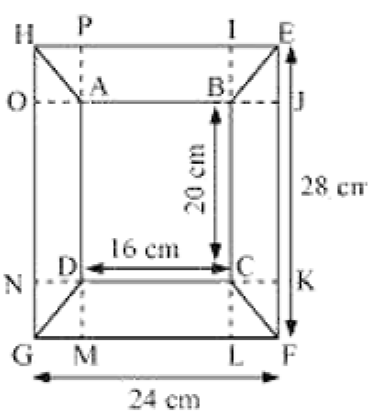
$$= (112.5 + 225) m^2$$

$$= 337.5 m^2$$

11. Diagram of the adjacent picture frame has outer dimensions = $24 cm \times 28 cm$ **and inner dimensions** $16 cm \times 20 cm$ **Find the area of each section of the frame, if the width of each section is same.**



Ans:



Given that, the width of each section is the same.

Therefore,

IB = BJ = CK = CL = DM = DN = AO = AP

IL = IB + BC + CL

$28 = IB + 20 + CL$

$28 - 20 = IB + CL$

$8 = IB + CL$

IB = CL = 4cm

Hence, IB = BJ = CK = CL = DM = DN = AO = AP = 4cm

Area of section BEFC = Area of section DGHA = Area of Trapezium

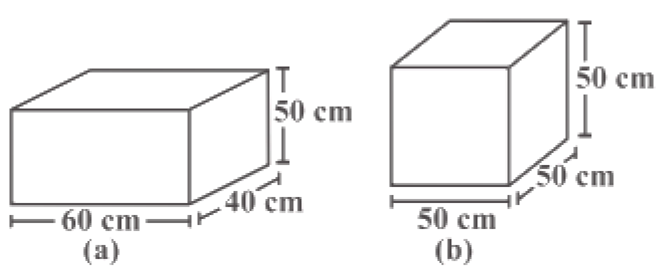
$$\left[\frac{1}{2}(\text{base}_1 + \text{base}_2)(h)\right] = \left[\frac{1}{2}(20 + 28)(4)\right]\text{cm}^2 = 96\ \text{cm}^2$$

Therefore, Area of section ABEH = Area of section CDGF.

Hence area of each section of frame is $96\ \text{cm}^2$

Exercise 9.2

1. There are two cuboidal boxes as shown in the adjoining figure. Which box requires the lesser amount of material to make?



Ans: From the given figure; Length(l), Breadth(b) and Height(h) of the Cuboid is 60cm, 40cm, 50cm respectively.

And, Side of Cube is 50cm.

Now, Total Surface area of Cuboid(a) = $2(lh + bh + lb)$

$= [2\{(60)(40)+(40)(50)+(50)(60)\}]cm^2$

$= [2(2400+2000+3000)]cm^2$

$= (2 \times 7400)cm^2$

$= 14800cm^2$

Total Surface area of Cube(b) = $6l^2$

$= 6(50\ cm)^2 = 15000\ cm^2$

Therefore, Cuboidal box(a) requires lesser amount of material for making.

2. A suitcase with measure $80cm \times 48cm \times 24cm$ is to be covered with a tarpaulin cloth. How many metres of tarpaulin of width $96cm$ is required to cover 100 such suitcases?

Ans: Given that length(l),breadth(b),height(h) of suitcase is $(80,48,24)cm$ respectively.

Total surface area of suitcase = $2(lh + bh + lb)$

$= 2[(80)(48)+(48)(24)+(24)(80)]$

$= 2[3840+1152+1920]$

$= 13824\ cm^2$

Total surface area of 100 suitcases = $100 \times 13824cm^2$

$= 1382400cm^2$

Required Tarpaulin

We have given that breadth of Tarpaulin is $96cm$ and we have to find Length of tarpaulin.

Required Tarpaulin = (Length x Breadth) of Tarpaulin

$1382400cm^2$ = Length x $96cm$

Length = $\left(\frac{1382400}{96}\right)cm = 14400\ cm$

Therefore, Length = $144m \quad (\because 1m = 100cm)$

Thus, $144m$ of tarpaulin is required to cover 100 suitcases.

3. Find the side of a cube whose surface area is $600cm^2$.

Ans: It is given that surface area of cube is $600cm^2$.

We have to find side of cube (a).

Surface area of cube = $6a^2$

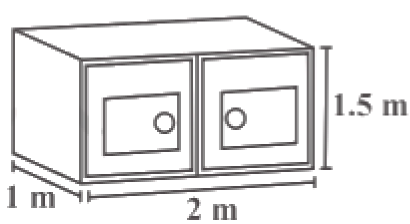
$600cm^2 = 6a^2$

$\therefore a^2 = 100cm^2$

$a = 10cm$

Thus, side of cube is $10cm$.

4. Rukhsar painted the outside of the cabinet of measure $1m \times 2m \times 1.5m$. How much surface area did she cover if she painted all except the bottom of the cabinet?



Ans: It is given that length (l), breadth(b), height(h) of the cabinet is $2m, 1m, 1.5m$ respectively.

Area of the surface = $2h(l + b) + lb$

$= [2x1.5x(2+1)+(2)(1)]m^2$

$= [3(3)+2]m^2$

$= 11m^2$

5. Daniel is painting the walls and ceiling of a cuboidal hall with length, breadth and height of $15m, 10m \text{ and } 7m$ **respectively. From each can of paint** $100m^2$ **of area is painted. How many cans of paint will she need to paint the room?**

Ans: Given that length (l), breadth(b), height(h) of Cuboid is $15m, 10m \text{ and } 7m$ respectively.

Area of the hall to be painted = Area of the wall + Area of ceiling

$= 2h(l+b)+lb$

$= [2x7(15+10)+(15x10)]m^2$

$= [(2x175)+150]m^2$

$= 500m^2$

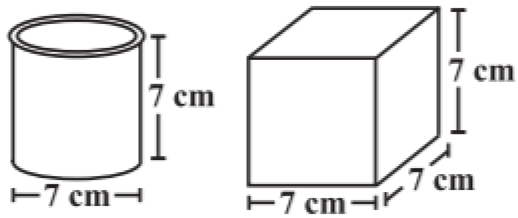
It is given that $100m^2$ area is to be painted from each can.

Therefore, Number of cans required to paint an area of $500m^2$

$= \frac{500}{100} = 5$

Hence, 5 cans of paint are required to paint the room.

6. Describe how the two figures at the right are alike and how they are different. Which box has larger lateral surface area?



Ans: The above given two figures alike for same height$(h) = 7cm$

And the difference between in these two figures is that one is cylinder and the other one is cube.

Now, we have to find the lateral surface area for both of the given figures.

Given that Side of cube$(l) = 7cm$

Height and Diameter of cylinder = $7cm$ each

Radius of cylinder = $\frac{\text{Diameter}}{2} = \frac{7}{2}cm = 3.5cm$

First, Lateral surface area of Cube = $4l^2$

$$= 4(7^2)cm^2 = 4 \text{ x } 49cm^2 = 196cm^2$$

Second, Lateral surface area of cylinder = $2\pi rh$

$$= 2 \text{ x } \frac{22}{7} \text{ x } 3.5cm \text{ x } 7cm = 154cm^2$$

Therefore, Cube has larger lateral surface area.

7. A closed cylindrical tank of radius $7m$ and height $3m$ is made from a sheet of metal. How much sheet of metal is required?

Ans: Given that radius and height of Cylinder is $7m$ and $3m$ respectively.

Therefore, Total surface area of Cylinder = $2\pi r(r + h)$

$$= 2 \text{ x } \frac{22}{7} \text{ x } 7m(7m + 3m)$$

$$= 440m^2$$

Thus, $440m^2$ of metal sheet is required.

8. The lateral surface area of a hollow cylinder is $4224cm^2$. It is cut along its height and formed a rectangular sheet of width $33cm$. Find the perimeter of rectangular?

Ans: It is given that Hollow cylinder is cut along its height and formed a

Rectangular sheet.

Area of cylinder = $4224cm^2$

And, Breadth of rectangular sheet = $33cm$

So, Area of Cylinder = Area of Rectangular Sheet

$4224cm^2$ = Length x Breadth

$4224cm^2$ = Length x $33cm$

Length = $\frac{4224}{33}cm = 128cm$

Now, Perimeter of Rectangle = 2 (length + breadth)

$$= 2(128 + 33)cm = 2(161cm) = 322cm$$

9. A road roller takes 750 complete revolutions to move once over to level a road. Find the area of the road if the diameter of a road roller is $84cm$ and length is $1m$.

Ans: In one revolution, the roller will cover an area equal to its lateral surface area.

Here, Radius = $\frac{\text{diameter}}{2} = \frac{84}{2}cm = 42cm = \frac{42}{100}m \quad (\because 1m = 100cm)$

Height = $1m$

Thus, In One Revolution,

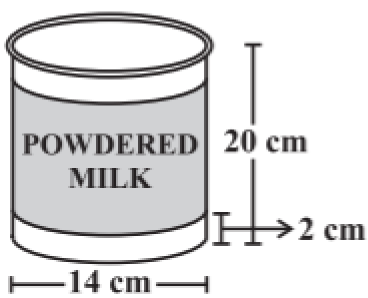
Area of the road covered = $2\pi rh$

$$= 2 \times \frac{22}{7} \times \frac{42}{100} \times 1m^2$$

$$= \frac{264}{100} m^2$$

In 750 revolutions, area of road covered = $750 \times \frac{264}{100} m^2 = 1980m^2$

10. A company packages its milk powder in cylindrical container whose base has a diameter of 14cm and height 20cm. Company places a label around the surface of the container (as shown in the figure). If the label is placed 2cm from top and bottom, what is the area of the label.



Ans: It is given that Radius = $\frac{\text{diameter}}{2} = \frac{14}{2}cm = 7cm$

Height of label = $(20 - 2 - 2)cm$ $(\because 2cm \text{ deducted from top bottom each})$

$$= 16cm$$

As shown in figure that label is in shape of cylinder.

So, Area of label(cylinder)= $2\pi rh$

$$= 2 \times \frac{22}{7} \times 7cm \times 16cm = 44 \times 16cm^2$$

$$= 704cm^2$$

Exercise 9.3

1. Given a cylindrical tank, in which situation will you find surface area and in which situation volume.

(a) To find how much it can hold

(b) Number of cement bags required to plaster it

(c) To find the number of smaller tanks that can be filled with water from it.

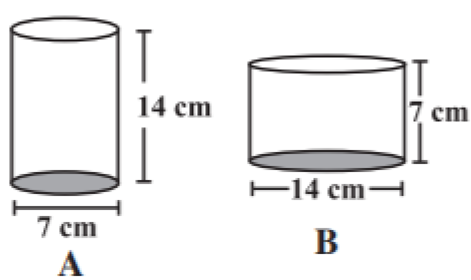
Ans: The answers are:

(a) In this situation, we will find the volume.

(b) Number of cement bags required to plaster cylindrical bags so for that situation, we will find the surface area.

(c) Number of smaller tanks that can be filled with so for that situation, we will find the volume.

2. Diameter of cylinder A is 7cm**, and the height is** 14cm**. Diameter of cylinder B is** 14cm **and height is** 7cm**. Without doing any calculations can you suggest whose volume is greater? Verify it by finding the volume of both the cylinders. Check whether the cylinder with greater volume also has greater surface area?**



Ans: The heights and diameters of these cylinders A and B are interchanged.

We know that,

Volume of cylinder = $\pi r^2 h$

If measures of radius(r) and height(h) are same, then the cylinder with greater radius will have greater area.

Here, Radius of cylinder A = $\frac{7}{2}$cm

Radius of cylinder B = $\frac{14}{2}$cm = 7cm

As the radius of cylinder B is greater, therefore, the volume of cylinder B will be greater.

Let us verify it by calculating the volume of both the cylinders.

Volume of Cylinder A = $\pi r^2 h$

$$= \frac{22}{7} \text{ x } \frac{7}{2} \text{ x } \frac{7}{2} \text{ x } 14\text{cm}^3 = 11 \text{ x } 49\text{cm}^3 = 539\text{cm}^3$$

Volume of Cylinder B = $\pi r^2 h$

$$= \frac{22}{7} \text{ x } 7 \text{ x } 7 \text{ x } 7\text{cm}^3 = 22 \text{ x } 49\text{cm}^3 = 1078\text{cm}^3$$

Therefore, volume of cylinder B is greater.

Now, Surface area of cylinder A = $2\pi r(r+h)$

$$= 2 \text{ x } \frac{22}{7} \text{ x } \frac{7}{2} \text{ x } (\frac{7}{2} + 14)\text{cm}^2$$

$$= 22 \text{ x } \frac{35}{2}\text{cm}^2 = 385\text{cm}^2$$

Surface area of cylinder B = $2\pi r(r+h)$

$$= 2 \text{ x } \frac{22}{7} \text{ x } 7 \text{ x } (7 + 7)\text{cm}^2$$

$$= 44 \text{ x } 14\text{cm}^2 = 616\text{cm}^2$$

3. Find the height of a cuboid whose base area is 180cm^2 and volume is 900cm^3?

Ans: Here, we have given that Base Area of Cuboid = Length x Breadth

$= 180cm^2$

Volume of Cuboid = Length x Breadth x Height

$900cm^3 = 180cm^2$ x Height

Height = $\frac{900}{180}$ cm = 5cm

4. A cuboid is of dimensions $60cm \times 54cm \times 30cm$. How many small cubes with side $6cm$ can be placed in the given cuboid?

Ans. From given condition,

Volume of Cuboid = $60cm \times 54cm \times 30cm$

$= 97200cm^3$

Given that side of cube = $6cm$

So, Volume of cube = $(6 \times 6 \times 6)cm^3 = 216cm^3$

Required number of cubes = $\frac{\text{volume of cuboid}}{\text{volume of cube}} = \frac{97200}{216} = 450$

Therefore, 450 cubes can be placed in the given Cuboid.

5. Find the height of the cylinder whose volume is $1.54m^3$ and diameter of the base is $140cm$?

Ans: It is given that Radius of Cylinder = $\frac{140}{2}$ cm = 70cm

Volume of Cylinder = $\pi r^2 h$

$$1.54m^3 = \frac{22}{7} \times \frac{70}{100} m \times \frac{70}{100} m \times h$$

Height = $\frac{1.54 \text{ x } 100}{22 \text{ x } 7}$ m = 1m

Hence, the height of cylinder = 1m

6. A milk tank is in the form of cylinder whose radius is 1.5m and length is 7m. Find the quantity of milk in litres that can be stored in the tank?

Ans: It is given that Radius and height of cylinder is 1.5m and 7m respectively.

Therefore, Volume of Cylinder = $\pi r^2 h$

$$= \frac{22}{7} \text{ x } 1.5\text{m x } 1.5\text{m x } 7\text{m}$$

$$= 22 \text{ x } 2.25\text{m}^3$$

$$= 49.5\text{m}^3$$

As, $1\text{m}^3 = 1000$ litre

So, Required Quantity = 49.5 x 1000 litre = 49500 litre

Therefore, 49500 litre can be stored in the tank.

7. If each edge of a cube is doubled,

(i) How many times will its surface area increase?

(ii) How many times will its volume increase?

Ans: The answers are:

(i) Let the edge of the cube be ‘ a ’.

Surface area of cube = $6a^2$

If each edge of the cube is doubled, then it becomes $2a$

Therefore, New surface area = $6(2a)^2 = 24a^2 = 4(6a^2)$

Clearly, the surface area will be increased by 4 times.

(ii) Let Volume of the cube = a^3

When each edge of the cube is doubled, it becomes $2a$.

New volume = $(2a)^3 = 8a^3 = 8 \text{ x } a^3$

Clearly, the volume of the cube will be increased by 8 times.

8. Water is pouring into a cubiodal reservoir at the rate of 60 litres per minute. If the volume of reservoir is $108m^3$, find the number of hours it will take to fill the reservoir.

Ans.: Volume of cuboidal reservoir = $108m^3$ = (108×1000) L = 108000 L

It is given that water is being poured at the rate of 60 L per minute.

=That is, (60×60) L = 3600 L per hour

Required number of hours = 30 hours

Thus, it will take 30 hours to fill the reservoir.