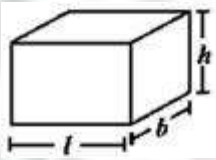
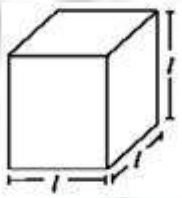
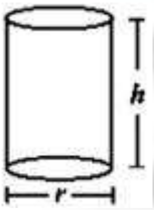
Notes
Chapter – 11
Mensuration

- **Perimeter**: Length of boundary of a simple closed figure.
  Perimeter of:
  Rectangle = 2(l + b)
  Square = 4a
  Parallelogram = 2(sum of two adjacent sides)
- **Area**: The measure of region enclosed in a simple closed figure.
- Area of a trapezium = half of the sum of the lengths of parallel sides × perpendicular distance between them.
- Area of a rhombus = half the product of its diagonals.
- Triangle = 1/ 2 x base x height
- **Diagonal of:**
  Rectangle = $\sqrt{l^2 + b^2}$
  Square = √ 2a
- **Surface area** of a solid is the sum of the areas of its faces.
- **Surface area of**:
  

  a cuboid = 2(lb + bh + hl)

  a cube = $6l^2$

  a cylinder = 2πr(r + h)
- Amount of region occupied by a solid is called its **volume.**
- Volume of
  a cuboid = l x b x h
  a cube = l^3
  a cylinder = $\pi r^2 h$

(i) 1 cm^3 = 1 ml

(ii) 1L = 1000 cm^3

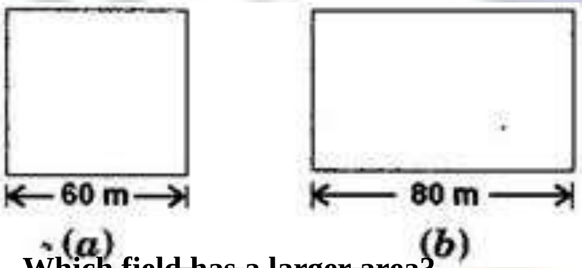
(iii) 1 m^3 = 1000000 cm^3 = 1000L

CHAPTER - 11

Mensuration

Ex. 11.1

1. A square and a rectangular field with measurements as given in the figure have the same perimeter.



Which field has a larger area?

Ans. Given: The side of a square = 60 m and the length of rectangular field = 80 m According to question,

Perimeter of rectangular file = Perimeter of square field

$\Rightarrow$ 2(l+b) = 4 X Side

$\Rightarrow 2(80+b) = 4\times 60$

$\Rightarrow (80+b) = \frac{240}{2}$

(80+b)=120

$\Rightarrow$ b = 120 - 80

$\Rightarrow$ b = 40 m

Hence, the breadth of the rectangular field is 40 m.

Now, Area of Square field= $(\text{Side})^2$

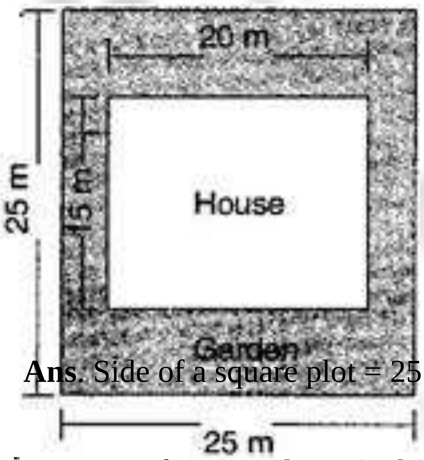
$= (60)^2$ sq.m = 3600 sq.m

Area of Rectangular field = (length $\times$ breadth)

$=80 \times 40$ sq. m = 3200 sq. m

Hence, area of square field is larger.

2. Mrs. Kaushik has a square plot with the measurement as shown in the figure. She wants to construct a house in the middle of the plot. A garden is developed around the house. Find the total cost of developing a garden around the house at the rate of Rs. 55 per m^2.



Ans. Side of a square plot = 25 m

$\therefore$ Area of square plot = $(\text{Side})^2 = (25)^2 = 625\ m^2$

Length and Breadth of the house is 20 m and 15 m respectively

$\therefore$ Area of the house = (length x breadth)

$=20 \times 15 = 300\ m^2$

Area of garden = Area of square plot – Area of house

$= (625 – 300) = 325\ m^2$

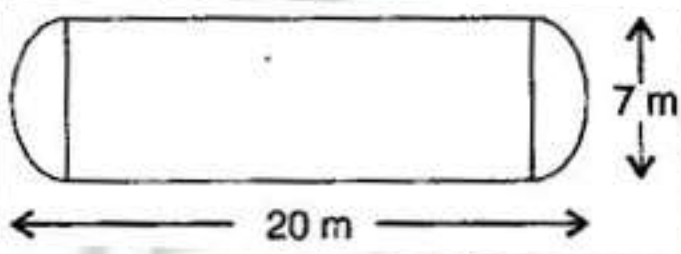
$\because$ Cost of developing the garden around the house is Rs.55

$\therefore$ Total Cost of developing the garden of area 325 sq. m = Rs.(55 $\times$ 325)

= Rs.17,875

3. The shape of a garden is rectangular in the middle and semi-circular at the ends as shown in the diagram. Find the area and the perimeter of this garden

[Length of rectangle is 20 – (3.5 + 3.5 meters]



Ans. Given: Total length of the diagram = 20 m Diameter of semi

circle on both the ends = 7 m

∴ Radius of semicircle = $\frac{Diameter}{2}$ $\frac{7}{2}$ = 3.5 m

Length of rectangular field = [Total length - (radius of semicircle on both side)]

={20 – (3.5 + 3.5)}

= 20 – 7 = 13 m

Breadth of the rectangular field = 7 m

∴ **Area of rectangular field = (l x b)**

= (13 × 7) ⟹ 91 m^2

Area of two semi circles = $2 \times \frac{1}{2} \pi r^2$

= $2 \times \frac{1}{2} \times \frac{22}{7} \times 3.5 \times 3.5$ = 38.5 m^2

Total Area of garden = (91 + 38.5) ⟹ 129.5 m^2

Perimeter of two semi circles = $2 \times \pi r = 2 \times \frac{22}{7} \times 3.5$

= 22 m

Hence, Perimeter of garden = (22 + 13 + 13)m = 48 m

4. A flooring tile has the shape of a parallelogram whose base is 24 cm and the corresponding height is 10 cm. How many such tiles are required to cover a floor of area1080 m^2 ? [If required you can split the tiles in whatever way you want to fill up the corners]

Ans. Base of flooring tile = 24 cm $\Rightarrow$ 0.24 m

height of a flooring tile = 10 cm $\Rightarrow$ 0.10 m **[1cm = 1/100 m]**

Now, **Area of flooring tile= Base $\times$ Altitude**

= 0.24 $\times$ 0.10 sq. m

= 0.024 m^2

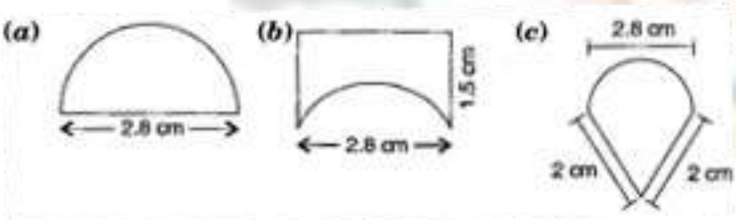
$\therefore$ **Number of tiles required to cover the floor =** $\frac{\text{Area of floor}}{\text{Area of one tile}}$

$= \frac{1080}{0.024}$

= 45000 tiles

Hence 45000 tiles are required to cover the floor.

5. An ant is moving around a few food pieces of different shapes scattered on the floor. For which food-piece would the ant have to take a longer round? Remember, circumference of a circle can be obtained by using the expression $c = 2\pi r$, where r is the radius of the circle.



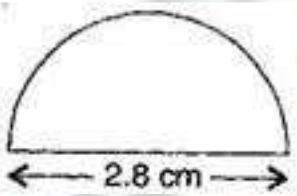
Ans. (a) Radius= $\frac{\text{Diameter}}{2} = \frac{2.8}{2}$

= 1.4 cm

Circumference of semi circle = πr

$= \frac{22}{7} \times 1.4 \Rightarrow$ 4.4 cm

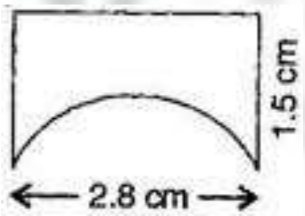
Total distance covered by the ant= (Circumference of semi circle + Diameter)



=(4.4 + 2.8)cm

= 7.2 cm

(b) Diameter of semi circle = 2.8 cm



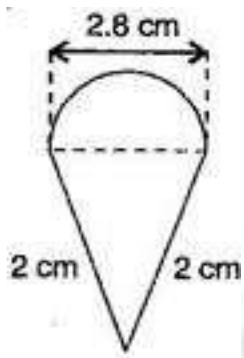
Radius = $\frac{\text{Diameter}}{2} = \frac{2.8}{2}$ ***= 1.4 cm***

Circumference of semi circle = πr

$= \frac{22}{7} \times 1.4 \Rightarrow$ 4.4 cm

Total distance covered by the ant=(1.5+2.8+1.5+4.4) $\Rightarrow$ **10.2 cm**

(c) Diameter of semi circle = 2.8 cm



Radius = $\frac{\text{Diameter}}{2} = \frac{2.8}{2}$

= 1.4 cm

Circumference of semi circle = πr

$= \frac{22}{7} \times 1.4 \Rightarrow$ 4.4 cm

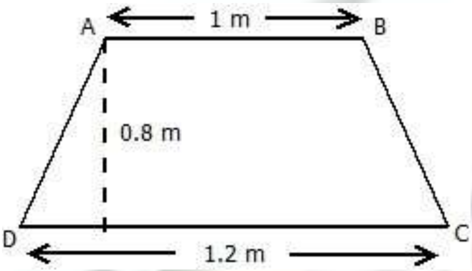
Total distance covered by the ant= (2 + 2 + 4.4) = 8.4 cm

Hence for figure (b) food piece, the ant would take a longer round.

Ex. 11.2

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

Ans.



Parallel side of the trapezium AB =1m , CD = 1.2 m and height (h) of the trapezium (AM) = 0.8 m

Area of top surface of the table = $\frac{1}{2}$ ***(sum of parallel sides) Height***

= $\frac{1}{2}$ x (AB + CD) x AM

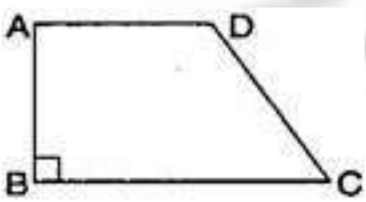
= $\frac{1}{2}\times(1+1.2)\times0.8$

= $\frac{1}{2}\times2.2\times0.8$

= 0.88 m^2

Thus surface area of the table is 0.88 m^2

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



Find the length of the other parallel side.

Ans. Let the length of the other parallel side be = b cm Length of

one parallel side = 10 am and height (h) = 4 cm

Areaoftrapezium= $\frac{1}{2}$ ***(sum of parallel sides) Height***

=> $34 = \frac{1}{2}$ (a+b)h

=> $34 = \frac{1}{2}(10+b)\times 4$

=> $34 = (10+b)\times 2$

=> $34 = 20 + 2b$

=> $34 - 20 = 2b$

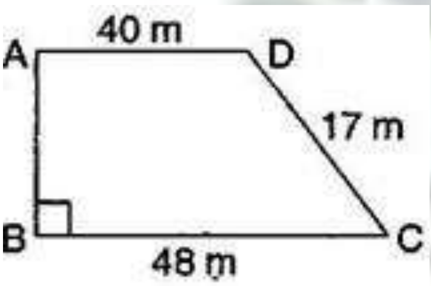
=> $14 = 2b$

=> $7 = b$

=> $b = 7$

Hence another required parallel side is 7 cm.

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



Ans. Given: BC = 48 m, CD = 17 m,

AD = 40 m and perimeter = 120 m

∵ *Perimeter of trapezium ABCD = Sum of all sides*

120 =**(AB + BC + CD + DA)**

120 = AB + 48 + 17 + 40

120 = AB + 105

(120–105) = AB

AB = 15m

Now **Area of the field =** $\frac{1}{2}$ **x (Sum of parallel sides) x Height**

$= \frac{1}{2}$ x(BC+AD)xAB

$= \frac{1}{2}$ x(48+40)x15 m^2

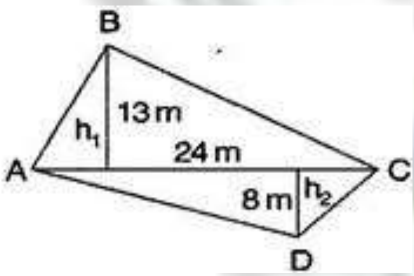
$= \frac{1}{2}$ x(88)x15 m^2

$= \frac{1}{2}$ (1320) m^2

= 660 m^2

Hence area of the field ABCD is 660 m^2.

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



Ans. Here h_1 = 13 m, h_2 = 8 m and AC = 24 m

Area of quadrilateral ABCD = Area of Δ*ABC + Area of* Δ*ADC*

$$= \frac{1}{2} b \times h_1 + \frac{1}{2} b \times h_2$$

$$= \frac{1}{2} b (h_1 + h_2)$$

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

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

$= 12 \times 21\ m^2$

$= 252\ m^2$

Hence required area of the field is 252 m^2

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

Ans. Given: d_1 =7.5 cm and d_2 = 12 cm

Area of rhombus = 1/2 x(Product of digonals)

$= \frac{1}{2} \times (d_1 \times d_2)$

$= \frac{1}{2} \times (7.5 \times 12) cm^2$

$= 45\ cm^2$

Hence area of rhombus I s 45 cm^2 .

6. Find the area of a rhombus whose side is 6 cm and whose altitude is 4 cm. If one of the diagonals is 8 cm long, find the length of the other diagonal.

Ans. *Rhombus is also a kind of Parallelogram.*

$\therefore$ ***Area of rhombus= Base $\times$ Altitude***

$= (6 \times 4)\ cm^2$

$= 24\ cm^2$

Also ***Area of rhombus =*** $\frac{1}{2}$ ***x (d_1 x d_2)***

$24 = \frac{1}{2} \times (8 \times d_2)$

$24 = 4d_2$

$\frac{24}{4}$ cm $= d_2$

$d_2 = 6$cm

Hence, the length of the other diagonal is 6 cm.

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

Ans. Here, $d_1 = 45$ cm and $d_2 = 30$ cm

∵ ***Area of one tile*** $= \frac{1}{2} \times (d_1 \times d_2)$

$= \frac{1}{2} \times (45 \times 30)$

$= \frac{1}{2} (1350)$

$= 675\ cm^2$

So, the area of one tile is 675 cm^2 Area of 3000 tiles = 675 X 3000 cm^2

$= 2025000\ cm^2$

$= \frac{2025000}{100*100} m^2$

[1 cm = $\frac{1}{100}$ m, Here cm^2 = Cm x cm = $\frac{1}{100} \times \frac{1}{100} m^2$]

$= 202.50\ m^2$

∵ Cost of polishing the floor per sq. meter = Rs. 4

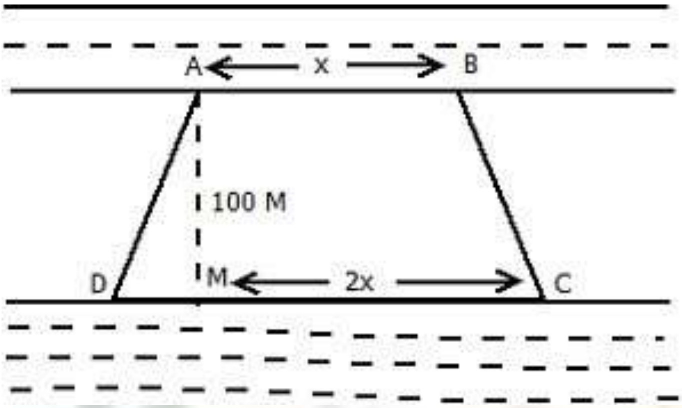
∴ Cost of polishing the floor per 202.50 sq. meter = Rs. 4 × 202.50 = Rs. 810

Hence the total cost of polishing the floor is 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. If the area of this field is 10500 m^2 and the perpendicular distance between the two parallel sides is 100 m, find the length of the side along the river.

Ans.



Given: Perpendicular distance (h) AM = 100 m Area of the trapezium shaped field = 10500 m^2

Let side along the road AB= x m side along the river CD = $2x$ m

Area of the trapezium field = $\frac{1}{2}$ x (AB + CD) x AM