## EXERCISE 16.1

**1. Find the area of a triangle whose base is 6 cm and corresponding height is 4 cm.**
**Solution:**

It is given that
Base of triangle = 6 cm
Height of triangle = 4 cm

We know that
Area of triangle = ½ × base × height
Substituting the values
= ½ × 6 × 4
By further calculation
= 6 × 2
= 12 $cm^2$

**2. Find the area of a triangle whose sides are**
**(i) 3 cm, 4 cm and 5 cm**
**(ii) 29 cm, 20 cm and 21 cm**
**(iii) 12 cm, 9.6 cm and 7.2 cm**
**Solution:**

(i) Consider a = 3 cm, b = 4 cm and c = 5 cm
We know that
S = Semi perimeter = (a + b + c)/ 2
Substituting the values
= (3 + 4 + 5)/ 2
= 12/2
= 6 cm

Here
$$Area\ of\ triangle = \sqrt{s(s-a)(s-b)(s-c)}$$

$$Substituting\ the\ values$$

$$= \sqrt{6(6-3)(6-4)(6-5)}$$

$$By\ further\ calculation$$

$$= \sqrt{6 \times 3 \times 2 \times 1}$$

$$= \sqrt{6 \times 6}$$
= 6 $cm^2$

(ii) Consider a = 29 cm, b = 20 cm and c = 21 cm
We know that

S = Semi perimeter = (a + b + c)/ 2
Substituting the values
= (29 + 20 + 21)/ 2
= 70/2
= 35 cm

Here

$$Area\ of\ triangle = \sqrt{s(s-a)(s-b)(s-c)}$$

$$Substituting\ the\ values$$

$$= \sqrt{35(35-29)(35-20)(35-21)}$$

$$By\ further\ calculation$$

$$= \sqrt{35 \times 6 \times 15 \times 14}$$

$$= \sqrt{7 \times 5 \times 3 \times 2 \times 5 \times 3 \times 7 \times 2}$$

$$We\ can\ write\ it\ as$$

$$= \sqrt{7 \times 7 \times 5 \times 5 \times 3 \times 3 \times 2 \times 2}$$

So we get
= 7 × 5 × 3 × 2
= 210 $cm^2$

(iii) Consider a = 12 cm, b = 9.6 cm and c = 7.2 cm
We know that
S = Semi perimeter = (a + b + c)/ 2
Substituting the values
= (12 + 9.6 + 7.2)/ 2
= 28.8/2
= 14.4 cm

Here

$$Area\ of\ triangle = \sqrt{s(s-a)(s-b)(s-c)}$$

$$Substituting\ the\ values$$

$$= \sqrt{14.4(14.4-12)(14.4-9.6)(14.4-7.2)}$$

$$By\ further\ calculation$$

$$= \sqrt{14.4 \times 2.4 \times 4.8 \times 7.2}$$

$$= \sqrt{6 \times 2.4 \times 2.4 \times 2 \times 2.4 \times 3 \times 2.4}$$

$$We\ can\ write\ it\ as$$

$$= 2.4 \times 2.4 \times \sqrt{6 \times 6}$$

So we get
= 2.4 × 2.4 × 6
= 34.56 $cm^2$

**3. Find the area of a triangle whose sides are 34 cm, 20 cm and 42 cm. hence, find the length of the altitude corresponding to the shortest side.**
**Solution:**

Consider 34 cm, 20 cm and 42 cm as the sides of triangle
a = 34 cm, b = 20 cm and c = 42 cm
We know that
S = Semi perimeter = (a + b + c)/ 2
Substituting the values
= (34 + 20 + 42)/ 2
= 96/2
= 48 cm

Here
$$Area\ of\ triangle = \sqrt{s(s-a)(s-b)(s-c)}$$

$$Substituting\ the\ values$$

$$= \sqrt{48(48-34)(48-20)(48-42)}$$

$$By\ further\ calculation$$

$$= \sqrt{48 \times 14 \times 28 \times 6}$$

$$= \sqrt{8 \times 6 \times 14 \times 14 \times 2 \times 6}$$

$$We\ can\ write\ it\ as$$

$$= 14 \times 6 \times \sqrt{8 \times 2}$$

$$= 14 \times 6 \times \sqrt{16}$$

So we get
= 14 × 6 × 4
= 336 $cm^2$

Here the shortest side of the triangle is 20 cm
Consider h cm as the corresponding altitude
Area of triangle = ½ × base × height
Substituting the values
336 = ½ × 20 × h
By further calculation
h = (336 × 2)/ 20
So we get
h = 336/10
h = 33.6 cm

Hence, the required altitude of the triangle is 33.6 cm.

**4. The sides of a triangular field are 975 m, 1050 m and 1125 m. If this field is sold at the rate of Rs 1000 per hectare, find its selling price. (1 hectare = 10000 $m^2$)**
**Solution:**

It is given that
a = 975 m, b = 1050 m and c = 1125 m
We know that
S = Semi perimeter = (a + b + c)/ 2
Substituting the values
= (975 + 1050 + 1125)/ 2
= 3150/2
= 1575 cm

Here

$$Area\ of\ triangular\ field = \sqrt{s(s-a)(s-b)(s-c)}$$

$$Substituting\ the\ values$$

$$= \sqrt{1575(1575-975)(1575-1050)(1575-1125)}$$

$$By\ further\ calculation$$

$$= \sqrt{1575 \times 600 \times 525 \times 450}$$

$$= \sqrt{525 \times 3 \times 150 \times 4 \times 525 \times 150 \times 3}$$

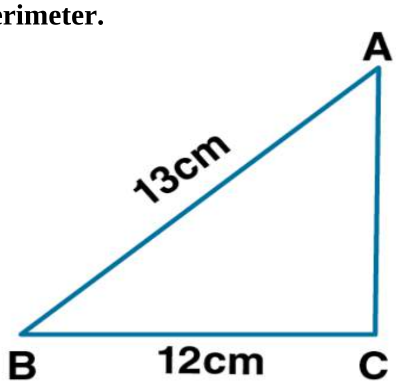
$$We\ can\ write\ it\ as$$

$$= 525 \times 3 \times 150 \times \sqrt{4}$$

So we get
= 525 × 450 × 2
It is given that
1 hectare = 10000 $m^2$
= (525 × 900)/ 10000
By further calculation
= (525 × 9)/ 100
= 4725/100
= 47.25 hectares

We know that
Selling price of 1 hectare field = Rs 1000
Selling price of 47.25 hectare field = 1000 × 47.25 = Rs 47250

**5. The base of a right angled triangle is 12 cm and its hypotenuse is 13 cm long. Find its area and the perimeter.**




**Solution:**

It is given that
ABC is a right angled triangle
BC = 12 cm and AB = 13 cm

Using the Pythagoras theorem
$AB^2 = AC^2 + BC^2$
Substituting the values
$13^2 = AC^2 + 12^2$
By further calculation
$AC^2 = 13^2 - 12^2$
So we get
$AC^2 = 169 – 144 = 25$
AC = √25 = 5 cm

We know that
Area of triangle ABC = ½ × base × height
Substituting the values
= ½ × 12 × 5
= 30 $cm^2$

Similarly
Perimeter of triangle ABC = AB + BC + CA

Substituting the values
= 13 + 12 + 5
= 30 cm

**6. Find the area of an equilateral triangle whose side is 8 m. Give your answer correct to two decimal places.**
**Solution:**

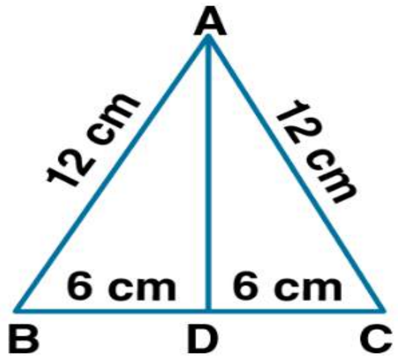
It is given that
Side of equilateral triangle = 8 m
We know that
Area of equilateral triangle = $\sqrt{3}/4\ (\text{side})^2$
Substituting the values
= $\sqrt{3}/4 \times 8 \times 8$
By further calculation
= $\sqrt{3} \times 2 \times 8$
= $1.73 \times 16$
= $27.71\ m^2$

**7. If the area of an equilateral triangle is $81\sqrt{3}\ cm^2$ find its perimeter.**
**Solution:**

We know that
Area of equilateral triangle = $\sqrt{3}/4\ (\text{side})^2$
Substituting the values
$81\sqrt{3} = \sqrt{3}/4\ (\text{side})^2$
By further calculation
$\text{Side}^2 = (81\sqrt{3} \times 4)/\sqrt{3}$
So we get
$(\text{side})^2 = 81 \times 4$
side = $\sqrt{(81 \times 4)}$
side = $9 \times 2 = 18$ cm

So the perimeter of equilateral triangle = $3 \times$ side
= $3 \times 18$
= 54 cm

**8. If the perimeter of an equilateral triangle is 36 cm, calculate its area and height.**
**Solution:**



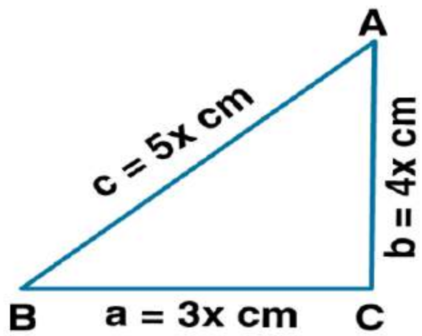

We know that
Perimeter of an equilateral triangle = 3 × side
Substituting the values
36 = 3 × side
By further calculation
side = 36/3 = 12 cm
So AB = BC = CA = 12 cm

Here
Area of equilateral triangle = $\sqrt{3}/4\ (\text{side})^2$
Substituting the values
= $\sqrt{3}/4\ (12)^2$
By further calculation
= $\sqrt{3}/4 \times 12 \times 12$
So we get
= $\sqrt{3} \times 3 \times 12$
= 1.73 × 36
= 62.4 $cm^2$

In triangle ABD
Using Pythagoras Theorem
$AB^2 = AD^2 + BD^2$
Here BD = 12/2 = 6 cm
Substituting the values
$12^2 = AD^2 + 6^2$
By further calculation
$144 = AD^2 + 36$
$AD^2 = 144 - 36 = 108$
So we get
AD = $\sqrt{108}$ = 10.4

Therefore, the required height is 10.4 cm.

**9. (i) If the length of the sides of a triangle are in the ratio 3: 4: 5 and its perimeter is 48 cm, find its area.**
**(ii) The sides of a triangular plot are in the ratio 3: 5: 7 and its perimeter is 300 m. Find its area.**
**Solution:**




(i) Consider ABC as the triangle
Ratio of the sides are 3x, 4x and 5x
Take a = 3x cm, b = 4x cm and c = 5x cm
We know that
a + b + c = 48
Substituting the values
3x + 4x + 5x = 48
12x = 48
So we get
x = 48/12 = 4

Here
a = 3x = 3 × 4 = 12 cm
b = 4x = 4 × 4 = 16 cm
c = 5x = 5 × 4 = 20 cm
We know that
S = Semi perimeter = (a + b + c)/ 2
Substituting the values
= (12 + 16 + 20)/ 2
= 48/2
= 24 cm

Here

$$Area\ of\ triangle = \sqrt{s(s-a)(s-b)(s-c)}$$

$$Substituting\ the\ values$$

$$= \sqrt{24(24-12)(24-16)(24-20)}$$

$$By\ further\ calculation$$

$$= \sqrt{24 \times 12 \times 8 \times 4}$$

$$= \sqrt{12 \times 2 \times 12 \times 4 \times 2 \times 4}$$

So we get
= 12 × 4 × 2

= 96 $cm^2$

(ii) It is given that
Sides of a triangle are in the ratio = 3: 5: 7
Perimeter = 300 m

We know that
First side = (300 × 3)/ sum of ration
Substituting the values
= (300 × 3)/ (3 + 5 + 7)
By further calculation
= (300 × 3)/ 15
= 60 m
Second side = (300 × 5)/ 15 = 100 m
Third side = (300 × 7)/ 15 = 140 m

Here
S = perimeter/2 = 300/2 = 150 m

So we get

$$Area\ of\ triangle = \sqrt{s(s-a)(s-b)(s-c)}$$

$$Substituting\ the\ values$$

$$= \sqrt{150(150-60)(150-100)(150-140)}$$

$$By\ further\ calculation$$

$$= \sqrt{150 \times 90 \times 50 \times 10}$$

$$= \sqrt{6750000}$$

$$We\ can\ write\ it\ as$$

$$= \sqrt{225 \times 10000 \times 3}$$

$$= 15 \times 100 \times \sqrt{3}$$

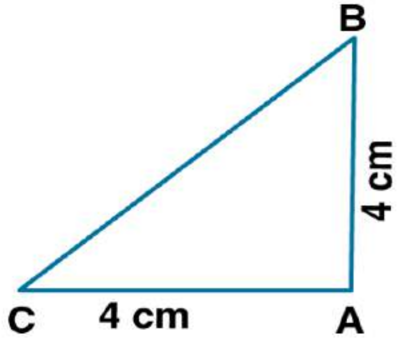
$$= 1500 \times \sqrt{3}$$

We get
= 1500 × 1.732
= 2598 $m^2$

**10. ABC is a triangle in which AB = AC = 4 cm and ∠A = $90^0$. Calculate the area of △ABC. Also find the**

**length of perpendicular from A to BC.**
**Solution:**

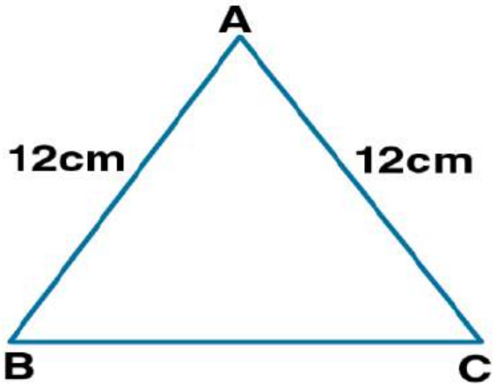
It is given that
AB = AC = 4 cm
Using the Pythagoras theorem
$BC^2 = AB^2 + AC^2$
Substituting the values
$BC^2 = 4^2 + 4^2$
By further calculation
$BC^2 = 16 + 16 = 32$
BC = √32 = 4√2 cm




We know that
Area of △ABC = ½ × BC × h
Substituting the values
8 = ½ × 4√2 × h
By further calculation
h = (8 × 2)/ 4√2
We can write it as
h = (2 × 2)/ √2 × √2/√2
So we get
h = 4√2/2 = 2 × √2
h = 2 × 1.41 = 2.82 cm

**11. Find the area of an isosceles triangle whose equal sides are 12 cm each and the perimeter is 30 cm.**
**Solution:**

Consider ABC as the isosceles triangles



Here AB = AC = 12cm
Perimeter = 30 cm
So BC = 30 – (12 + 12) = 30 – 24 = 6 cm

We know that
S = Semi perimeter = (a + b + c)/ 2
Substituting the values
= 30/ 2
= 15 cm

Here

$$Area\ of\ triangle\ ABC = \sqrt{s(s-a)(s-b)(s-c)}$$

$$Substituting\ the\ values$$

$$= \sqrt{15(15-12)(15-12)(15-6)}$$

$$By\ further\ calculation$$

$$= \sqrt{15 \times 3 \times 3 \times 9}$$

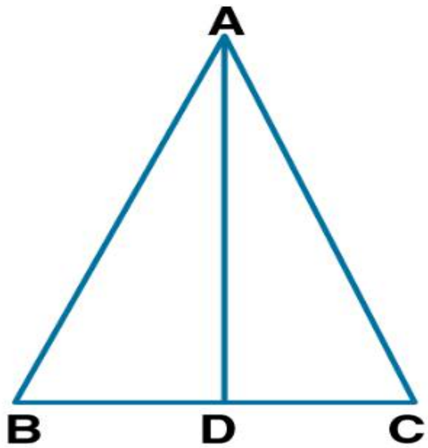
$$= \sqrt{81 \times 15}$$

$$= 9\sqrt{15}$$

We can write it as
= 9 × 3.873
= 34.857
= 34.86 $cm^2$

**12. Find the area of an isosceles triangle whose base is 6 cm and perimeter is 16 cm.**
**Solution:**

It is given that
Base = 6 cm
Perimeter = 16 cm
Consider ABC as an isosceles triangle in which
AB = AC = x
So BC = 6 cm



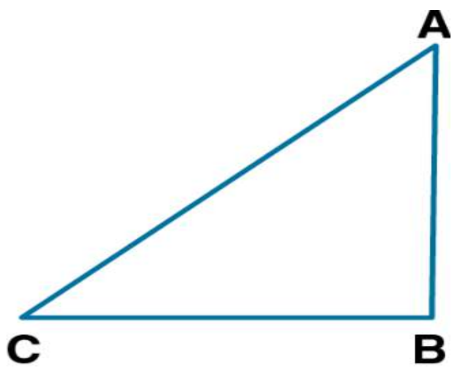

We know that
Perimeter of △ABC = AB + BC + AC
Substituting the values
16 = x + 6 + x
By further calculation
16 = 2x + 6
16 – 6 = 2x
10 = 2x
So we get
x = 10/2 = 5
Here AB = AC = 5 cm
BC = ½ × 6 = 3 cm

In △ABD
$AB^2 = AD^2 + BD^2$
Substituting the values
$5^2 = AD^2 + 3^2$
$25 = AD^2 + 9$
By further calculation
$AD^2 = 25 – 9 = 16$
So we get
AD = 4 cm

Here
Area of △ABC = ½ × base × height
Substituting the values
= ½ × 6 × 4
= 3 × 4
= 12 $cm^2$

**13. The sides of a right angled triangle containing the right angle are 5x cm and (3x – 1) cm. Calculate the length of the hypotenuse of the triangle if its area is 60 $cm^2$.**
**Solution:**

Consider ABC as a right angled triangle
AB = 5x cm and BC = (3x – 1) cm




We know that
Area of △ABC = ½ × AB × BC
Substituting the values
60 = ½ × 5x (3x – 1)
By further calculation
120 = 5x (3x – 1)
$120 = 15x^2 - 5x$
It can be written as
$15x^2 - 5x - 120 = 0$
Taking out the common terms
$5 (3x^2 - x - 24) = 0$
$3x^2 - x - 24 = 0$
$3x^2 - 9x + 8x - 24 = 0$
Taking out the common terms
3x (x – 3) + 8 (x – 3) = 0
(3x + 8) (x – 3) = 0

Here
3x + 8 = 0 or x – 3 = 0
We can write it as
3x = -8 or x = 3
x = -8/3 or x = 3
x = -8/3 is not possible
So x = 3

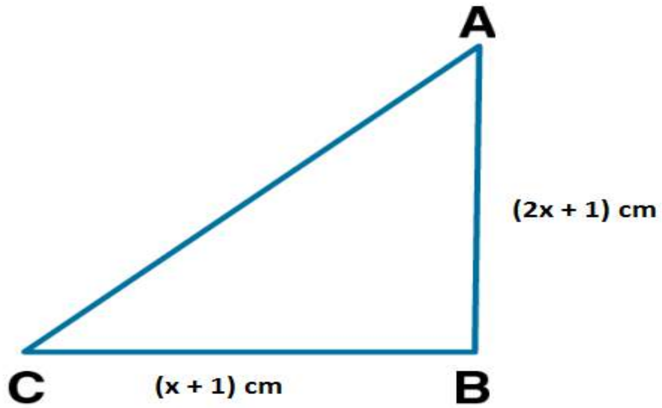
AB = 5 × 3 = 15 cm
BC = (3 × 3 – 1) = 9 – 1 = 8 cm

In right angled △ABC
Using Pythagoras theorem
$AC^2 = AB^2 + BC^2$
Substituting the values
$AC^2 = 15^2 + 8^2$
By further calculation
$AC^2 = 225 + 64 = 289$
$AC^2 = 17^2$
So AC = 17 cm

Therefore, the hypotenuse of the right angled triangle is 17 cm.

**14. In △ABC, ∠B = $90^0$, AB = (2A + 1) cm and BC = (A + 1) cm. If the area of the △ABC is 60 $cm^2$, find its perimeter.**
**Solution:**

It is given that
AB = (2x + 1) cm
BC = (x + 1) cm




We know that
Area of △ABC = ½ × AB × BC
Substituting the values
60 = ½ × (2x + 1) (x + 1)
By cross multiplication
60 × 2 = (2x + 1) (x + 1)
By further calculation
$120 = 2x^2 + 3x + 1$
We can write it as
$0 = 2x^2 + 3x + 1 – 120$
$0 = 2x^2 + 3x - 119$
So we get
$2x^2 + 3x – 119 = 0$
$2x^2 + 17x – 14x – 119 = 0$
Taking out the common terms
x (2x + 17) – 7 (2x + 17) = 0
(x – 7) (2x + 17) = 0

Here
x – 7 = 0 or 2x + 17 = 0
x = 7 or 2x = - 17
x = 7 or x = -17/2

AB = (2x + 1) = 2 × 7 + 1
AB = 14 + 1 = 15 cm
BC = (x + 1) = 7 + 1 = 8 cm

In right angled △ABC
Using Pythagoras Theorem
$AC^2 = AB^2 + BC^2$
Substituting the values

$AC^2 = 15^2 + 8^2$
$AC^2 = 225 + 64$
$AC^2 = 289$
So we get
AC = 17 cm
So the perimeter = AB + BC + AC
Substituting the values
= 15 + 8 + 17
= 40 cm

**15. If the perimeter of a right angled triangle is 60 cm and its hypotenuse is 25 cm, find its area.**
**Solution:**

We know that
Perimeter of a right angled triangle = 60 cm
Hypotenuse = 25 cm
Here the sum of two sides = 60 – 25 = 35 cm

Consider base = x cm
Altitude = (35 – x) cm
Using the Pythagoras theorem
$x^2 + (35 - x)^2 = 25^2$
By further calculation
$x^2 + 1225 + x^2 - 70x = 625$
$2x^2 - 70x + 1225 - 625 = 0$
$2x^2 - 70x + 600 = 0$
Dividing by 2
$x^2 - 35x + 300 = 0$
$x^2 - 15x - 20x + 300 = 0$
Taking out the common terms
x (x – 15) – 20 (x – 15) = 0
(x – 15) (x – 20) = 0

Here
x – 15 = 0
So we get
x = 15
Similarly
x – 20 = 0
So we get
x = 20 cm

So 15 cm and 20 cm are the sides of the triangle
Area = ½ × base × altitude
Substituting the values
= ½ × 15 × 20
= 150 $cm^2$

**16. The perimeter of an isosceles triangle is 40 cm. The base is two third of the sum of equal sides. Find the length of each side.**

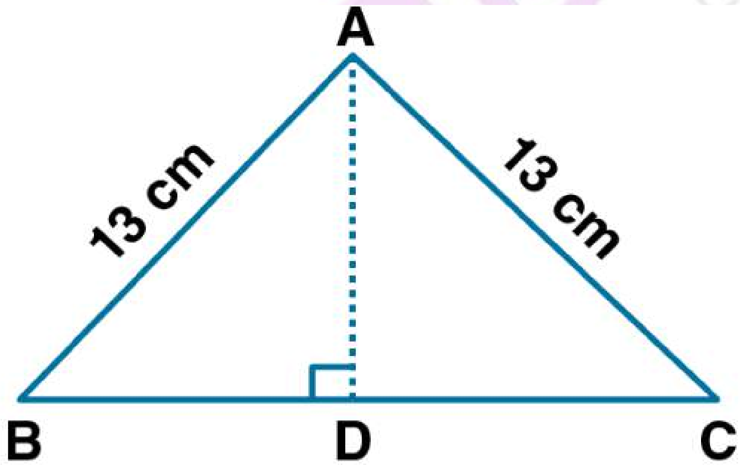
**Solution:**

It is given that
Perimeter of an isosceles triangle = 40 cm
Consider x cm as each equal side
We know that
Base = 2/3 (2x) = 4/3 x

So according to the sum
2x + 4/3 x = 40
By further calculation
6x + 4x = 120
10x = 120
By division
x = 120/10 = 12

Therefore, the length of each equal side is 12 cm.

**17. If the area of an isosceles triangle is 60 $cm^2$ and the length of each of its equal sides is 13 cm, find its base.**
**Solution:**
It is given that
Area of isosceles triangle = 60 $cm^2$
Length of each equal side = 13 cm
Consider base BC = x cm
Construct AD perpendicular to BC which bisects BC at D
So BD = DC = x/2 cm




In right △ABD
$AB^2 = BD^2 + AD^2$
Substituting the values
$13^2 = (x/2)^2 + AD^2$
By further calculation
$169 = x^2/4 + AD^2$
$AD^2 = 169 – x^2/4$ …… (1)

We know that

Area = 60 $cm^2$
AD = (area × 2)/ base
Substituting the values
AD = (60 × 2)/ x = 120/x …… (2)

Using both the equations
$169 – x^2 /4 = (120/x)^2$
By further calculation
$(676 – x^2)/ 4 = 14400/x^2$
By cross multiplication
$676x^2 – x^4 = 57600$
We can write it as
$x^4 – 676x^2 + 57600 = 0$
$x^4 – 576x^2 – 100x^2 + 57600 = 0$
Taking out the common terms
$x^2 (x^2 – 576) – 100 (x^2 – 576) = 0$
$(x^2 – 576) (x^2 – 100) = 0$
Here
$x^2 – 576 = 0$ where $x^2 = 576$
So x = 24
Similarly
$x^2 – 100 = 0$ where $x^2 = 100$
So x = 10

Hence, the base is 10 cm or 24 cm.

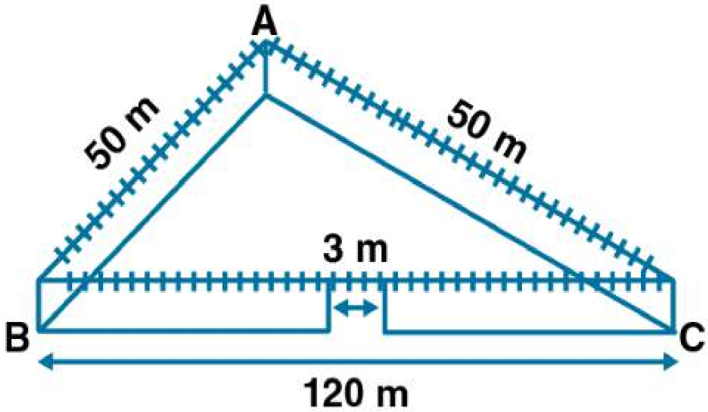
**18. The base of a triangular field is 3 times its height if the cost of cultivating the field at the rate of Rs 25 per 100 $m^2$ is Rs 60000; find its base and height.**
**Solution:**

It is given that
Cost of cultivating the field at the rate of Rs 25 per 100 $m^2$ = Rs 60000
Here the cost of cultivating the field of Rs 25 for 100 $m^2$
So the cost of cultivating the field of Rs 1 = 100/25 $m^2$
Cost of cultivating the field of Rs 60000 = 100/25 × 60000
= 4 × 60000
= 240000 $m^2$
So the area of field = 240000 $m^2$
½ × base × height = 240000 ….. (1)
Consider
Height of triangular field = h $m^2$
Base of triangular field = 3h $m^2$
Substituting the values in equation (1)
½ × 3h × h = 240000
By further calculation
$½ × 3h^2 = 240000$
$h^2 = (240000 × 2)/ 3$
$h^2 = 80000 × 2$
$h^2 = 160000$
So we get

h = √160000 = 400

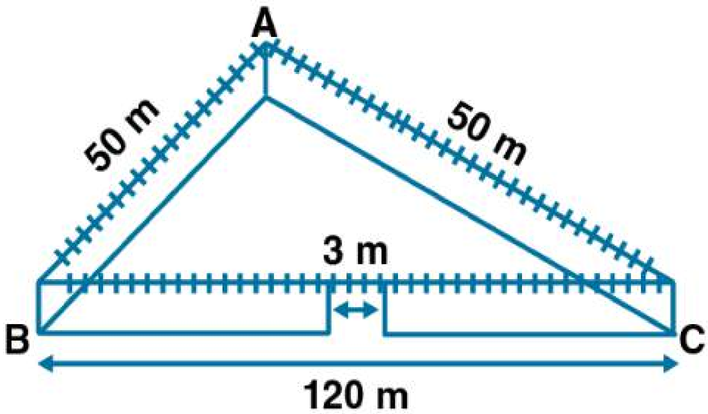
Here the height of triangular field = 400 m
Base of triangular field = 3 × 400 = 1200 $m^2$

**19. A triangular park ABC has sides 120 m, 80 m and 50 m (as shown in the given figure). A gardener Dhania has to put a fence around it and also plant grass inside. How much area does she need to plant? Find the cost of fencing it with barbed wire at the rate of Rs 20 per metre leaving a space 3 m wide for a gate on one side.**




**Solution:**

It is given that
ABC is a triangular park with sides 120 m, 80 m and 50 m.
Here the perimeter of triangle ABC = 120 + 80 + 50 = 250 m




We know that
Portion at which a gate is build = 3m
Remaining perimeter = 250 – 3 = 247 m
So the length of fence around it = 247 m
Rate of fencing = Rs 20 per m
Total cost of fencing = 20 × 247 = Rs 4940
We know that
S = Semi perimeter = (a + b + c)/ 2
Substituting the values
= 250/2
= 125 cm

Here

$$Area\ of\ triangle = \sqrt{s(s-a)(s-b)(s-c)}$$

$$Substituting\ the\ values$$

$$= \sqrt{125(125-50)(125-80)(125-120)}$$

$$By\ further\ calculation$$

$$= \sqrt{125 \times 75 \times 45 \times 5}$$

$$= \sqrt{5 \times 5 \times 5 \times 5 \times 5 \times 3 \times 3 \times 3 \times 5 \times 5}$$

$$= 5 \times 5 \times 3 \times 5\sqrt{15}$$

$$So\ we\ get$$

$$= 375\sqrt{15}m^2$$

**20. An umbrella is made by stitching 10 triangular pieces of cloth of two different colors (shown in the given figure), each piece measuring 20 cm, 50 cm and 50 cm. How much cloth of each color is required for the umbrella?**


**Solution:**

It is given that
An umbrella is made by stitching 10 triangular pieces of cloth of two different colors
20 cm, 50 cm, 50 cm are the measurement of each triangle
So we get
s/2 = (20 + 50 + 50)/ 2

s/2 = 120/2 = 60

We know that

$$Area\ of\ triangle = \sqrt{s(s-a)(s-b)(s-c)}$$

$$Substituting\ the\ values$$

$$= \sqrt{60(60-20)(60-50)(60-50)}$$

$$By\ further\ calculation$$

$$= \sqrt{60 \times 40 \times 10 \times 10}$$

$$So\ we\ get$$

$$= \sqrt{240000}$$

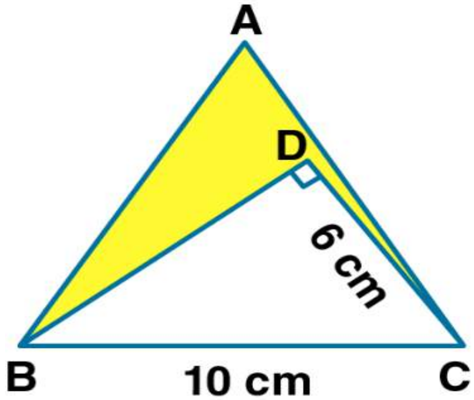
$$= 100\sqrt{24}$$

$$= 100 \times 2\sqrt{6}$$

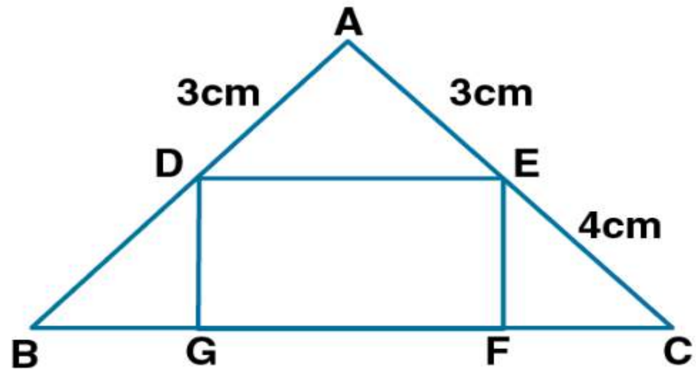
$$= 200\sqrt{6}cm^2$$

Here the area of 5 triangular piece of first color = 5 × 200 √6 = 1000 √6 $cm^2$
Area of triangular piece of second color = 1000 √6 $cm^2$

**21. (a) In the figure (1) given below, ABC is an equilateral triangle with each side of length 10 cm. In △BCD, ∠D = $90^0$ and CD = 6 cm.**
**Find the area of the shaded region. Give your answer correct to one decimal place.**




**(b) In the figure (ii) given, ABC is an isosceles right angled triangle and DEFG is a rectangle. If AD = AE = 3 cm and DB = EC = 4 cm, find the area of the shaded region.**




**Solution:**

(a) It is given that
ABC is an equilateral triangle of side = 10 cm
We know that
Area of equilateral triangle ABC = $\sqrt{3}/4 \times (\text{side})^2$
Substituting the values
= $\sqrt{3}/4 \times 10^2$
= $\sqrt{3}/4 \times 100$
So we get
= $\sqrt{3} \times 25$
= $1.73 \times 25$
= $43.3 \text{ cm}^2$

In right angled triangle BDC
$\angle D = 90^0$
BC = 10 cm
CD = 6 cm

Using Pythagoras Theorem
$BD^2 + DC^2 = BC^2$
Substituting the values
$BD^2 + 6^2 = 10^2$
$BD^2 + 36 = 100$
So we get
$BD^2 = 100 - 36 = 64$
$BD = \sqrt{64} = 8$ cm

We know that
Area of triangle BDC = ½ × base × height
So we get
= ½ × BD × DC
Substituting the values
= ½ × 8 × 6
= 4 × 6
= $24 \text{ cm}^2$

Here the area of shaded portion = Area of triangle ABC – Area of triangle BDC
Substituting the values

= 43.3 – 24
= 19.3 $cm^2$

(b) It is given that
AD = AE = 3 cm
DB = EC = 4 cm
By addition we get
AD + DB = AE + EC = (3 + 4) cm
AB = AC = 7 cm
∠A = $90^0$

We know that
Area of right triangle ADE = ½ × AD × AE
Substituting the values
= ½ × 3 × 3
= 9/2 $cm^2$
So triangle BDG is an isosceles right triangle

Similarly
$DG^2 + BG^2 = BD^2$
$DG^2 + DG^2 = 4^2$
By further calculation
$2DG^2 = 16$
$DG^2 = 16/2 = 8$
DG = √8 cm

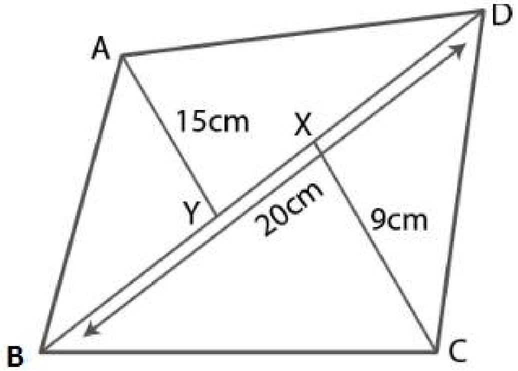
Area of triangle BDG = ½ × BG × DG
We can write it as
= ½ × DG × DG
Substituting the values
= ½ $(\sqrt{8})^2$
= ½ × 8
= 4 $cm^2$

Area of isosceles right triangle EFC = 4 $cm^2$
So the area of shaded portion = 9/2 + 4 + 4
Taking LCM
= (9 + 8 + 8)/ 2
= 25/2
= 12.5 $cm^2$

## EXERCISE 16.2

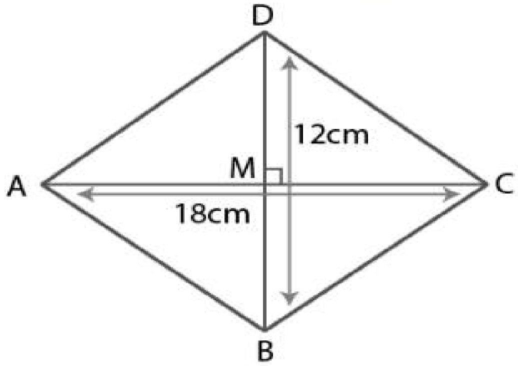
**1. (i) Find the area of quadrilateral whose one diagonal is 20 cm long and the perpendiculars to this diagonal from other vertices are of length 9 cm and 15 cm.**
**(ii) Find the area of a quadrilateral whose diagonals are of length 18 cm and 12 cm and they intersect each other at right angles.**
**Solution:**

(i) Consider ABCD as a quadrilateral in which AC = 20 cm
We know that
BY = 9 cm and DY = 15 cm




Here
Area of quadrilateral ABCD = Area of triangle ABC + Area of triangle ACD
We can write it as
= ½ × base × height + ½ × base × height
So we get
= ½ × AC × BX + ½ × AC × DY
Substituting the values
= (½ × 20 × 9) + (½ × 20 × 15)
By further calculation
= (10 × 9 + 10 × 15)
= 90 + 150
= 240 $cm^2$

(ii) Consider ABCD as a quadrilateral in which the diagonals AC and BD intersect each other at M at right angles
AC = 18 cm and BD = 12 cm

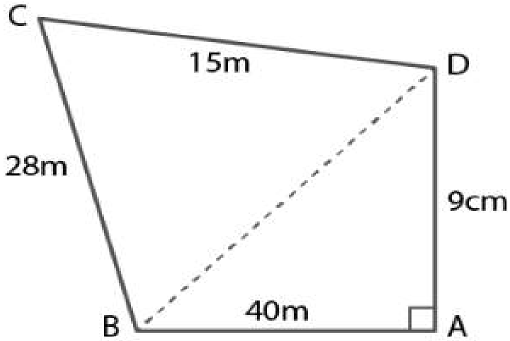



We know that
Area of quadrilateral ABCD = ½ × diagonal AC × diagonal BD
Substituting the values

= ½ × 18 × 12
By further calculation
= 9 × 12
= 108 $cm^2$

**2. Find the area of the quadrilateral field ABCD whose sides AB = 40 m, BC = 28 m, CD = 15 m, AD = 9 m and ∠A = $90^0$.**
**Solution:**

It is given that
ABCD is a quadrilateral field
AB = 40 m, BC = 28 m, CD = 15 m, AD = 9 m and ∠A = $90^0$




In triangle BAD
∠A = $90^0$
Using the Pythagoras Theorem
$BD^2 = BA^2 + AD^2$
Substituting the values
$BD^2 = 40^2 + 9^2$
By further calculation
$BD^2 = 1600 + 81 = 1681$
So we get
BD = 41

We know that
Area of quadrilateral ABCD = Area of △BAD + Area of △BDC
It can be written as
= ½ × base × height + Area of △BDC
Substituting the values
= ½ × 40 × 9 + Area of △BDC
By further calculation
= 180 $m^2$ + Area of △BDC

Determining the area of △BDC
Consider a = BD = 41 m, b = CD = 15 m, c = BC = 28 m
We know that
S = Semi perimeter = (a + b + c)/ 2
Substituting the values
= (41 + 15 + 28)/ 2
= 42 cm

Here

$$Area\ of\ \Delta BDC = \sqrt{s(s-a)(s-b)(s-c)}$$

$$Substituting\ the\ values$$

$$= \sqrt{42(42-41)(42-15)(42-28)}$$

$$By\ further\ calculation$$

$$= \sqrt{42 \times 1 \times 27 \times 14}$$

$$We\ can\ write\ it\ as$$

$$= \sqrt{2 \times 3 \times 7 \times 3 \times 3 \times 3 \times 2 \times 7}$$

So we get

= 2 × 7 × 3 × 3

= 126 $m^2$

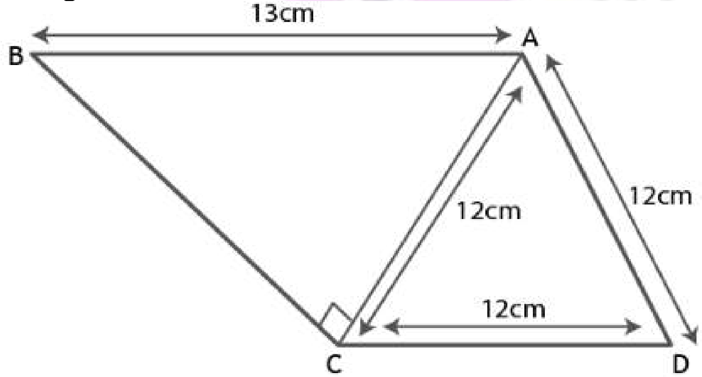
So the area of quadrilateral ABCD = 180 $m^2$ + Area of △BDC

Substituting the values

= 180 + 126

= 306 $m^2$

**3. Find the area of the quadrilateral ABCD in which ∠BCA = $90^0$, AB = 13 cm and ACD is an equilateral triangle of side 12 cm.**




**Solution:**

It is given that

ABCD is a quadrilateral in which ∠BCA = $90^0$ and AB = 13 cm

ABCD is an equilateral triangle in which AC = CD = AD = 12 cm

In right angled △ABC

Using Pythagoras theorem,

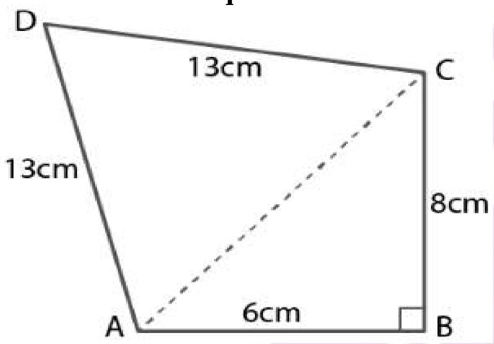
$AB^2 = AC^2 + BC^2$

Substituting the values

$13^2 = 12^2 + BC^2$
By further calculation
$BC^2 = 13^2 - 12^2$
$BC^2 = 169 – 144 = 25$
So we get
BC = √25 = 5 cm

We know that
Area of quadrilateral ABCD = Area of △ABC + Area of △ACD
It can be written as
= ½ × base × height + √3/4 × side$^2$
= ½ × AC × BC + √3/4 × $12^2$
Substituting the values
= ½ × 12 × 5 + √3/4 × 12 × 12
So we get
= 6 × 5 + √3 × 3 × 12
= 30 + 36√3
Substituting the value of √3
= 30 + 36 × 1.732
= 30 + 62.28
= 92.28 cm$^2$

**4. Find the area of quadrilateral ABCD in which ∠B = $90^0$, AB = 6 cm, BC = 8 cm and CD = AD = 13 cm.**




**Solution:**

It is given that
ABCD is a quadrilateral in which ∠B = $90^0$, AB = 6 cm, BC = 8 cm and CD = AD = 13 cm

In △ABC
Using Pythagoras theorem
$AC^2 = AB^2 + BC^2$
Substituting the values
$AC^2 = 6^2 + 8^2$
By further calculation
$AC^2 = 36 + 64 = 100$
So we get
$AC^2 = 10^2$
AC = 10 cm

We know that

Area of quadrilateral ABCD = Area of △ABC + Area of △ACD
It can be written as
= ½ × base × height + Area of △ACD
= ½ × AB × BC + Area of △ACD
Substituting the values
= ½ × 6 × 8 + Area of △ACD
By further calculation
= 24 $cm^2$ + Area of △ACD …… (1)

Finding the area of △ACD
Consider a = AC = 10 cm, b = CD = 13 cm, c = AD = 13 cm
We know that
S = Semi perimeter = (a + b + c)/ 2
Substituting the values
= (10 + 13 + 13)/ 2
= (10 + 26)/2
= 36/2
= 18 cm

Here
$$Area\ of\ \Delta ACD = \sqrt{s(s-a)(s-b)(s-c)}$$

$$Substituting\ the\ values$$

$$= \sqrt{18(18-10)(18-13)(18-13)}$$

$$By\ further\ calculation$$

$$= \sqrt{18 \times 8 \times 5 \times 5}$$

$$We\ can\ write\ it\ as$$

$$= \sqrt{6 \times 3 \times 8 \times 5 \times 5}$$

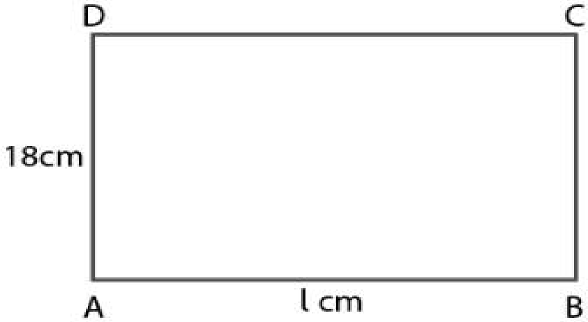
$$= \sqrt{3 \times 2 \times 3 \times 2 \times 2 \times 2 \times 5 \times 5}$$

So we get
= 3 × 2 × 2 × 5
= 60 $cm^2$

Using equation (1)
Area of quadrilateral ABCD = 24 $cm^2$ + Area of △ACD
Substituting the values
= 24 + 60
= 84 $cm^2$

**5. The perimeter of a rectangular cardboard is 96 cm; if its breadth is 18 cm, find the length and the area of the cardboard.**
**Solution:**

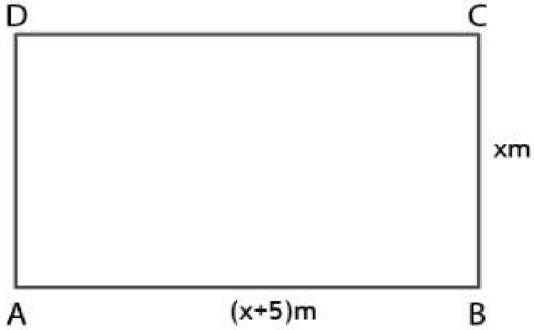
Consider ABCD as a rectangle
Take length = l cm
Breadth = 18 cm
Perimeter = 96 cm




We know that
2 × (l + b) = 96 cm
Substituting the values
2 × (l + 18) = 96 cm
By further calculation
(l + 18) = 96/2
l + 18 = 48
So we get
l = 48 – 18 = 30 cm

Here
Area of rectangular cardboard = l × b
Substituting the values
= 30 × 18
= 540 $cm^2$

**6. The length of a rectangular hall is 5 cm more than its breadth, if the area of the hall is 594 $m^2$, find its perimeter.**




**Solution:**

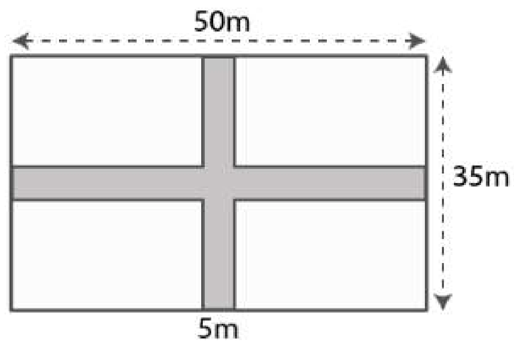
Consider ABCD is a rectangular hall
Take Breadth = x m
Length = (x + 5) m

We know that
Area of rectangular field = l × b
Substituting the values
594 = x (x + 5)
By further calculation
$594 = x^2 + 5x$
$0 = x^2 + 5x – 594$
$x^2 + 5x – 594 = 0$
It can be written as
$x^2 + 27x – 22x – 594 = 0$
Taking out the common terms
x (x + 27) – 22 (x + 27) = 0
So we get
(x – 22) (x + 27) = 0

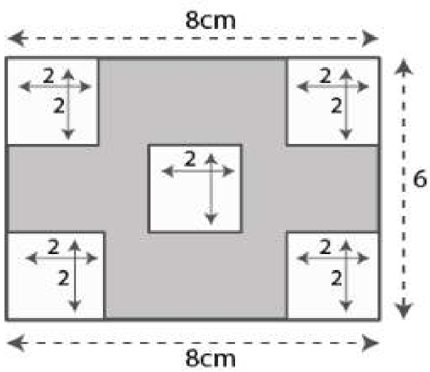
Here
x – 22 = 0 or x + 27 = 0
We get
x = 22 m or x = -27 which is not possible

We know that
Breadth = 22 m
Length = (x + 5) = 22 + 5 = 27 m
Perimeter = 2 (l + b)
Substituting the values
= 2 (27 + 22)
By further calculation
= 2 × 49
= 98 m

**7. (a) The diagram (i) given below shows two paths drawn inside a rectangular field 50 m long and 35 m wide. The width of each path is 5 metres. Find the area of the shaded portion.**
**(b) In the diagram (ii) given below, calculate the area of the shaded portion. All measurements are in centimetres.**



(i)

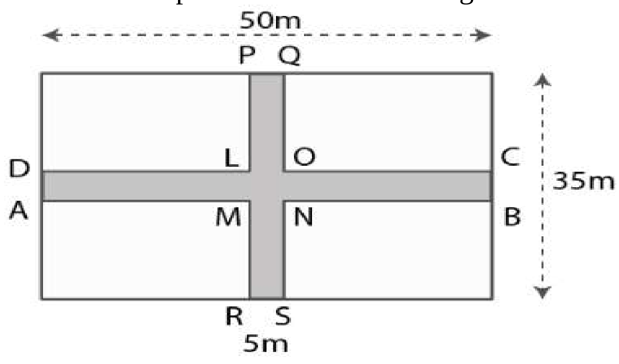


(ii)

**Solution:**

(a) We know that

Area of shaded portion = Area of rectangle ABCD + Area of rectangle PQRS – Area of square LMNO

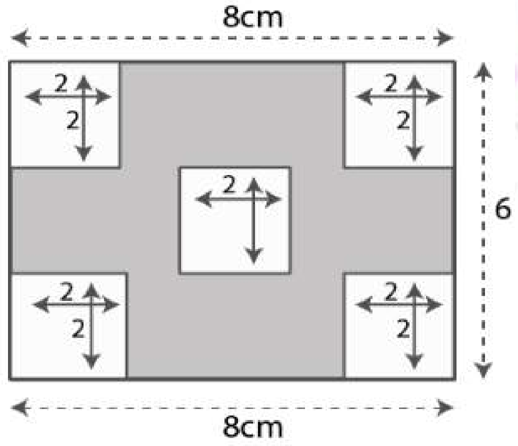


(i)

Substituting the values
= 50 × 5 + 5 × 35 – 5 × 5
By further calculation
= 250 + 175 – 25
So we get
= 250 + 150
= 400 $m^2$

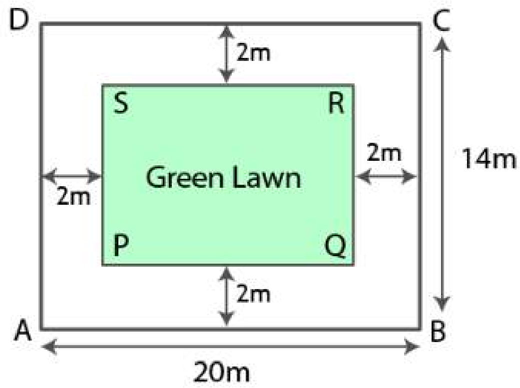
(b) We know that
Area of shaded portion = Area of ABCD – 5 × Area of any small square

(ii)




It can be written as
= l × b – 5 × side × side
Substituting the values
= 8 × 6 – 5 × 2 × 2
By further calculation
= 48 – 20
= 28 $cm^2$

**8. A rectangular plot 20 m long and 14 m wide is to be covered with grass leaving 2 m all around. Find the area to be laid with grass.**
**Solution:**



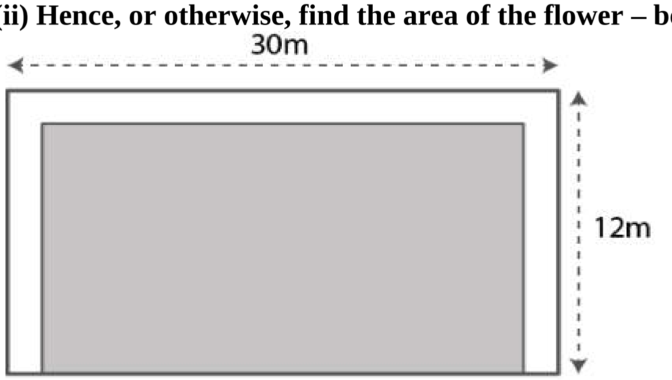

Consider ABCD as a plot
Length of plot = 20 m
Breadth of plot = 14 m
Take PQRS as the grassy plot

Here
Length of grassy lawn = 20 – 2 × 2
By further calculation
= 20 – 4
= 16 m

Breadth of grassy lawn = 14 – 2 × 2
By further calculation
= 14 – 4
= 10 m

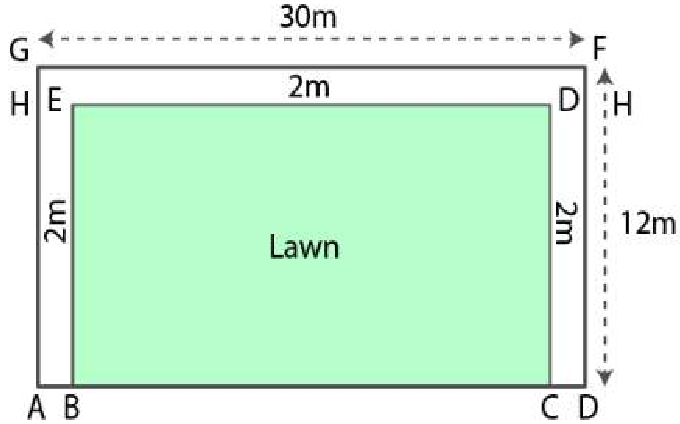
Area of grassy lawn = length × breadth
Substituting the values
= 16 × 10
= 160 $m^2$

**9. The shaded region of the given diagram represents the lawn in front of a house. On three sides of the lawn there are flower beds of width 2 m.**
**(i) Find the length and the breadth of the lawn.**
**(ii) Hence, or otherwise, find the area of the flower – beds.**




**Solution:**

Consider BCDE as the lawn



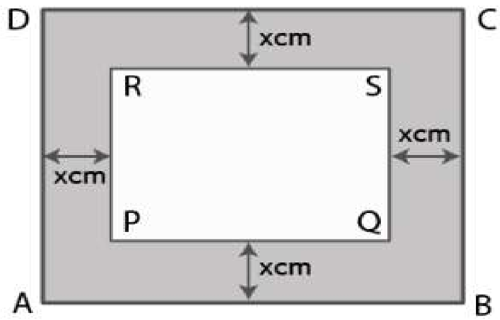

(i) We know that
Length of lawn BCDE = BC
It can be written as
= AD – AB – CD
Substituting the values
= 30 – 2 – 2
By further calculation
= 30 – 4
= 26 m

Breadth of lawn BDCE = BE
It can be written as
= AG – GH
Substituting the values
= 12 – 2
= 10 m

(ii) We know that
Area of flower beds = Area of rectangle ADFG – Area of lawn BCDE
It can be written as
= AD × AG – BC × BE
Substituting the values
= 30 × 12 – 26 × 10
By further calculation
= 360 – 260
= 100 $m^2$

**10. A foot path of uniform width runs all around the inside of a rectangular field 50 m long and 38 m wide. If the area of the path is 492 $m^2$, find its width.**
**Solution:**

Consider ABCD as a rectangular field having
Length = 50 m
Breadth = 38 m




We know that

Area of rectangular field ABCD = l × b

Substituting the values

= 50 × 38

= 1900 $m^2$

Let x m as the width of foot path all around the inside of a rectangular field

Length of rectangular field PQRS = (50 – x – x) = (50 – 2x) m

Breadth of rectangular field PQRS = (38 – x – x) = (38 – 2x) m

Here

Area of foot path = Area of rectangular field ABCD – Area of rectangular field PQRS

Substituting the values

492 = 1900 – (50 – 2x) (38 – 2x)

It can be written as

492 = 1900 – [50 (38 – 2x) – 2x (38 – 2x)]

By further calculation

492 = 1900 – (1900 – 100x – 76x + $4x^2$)

492 = 1900 – 1900 + 100x + 76x – $4x^2$

On further simplification

492 = 176x – $4x^2$

Taking out 4 as common

492 = 4 (44x – $x^2$)

44x – $x^2$ = 492/4 = 123

We get

$x^2$ – 44x + 123 = 0

It can be written as

$x^2$ – 41x – 3x + 123 = 0

Taking out the common terms

x (x – 41) – 3 (x – 41) = 0

(x – 3) (x – 41) = 0

Here

x – 3 = 0 or x – 41 = 0

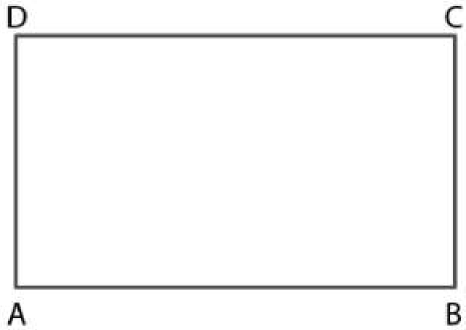
So x = 3 m or x = 41 m which is not possible

Therefore, width is 3 m.

**11. The cost of enclosing a rectangular garden with a fence all around at the rate of Rs 15 per metre is Rs 5400. If the length of the garden is 100 m, find the area of the garden.**

**Solution:**

Consider ABCD as a rectangular garden
Length = 100 m
Take breadth = x m



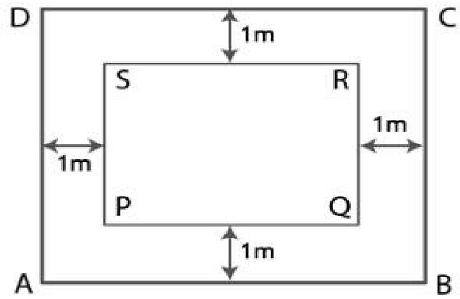

We know that
Perimeter of the garden = 2 (l + b)
Substituting the values
= 2 (100 + x)
= (200 + 2x) m

We know that
Cost of 1 m to enclosing a rectangular garden = Rs 15
So the cost of (200 + 2x) m to enclosing a rectangular garden = 15 (200 + 2x)
= 3000 + 30x

Given cost = Rs 5400
We get
3000 + 30x = 5400
It can be written as
30x = 5400 – 3000
x = 2400/30 = 80 m
Breadth of garden = 80 m
So the area of rectangular field = l × b
Substituting the values
= 100 × 80
= 8000 $m^2$

**12. A rectangular floor which measures 15 m × 8 m is to be laid with tiles measuring 50 cm × 25 cm find the number of tiles required further, if a carpet is laid on the floor so that a space of 1 m exists between its edges and the edges of the floor, what fraction of the floor is uncovered?**
**Solution:**

Consider ABCD as a rectangular field of measurement 15m × 8m
Length = 15 m
Breadth = 8 m




Here the area = l × b = 15 × 8 = 120 $m^2$

Measurement of tiles = 50 cm × 25 cm
Length = 50 cm = 50/100 = ½ m
Breadth = 25 cm = 25/100 = ¼ m
So the area of one tile = ½ × ¼ = 1/8 $m^2$

No. of required tiles = Area of rectangular field/Area of one tile
Substituting the values
= 120/ (1/8)
By further calculation
= (120 × 8)/ 1
= 960 tiles

Length of carpet = 15 – 1 – 1
= 15 – 2
= 13 m
Breadth of carpet = 8 – 1 – 1
= 8 – 2
= 6 m
Area of carpet = l × b
= 13 × 6
= 78 $m^2$

We know that
Area of floor which is uncovered by carpet = Area of floor – Area of carpet
Substituting the values
= 120 – 78
= 42 $m^2$

Fraction = Area of floor which is uncovered by carpet/ Area of floor
Substituting the values
= 42/120
= 7/20

**13. The width of a rectangular room is 3/5 of its length x metres. If its perimeter is y metres, write an equation connecting x and y. Find the floor area of the room if its perimeter is 32 m.**
**Solution:**

It is given that

Length of rectangular room = x m
Width of rectangular room = 3/5 of its length
= 3x/5 m
Perimeter = y m

We know that
Perimeter = 2 (l + b)
Substituting the values
y = 2 [(5x + 3x)/ 5]
By further calculation
y = 2 × 8x/5
y = 16x/5
We get
5y = 16x
16x = 5y ….. (1)

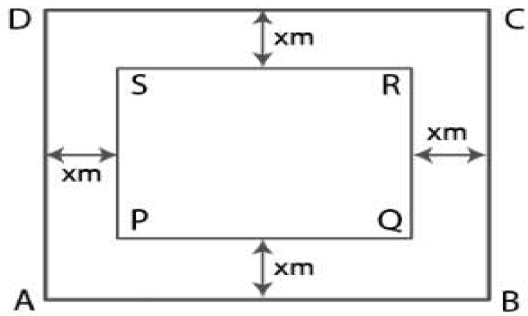
Equation (1) is the required relation between x and y
Given perimeter = 32 m
So y = 32 m
Now substituting the value of y in equation (1)
16x = 5 × 32
By further calculation
x = (5 × 32)/ 16
x = (5 × 2)/ 1
x = 10 m

Breadth = 3/5 × x
Substituting the value of x
= 3/5 × 10
= 3 × 2
= 6 m

Here the floor area of the room = l × b
Substituting the values
= 10 × 6
= 60 $m^2$

**14. A rectangular garden 10 m by 16 m is to be surrounded by a concrete walk of uniform width. Given that the area of the walk is 120 square metres, assuming the width of the walk to be x, form an equation in x and solve it to find the value of x.**
**Solution:**

Consider ABCD as a rectangular garden




Length = 10 m
Breadth = 16 m
So the area of ABCD = l × b
Substituting the values
= 10 × 16
= 160 $m^2$

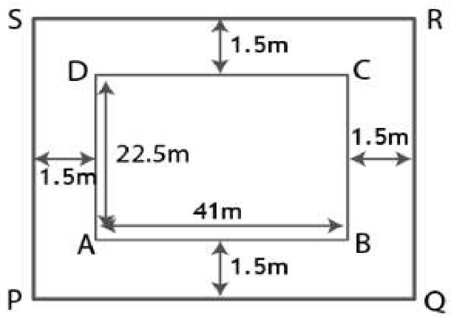
Consider x m as the width of the walk
Length of rectangular garden PQRS = 10 – x – x = (10 – 2x) m
Breadth of rectangular garden PQRS = 16 – x – x = (16 – 2x) m

**15. A rectangular room is 6 m long, 4.8 m wide and 3.5 m high. Find the inner surface of the four walls.**
**Solution:**

It is given that
Length of rectangular room = 6 m
Breadth of rectangular room = 4.8 m
Height of rectangular room = 3.5 m

Here
Inner surface area of four wall = 2 (l + b) × h
Substituting the values
= 2 (6 + 4.8) × 3.5
By further calculation
= 2 × 10.8 × 3.5
= 21.6 × 3.5
= 75.6 $m^2$

**16. A rectangular plot of land measures 41 metres in length and 22.5 metres in width. A boundary wall 2 metres high is built all around the plot at a distance of 1.5 m from the plot. Find the inner surface area of the boundary wall.**
**Solution:**

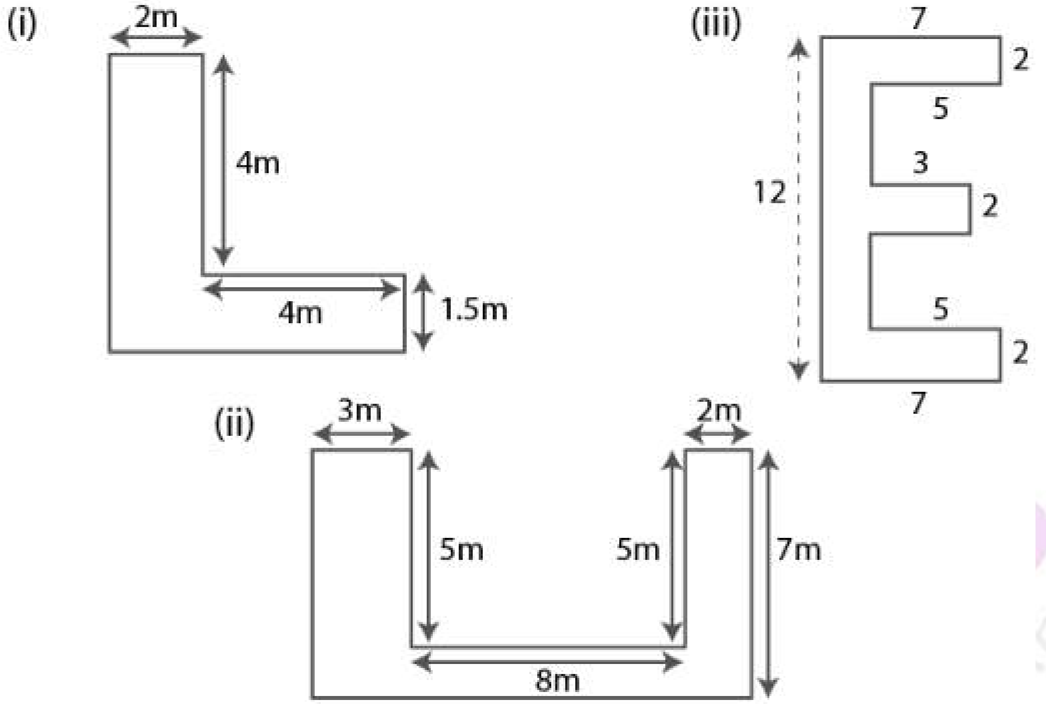



It is given that
Length of rectangular plot = 41 metres
Breadth of rectangular plot = 22.5 metres
Height of boundary wall = 2 metre

Here
Boundary wall is built at a distance of 1.5 m
New length = 41 + 1.5 + 1.5
= 41 + 3
= 44 m
New breadth = 22.5 + 1.5 + 1.5
= 22.5 + 3
= 25.5 m

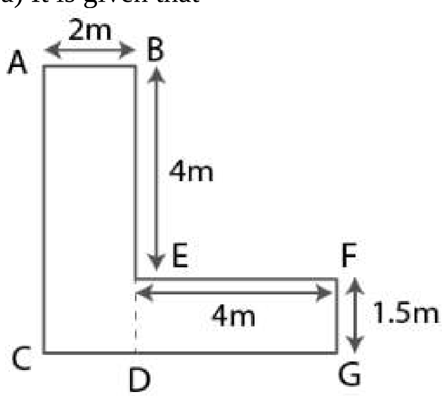
We know that
Inner surface area of the boundary wall = 2 (l + b) × h
Substituting the values
= 2 (44 + 25.5) × 2
By further calculation
= 2 × 69.5 × 2
= 2 × 139
= 278 $m^2$

**17. (a) Find the perimeter and area of the figure**
**(i) given below in which all corners are right angled.**
**(b) Find the perimeter and area of the figure**
**(ii) given below in which all corners are right angles.**
**(c) Find the area and perimeter of the figure**
**(iii) given below in which all corners are right angled and all measurement in centimetres.**




**Solution:**

(a) It is given that



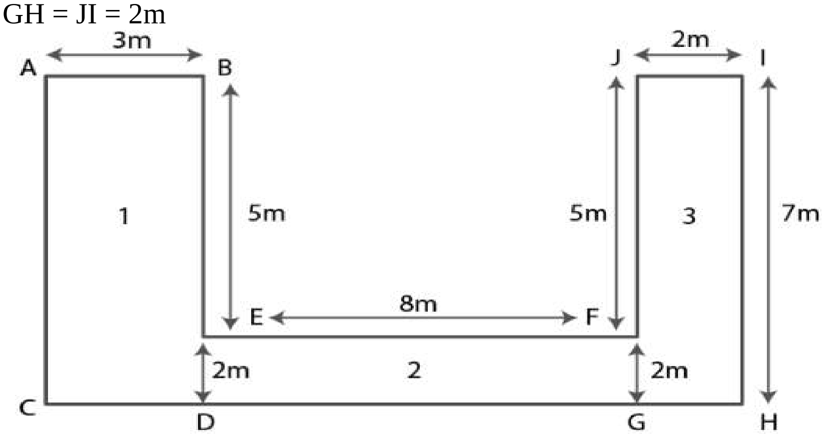

AB = 2m, BE = 4m, FE = 4m and FG = 1.5 m
So BD = 4 + 1.5 = 5.5 m
AC = BD = 5.5 m
CG = (4 + 2) = 6 m

We know that
Perimeter of figure (i) = AC + CG + GF + FE + EB + BA
Substituting the values
= 5.5 + 6 + 1.5 + 4 + 4 + 2
= 23 m

Here
Area of given figure = Area of ABEDC + Area of FEDG

It can be written as
= length × breadth + length × breadth
Substituting the values
= 2 × 5.5 + 4 × 1.5
= 11 + 6
= 17 $m^2$

(b) It is given that
AB = CD = 3m
HI = AC = 7m
JE = BE = 5m
GF = DE = 2m
DG = EF = 8m
GH = JI = 2m



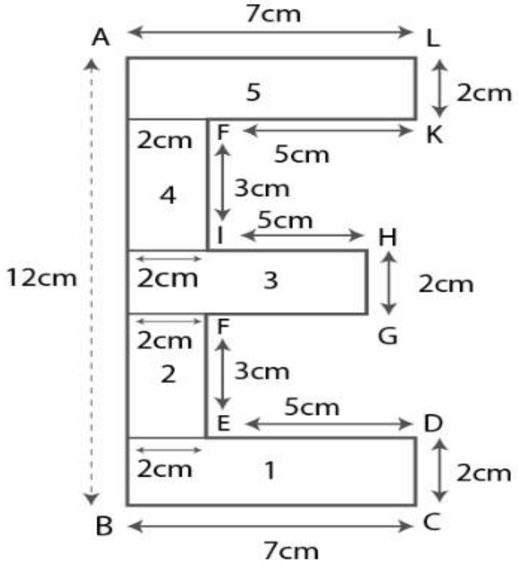

We know that
CH = CD + DG + GH
Substituting the values
= 3 + 8 + 2
= 13 m

Perimeter of the given figure = AB + AC + CH + HI + IJ + JF + FE + BE
Substituting the values
= 3 + 7 + 13 + 7 + 2 + 5 + 8 + 5
= 50 m

Here
Area of given figure = Area of first figure + Area of second figure + Area of third figure
Substituting the values
= 7 × 3 + 8 × 2 + 7 × 2
By further calculation
= 21 + 16 + 14
= 51 $m^2$

(c) It is given that
AB = 12 cm
AL = BC = 7 cm
JK = DE = 5 cm
HJ = GF = 3 cm

LK = HG = CD = 2 cm




We know that

Perimeter of given figure = AB + BC + CD + DE + EF + FG + GH + HI + IJ + JK + KL + LA

Substituting the values

= 12 + 7 + 2 + 5 + 3 + 3 + 2 + 3 + 3 + 5 + 2 + 7

= 54 cm

Here

Area of given figure =Area of first part + Area of second part + Area of third part + Area of fourth part + Area of fifth part

Substituting the values

= 7 × 2 + 2 × 3 + (2 + 3) × 2 + 2 × 3 + 7 × 2

By further calculation

= 14 + 6 + 10 + 6 + 14

= 50 $cm^2$

**18. The length and the breadth of a rectangle are 12 cm and 9 cm respectively. Find the height of a triangle whose base is 9 cm and whose area is one third that of rectangle.**

**Solution:**

It is given that

Length of a rectangle = 12 cm

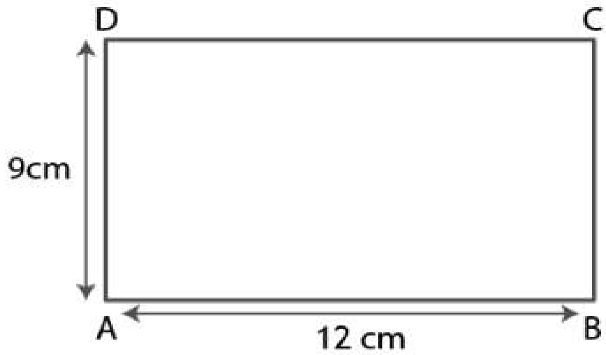
Breadth of a rectangle = 9 cm

So the area = l × b

Substituting the values

= 12 × 9

= 108 $cm^2$

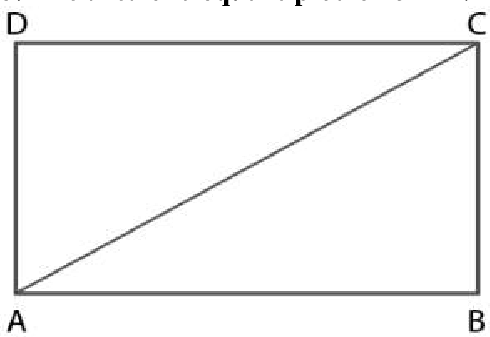



Using the condition
Area of triangle ABC = 1/3 × area of rectangle
Substituting the values
= 1/3 × 108
= 36 $cm^2$

Consider h cm as the height of triangle ABC
Area of triangle ABC = ½ × base × height
Substituting the values
36 = ½ × 9 × h
By further calculation
36 × 2 = 9 × h
h = (36 × 2)/ 9
So we get
h = 4 × 2
h = 8 cm

Therefore, height of triangle ABC is 8 cm.

**19. The area of a square plot is 484 $m^2$. Find the length of its one side and the length of its one diagonal.**




**Solution:**

It is given that
ABCD is a square plot having area = 484 $m^2$
Sides of square are AB, BC, CD and AD

We know that
Area of square = side × side
Substituting the values
484 = $(side)^2$

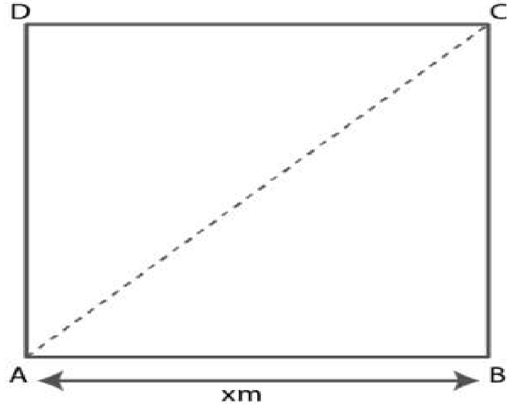
So we get
Side = $\sqrt{484}$ = 22 m
AB = BC = 22 m

In triangle ABC
Using Pythagoras Theorem
$AC^2 = AB^2 + BC^2$
Substituting the values
$AC^2 = 22^2 + 22^2$
$AC^2 = 484 + 484 = 968$
By further calculation
AC = $\sqrt{968} = \sqrt{(484 \times 2)}$
AC = $22 \times \sqrt{2}$
So we get
AC = $22 \times 1.414 = 31.11$ m

Therefore, length of side is 22 m and length of diagonal is 31.11 m.

**20. A square has the perimeter 56 m. Find its area and the length of one diagonal correct up to two decimal places.**
**Solution:**

Consider ABCD as a square with side x m
Perimeter of square = 4 × side
Substituting the values
56 = 4x
By further calculation
x = 56/4 = 14 m




In triangle ABC
Using Pythagoras theorem
$AC^2 = AB^2 + BC^2$
Substituting the values
$AC^2 = 14^2 + 14^2$
By further calculation
$AC^2 = 196 + 196 = 392$
So we get
AC = $\sqrt{392}$
AC = $\sqrt{(196 \times 2)}$

AC = 14 √2
Substituting the value of √2
AC = 14 × 1.414
AC = 19.80 m

Therefore, the side of square is 14 m and diagonal is 19.80 m.

**21. A wire when bent in the form of an equilateral triangle encloses an area of 36 √3 $cm^2$. Find the area enclosed by the same wire when bent to form:**
**(i) a square, and**
**(ii) a rectangle whose length is 2 cm more than its width.**
**Solution:**

It is given that
Area of equilateral triangle = 36 √3 $cm^2$
Consider x cm as the side of equilateral triangle

We know that
Area = √3/4 $(side)^2$
Substituting the values
36 √3 = √3/4 × $(x)^2$
By further calculation
$x^2$ = (36 √3 × 4)/ √3
$x^2$ = 36 × 4
So we get
x = √ (36 × 4)
x = 6 × 2
x = 12 cm

Here
Perimeter of equilateral triangle = 3 × side
= 3 × 12
= 36 cm

(i) We know that
Perimeter of equilateral triangle = Perimeter of square
It can be written as
36 = 4 × side
So we get
Side = 36/4 = 9 cm

Area of square = side × side
= 9 × 9
= 81 $cm^2$

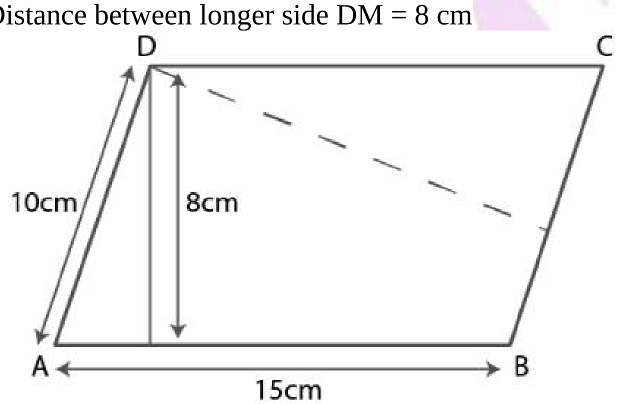
(ii) We know that
Perimeter of triangle = Perimeter of rectangle …. (1)
According to the condition of rectangle
Length is 2 cm more than its width

Width of rectangle = x cm
Length of rectangle = (x + 2) cm
Perimeter of rectangle = 2 (l + b)
Substituting the values
= 2 [(x + 2) + x]
By further calculation
= 2 (2x + 2)
= 4x + 4
Using equation (1)
4x + 4 = Perimeter of triangle
4x + 4 = 36
By further calculation
4x = 36 – 4 = 32 cm
So we get
x = 32/4 = 8 cm

Here
Length of rectangle = 8 + 2 = 10 cm
Breadth of rectangle = 8 cm
Area of rectangle = length × breadth
= 10 × 8
= 80 $cm^2$

**22. Two adjacent sides of a parallelogram are 15 cm and 10 cm. If the distance between the longer sides is 8 cm, find the area of the parallelogram. Also find the distance between shorter sides.**
**Solution:**

Consider ABCD as a parallelogram
Longer side AB = 15 cm
Shorter side = 10 cm
Distance between longer side DM = 8 cm



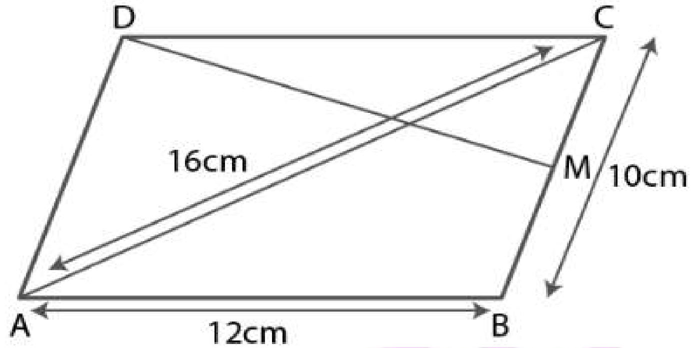

Consider DN as the distance between the shorter side
Area of parallelogram ABCD = base × height
We can write it as
= AB × DM
Substituting the values
= 15 × 8
= 120 $cm^2$

If base is AD
Area of parallelogram = AD × DN
Substituting the values
120 = 10 × DN
So we get
DN = 120/10 = 12 cm

Therefore, the area of parallelogram is 120 $cm^2$ and the distance between shorter side is 12 cm.

**23. ABCD is a parallelogram with sides AB = 12 cm, BC = 10 cm and diagonal AC = 16 cm. Find the area of the parallelogram. Also find the distance between its shorter sides.**
**Solution:**

It is given that
ABCD is a parallelogram
AB = 12 cm, BC = 10 cm and AC = 16 cm




Area of triangle ABC
BC = a = 10 cm
AC = b = 16 cm
AB = c = 12 cm

We know that
s = (a + b + c)/ 2
Substituting the values
s = (10 + 16 + 12)/ 2
By further calculation
s = 38/2 = 19 cm

Here

$$Area\ of\ \Delta ABC = \sqrt{s(s-a)(s-b)(s-c)}$$

$$Substituting\ the\ values$$

$$= \sqrt{19(19-10)(19-16)(19-12)}$$

$$By\ further\ calculation$$

$$= \sqrt{19 \times 9 \times 3 \times 7}$$

$$We\ can\ write\ it\ as$$

$$= \sqrt{19 \times 3 \times 3 \times 3 \times 7}$$

$$= 3\sqrt{19 \times 3 \times 7}$$

$$= 3\sqrt{19 \times 21}$$

So we get
= 3 √399 $cm^2$

We know that
Area of parallelogram = 2 × Area of triangle ABC
Substituting the values
= 2 × 3 √399
= 6 √399
So we get
= 6 × 19.96
= 119.8 $cm^2$

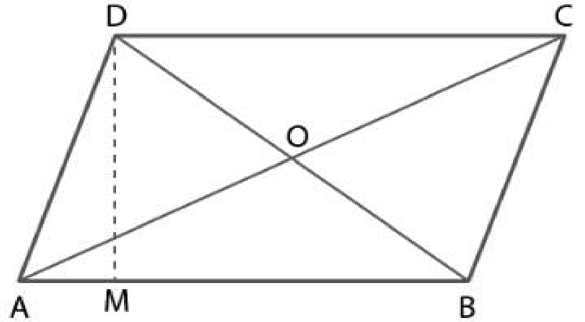
Consider DM as the distance between the shorter lines
Base = AD = BC = 10 cm
Area of parallelogram = AD × DM
Substituting the values
119.8 = 10 × DM
By further calculation
DM = 119.8/ 10
DM = 11.98 cm

Therefore, the distance between shorter lines is 11.98 cm.

**24. Diagonals AC and BD of a parallelogram ABCD intersect at O. Given that AB = 12 cm and perpendicular distance between AB and DC is 6 cm. Calculate the area of the triangle AOD.**
**Solution:**

It is given that

ABCD is a parallelogram
AC and BD are the diagonal which intersect at O
AB = 12 cm and DM = 6 cm

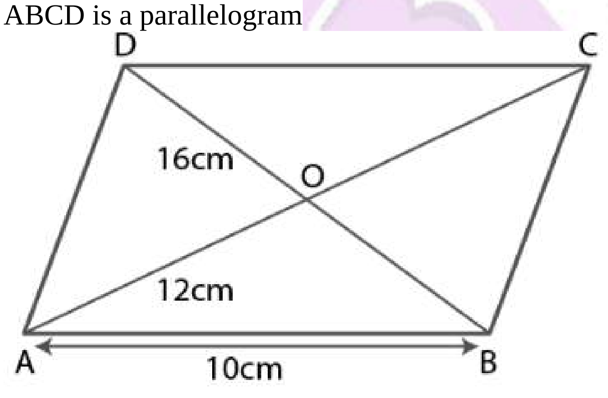



We know that
Area of parallelogram ABCD = AB × DM
Substituting the values
= 12 × 6
= 72 $cm^2$

Similarly
Area of triangle AOD = ¼ × Area of parallelogram
Substituting the values
= ¼ × 72
= 18 $cm^2$

**25. ABCD is a parallelogram with side AB = 10 cm. Its diagonals AC and BD are of length 12 cm and 16 cm respectively. Find the area of the parallelogram ABCD.**
**Solution:**

It is given that
ABCD is a parallelogram




AB = 10 cm, AC = 12 cm
AO = CO = 12/2 = 6 cm
BD = 16 cm
BO = OD = 16/2 = 8 cm

In triangle AOB
a = 10 cm, b = AO = 6 cm, c = BO = 8 cm
We know that
s = (a + b + c)/ 2

Substituting the values
s = (10 + 6 + 8)/ 2
By further calculation
s = 24/2 = 12 cm

$$Area\ of\ \Delta AOB = \sqrt{s(s-a)(s-b)(s-c)}$$

$$Substituting\ the\ values$$

$$= \sqrt{12(12-10)(12-6)(12-8)}$$

$$By\ further\ calculation$$

$$= \sqrt{12 \times 2 \times 6 \times 4}$$

$$= \sqrt{12 \times 2 \times 4}$$

So we get
= 12 × 2
= 24 $cm^2$

We know that
Area of parallelogram ABCD = 4 × Area of triangle AOB
Substituting the values
= 4 × 24
= 96 $cm^2$

**26. The area of a parallelogram is p $cm^2$ and its height is q cm. A second parallelogram has equal area but its base is r cm more than that of the first. Obtain an expression in terms of p, q and r for the height h of the second parallelogram.**
**Solution:**

It is given that
Area of a parallelogram = p $cm^2$
Height of first parallelogram = q cm

We know that
Area of parallelogram = base × height
Substituting the values
p = base × q
Base = p/q

Here
Base of second parallelogram = (p/q + r)
Taking LCM
= (p + qr)/ q cm

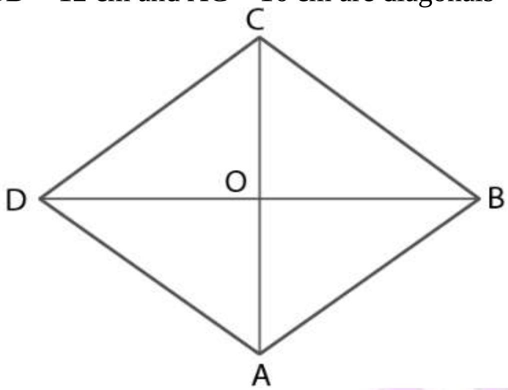
Area of second parallelogram = Area of first parallelogram = p $cm^2$

It can be written as
Base × height = p $cm^2$
Substituting the values
[(p + qr)/q] × h = p
So we get
h = pq/ (p + qr) cm

Therefore, the height of second parallelogram is h = pq/ (p + qr) cm.

**27. What is the area of a rhombus whose diagonals are 12 cm and 16 cm?**
**Solution:**

It is given that
ABCD is a rhombus
BD = 12 cm and AC = 16 cm are diagonals




We know that
Area of rhombus ABCD = ½ × AC × BD
Substituting the values
= ½ × 16 × 12
By further calculation
= 8 × 12
= 96 $cm^2$

**28. The area of a rhombus is 98 $cm^2$. If one of its diagonal is 14 cm, what is the length of the other diagonal?**
**Solution:**

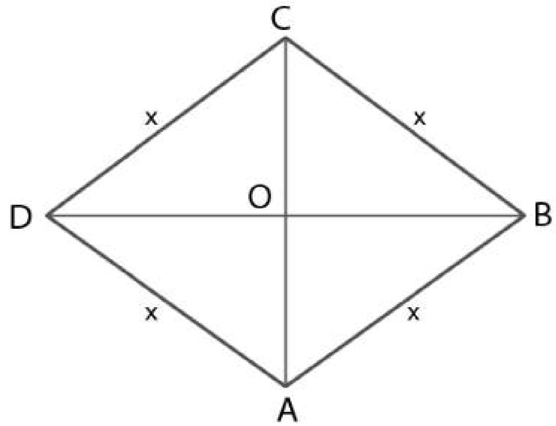
It is given that
Area of rhombus = 98 $cm^2$
One of its diagonal = 14 cm

We know that
Area of rhombus = ½ × product of diagonals
Substituting the values
98 = ½ × one diagonal × other diagonal
98 = ½ × 14 × other diagonal
By further calculation
Other diagonal = (98 × 2)/ 14
= 7 × 2
= 14 cm

Therefore, the other diagonal is 14 cm.

**29. The perimeter of a rhombus is 45 cm. If its height is 8 cm, calculate its area.**
**Solution:**

It is given that
ABCD is a rhombus
Consider x cm as each side

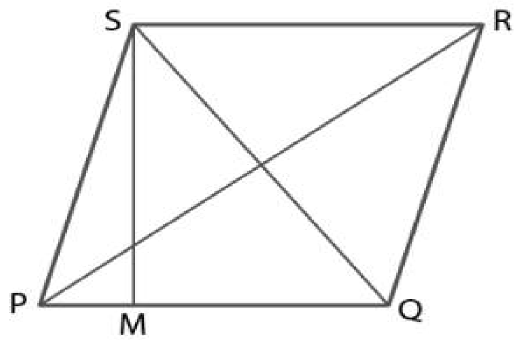



Perimeter = 45 cm
AB + BC + CD + AD = 45 cm
Substituting the values
x + x + x + x = 45
4x = 45
By division
x = 45/4 cm

We know that
Height = 8 cm
Area of rhombus = base × height
Substituting the values
= 45/4 × 8
= 45 × 2
= 90 $cm^2$

**30. PQRS is a rhombus. If it is given that PQ = 3 cm and the height of the rhombus is 2.5 cm, calculate its area.**
**Solution:**

It is given that
PQRS is a rhombus

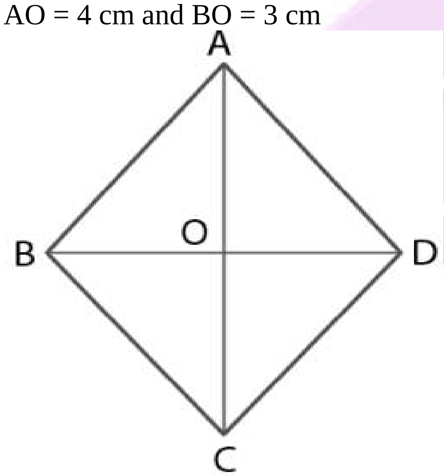



PQ = 3 cm
Height = 2.5 cm
Consider PQ as the base of rhombus PQRS.
SM = 2.5 cm is the height of rhombus

We know that
Area of rhombus PQRS = base × height
Substituting the values
= 3 × 2.5
= 7.5 $cm^2$

**31. If the diagonals of a rhombus are 8 cm and 6 cm, find its perimeter.**
**Solution:**

Consider ABCD as a rhombus with AC and BD as two diagonals
Here
AC = 8 cm and BD = 6 cm
AO = 4 cm and BO = 3 cm



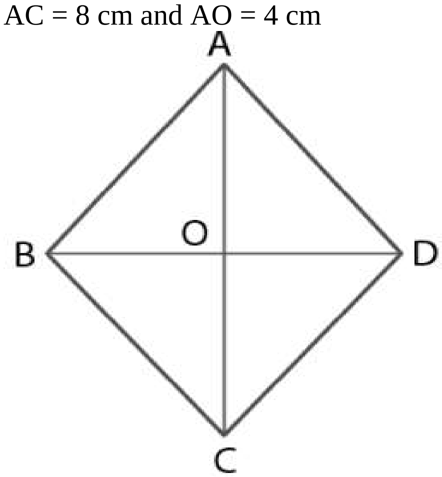

In triangle ABC
Using Pythagoras theorem
$AB^2 = AO^2 + BO^2$
Substituting the values
$AB^2 = 4^2 + 3^2$
By further calculation
$AB^2 = 16 + 9 = 25$
So we get
AB = √25 = 5 cm

Side of rhombus ABCD = 5 cm

Here
Perimeter of rhombus = 4 × side
Substituting the values
= 4 × 5
= 20 cm

**32. If the sides of a rhombus are 5 cm each and one diagonal is 8 cm, calculate**
**(i) the length of the other diagonal, and**
**(ii) the area of the rhombus.**
**Solution:**

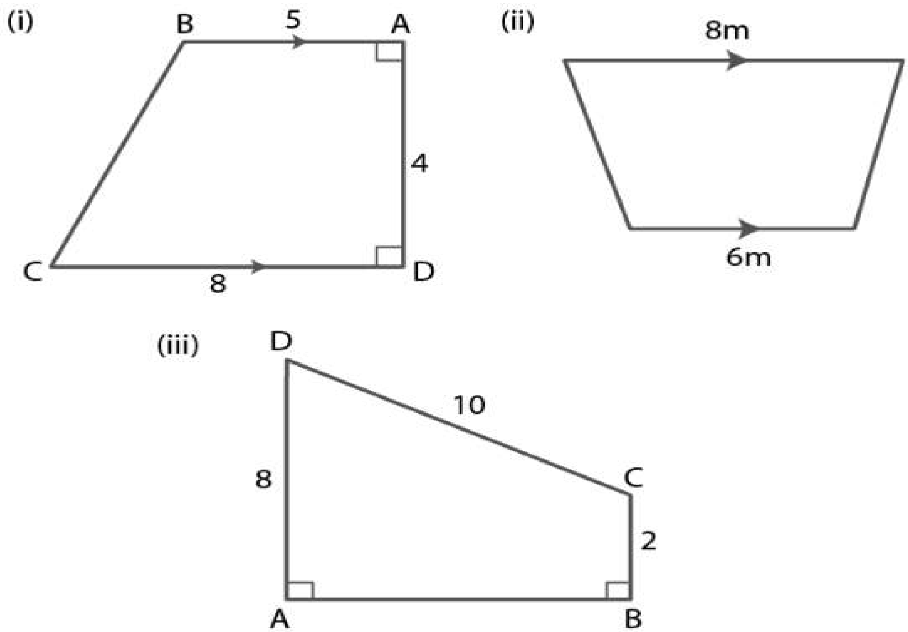
It is given that
ABCD is a rhombus with side AB, BC, CD and AD
AB = BC = CD = AD = 5 cm
AC = 8 cm and AO = 4 cm




In triangle AOB
Using Pythagoras theorem
$AB^2 = AO^2 + BO^2$
Substituting the values
$5^2 = 4^2 + BO^2$
By further calculation
$25 = 16 + BO^2$
$BO^2 = 25 – 16 = 9$
So we get
BO = √9 = 3 cm
BD = 2 × BO = 2 × 3 = 6 cm
Length of other diagonal = 6 cm

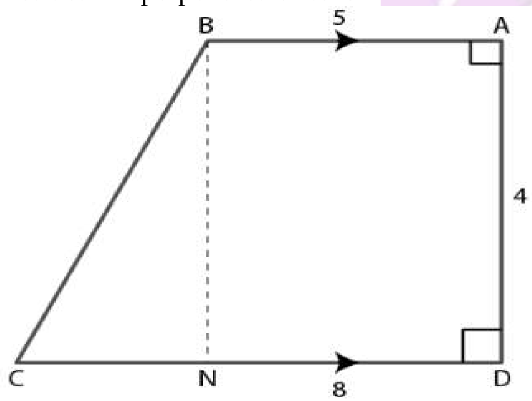
Area of rhombus = ½ × product of diagonals
Substituting the values
= ½ × 8 × 6
By further calculation
= 4 × 6
= 24 $cm^2$

**33. (a) The diagram (i) given below is a trapezium. Find the length of BC and the area of the trapezium. Assume AB = 5 cm, AD = 4 cm, CD = 8 cm.**
**(b) The diagram (ii) given below is a trapezium. Find**
**(i) AB**
**(ii) area of trapezium ABCD**
**(c) The cross-section of a canal is shown in figure (iii) given below. If the canal is 8 m wide at the top and 6 m wide at the bottom and the area of the cross-section is 16.8 $m^2$, calculate its depth.**




**Solution:**

(a) It is given that
ABCD is a trapezium
AB = 5 cm, AD = 4 cm and CD = 8 cm
Construct BN perpendicular to CD

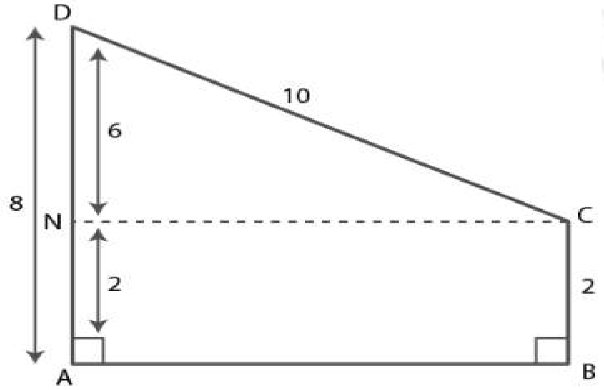



Here
BN = 4 cm
CN = CD – ND
CN = CD – AO
CN = 8 – 5 = 3 cm

In triangle BCN
Using Pythagoras theorem
$BC^2 = BN^2 + CN^2$
Substituting the values
$BC^2 = 4^2 + 3^2$
By further calculation
$BC^2 = 16 + 9 = 25$
$BC = \sqrt{25} = 5$ cm
Length of BC = 5 cm

Area of trapezium = ½ × sum of parallel sides × height
It can be written as
= ½ × (AB + CD) × AD
Substituting the values
= ½ × (5 + 8) × 4
By further calculation
= ½ × 13 × 4
So we get
= 13 × 2
= 26 $cm^2$
Area of trapezium = 26 $cm^2$

(b) From the figure (ii)
AD = 8 units
BC = 2 units
CD = 10 units
Construct CN perpendicular to AD
AN = 2 units



(ii)

We know that
DN = AD – DN
Substituting the values
= 8 – 6
= 2 units

In triangle CDN
Using Pythagoras theorem
$CD^2 = DN^2 + NC^2$

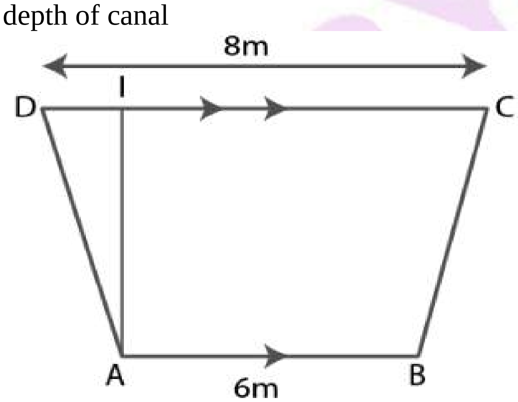
Substituting the values
$10^2 = 6^2 + NC^2$
By further calculation
$NC^2 = 10^2 - 6^2$
$NC^2 = 100 – 36 = 64$
So we get
NC = √64 = 8 units

From the figure NC = AB = 8 units

We know that
Area of trapezium = ½ × sum of parallel sides × height
It can be written as
= ½ × (BC + AD) × AB
Substituting the values
= ½ × (2 + 8) × 8
By further calculation
= ½ × 10 × 8
= 5 × 8
= 40 sq. units

(c) Consider ABCD as the cross section of canal in the shape of trapezium.
AB = 6 m, DC = 8 m
Take AL as the depth of canal

(iii)

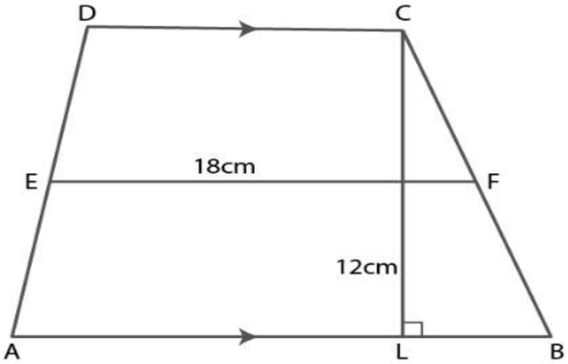



So the area of cross-section = 16.8 $m^2$
It can be written as
½ × sum of parallel sides × depth = 16.8
½ × (AB + DC) × AL = 16.8
Substituting the values
½ × (6 + 8) × AL = 16.8
By further calculation
½ × 14 × AL = 16.8
AL = (16.8 × 2)/ 14
So we get
AL = (16.8 × 1)/7
AL = 2.4 m

**34. The distance between parallel sides of a trapezium is 12 cm and the distance between mid-points of other sides is 18 cm. Find the area of the trapezium.**

**Solution:**

Consider ABCD as a trapezium in which AB || DC
Height CL = 12 cm
E and F are the mid-points of sides AD and BC
EF = 18 cm




We know that
EF = ½ (AB + DC) = 18 cm
Here
Area of trapezium ABCD = ½ (AB + DC) × height
Substituting the values
= 18 × 12
= 216 $cm^2$

**35. The area of a trapezium is 540 $cm^2$. If the ratio of parallel sides is 7: 5 and the distance between them is 18 cm, find the length of parallel sides.**
**Solution:**

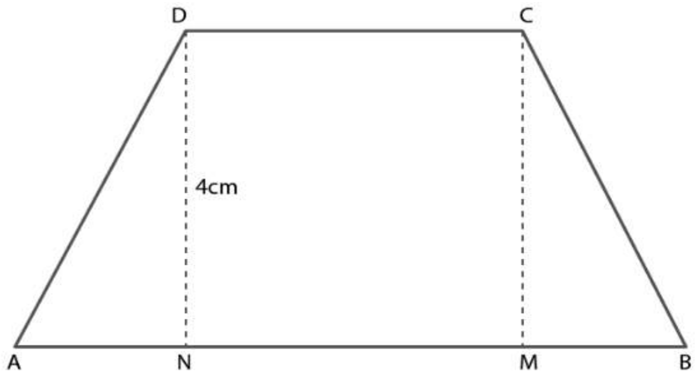
It is given that
Area of trapezium = 540 $cm^2$
Ratio of parallel sides = 7: 5
Consider 7x cm as one parallel side
Other parallel side = 5x cm
Distance between the parallel sides = height = 18 cm

We know that
Area of trapezium = ½ × sum of parallel sides × height
Substituting the values
540 = ½ × (7x + 5x) × 18
By further calculation
540 = ½ × 12x × 18
540 = 6x × 18
540 = 108x
x = 540/108 = 5

Here
First parallel side = 7x = 7 × 5 = 35 cm
Second parallel side = 5x = 5 × 5 = 25 cm

**36. The parallel sides of an isosceles trapezium are in the ratio 2: 3. If its height is 4 cm and area is 60 $cn^2$, find the perimeter.**
**Solution:**

It is given that
ABCD is an isosceles trapezium
BC = AD
Height = 4 cm
Consider CD = 2x and AB = 3x




We know that
Area of trapezium = ½ (sum of parallel sides) × height
Substituting the values
60 = ½ × (2x + 3x) × 4
By further calculation
60 = ½ × 5x × 4
60 = 5x × 2
60 = 10x
So we get
x = 60/10 = 6

Here
CD = 2x = 2 × 6 = 12 cm
AB = 3x = 3 × 6 = 18 cm

AN = BM
We can write it as
AN = AB – BN
AN = AB - (MN + BM)
We know that
MN = CD
AN = AB – (CD + BM)
Similarly BM = AN
AN = AB – (CD + AN)
Substituting the values
AN = 18 – (12 + AN)
AN = 18 – 12 – AN
AN + AN = 6
2AN = 6
By division

AN = 6/2 = 3

In triangle AND
Using Pythagoras theorem
$AD^2 = DN^2 + AN^2$
Here DN = 4 cm
$AD^2 = 4^2 + 3^2$
By further calculation
$AD^2 = 16 + 9 = 25$
So we get
AD= $\sqrt{25}$ = 5 cm
Here AD = BC = 5 cm

Perimeter of trapezium = AB + BC + CD + AD
Substituting the values
= 18 + 5 + 12 + 5
= 40 cm

**37. The area of a parallelogram is 98 $cm^2$. If one altitude is half the corresponding base, determine the base and the altitude of the parallelogram.**
**Solution:**

It is given that
Area of parallelogram = 98 $cm^2$
Condition – If one altitude is half the corresponding base
Take base = x cm
Corresponding altitude = x/2 cm

We know that
Area of parallelogram = base × altitude
Substituting the values
98 = x × x/2
$98 = x^2/2$
By cross multiplication
$x^2 = 98 \times 2 = 196$
So we get
x = $\sqrt{196}$ = 14 cm
Base = 14 cm

Here altitude = 14/2 = 7 cm

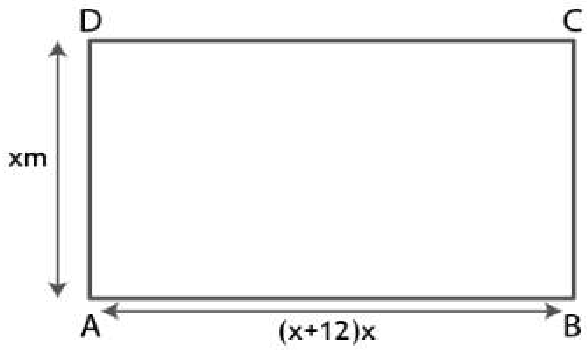
**38. The length of a rectangular garden is 12 m more than its breadth. The numerical value of its area is equal to 4 times the numerical value of its perimeter. Find the dimensions of the garden.**
**Solution:**

The dimensions of rectangular garden are
Breadth = x m
Length = (x + 12) m

We know that

Area = l × b
Substituting the values
Area = (x + 12) × x
Area = ($x^2$ + 12x) $m^2$

Perimeter = 2 (l + b)
Substituting the values
= 2 [(x + 12) + x]
= 2 [ x + 12 + x]
= 2 [2x + 12]
= (4x + 24) m



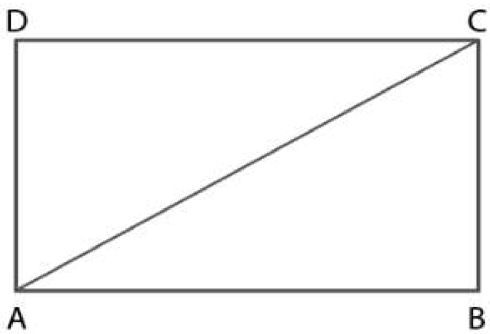

Based on the question
Numerical value of area = 4 × numerical value of perimeter
$x^2$ + 12x = 4 × (4x + 24)
By further calculation
$x^2$ + 12x = 16x + 96
$x^2$ + 12x – 16x – 96 = 0
$x^2$ – 4x – 96 = 0
It can be written as
$x^2$ – 12x + 8x – 96 = 0
Taking out the common terms
x (x – 12) + 8 (x – 12) = 0
(x + 8) (x – 12) = 0

Here
x + 8 = 0 or x – 12 = 0
So we get
x = -8 (not possible) or x = 12

Breadth of rectangular garden = 12 m
Length of rectangular garden = 12 + 12 = 24 m

**39. If the perimeter of a rectangular plot is 68 m and length of its diagonal is 26 m, find its area.**
**Solution:**

It is given that
Perimeter of a rectangular plot = 68 m
Length of its diagonal = 26 m
ABCD is a rectangular plot of length x m and breath y m




Perimeter = 2 (length + breadth)
Substituting the values
$68 = 2 (x + y)$
By further calculation
$68/2 = x + y$
$34 = x + y$
So we get
$x = 34 - y$ …… (1)

In triangle ABC
Using Pythagoras theorem
$AC^2 = AB^2 + BC^2$
Substituting the values
$26^2 = x^2 + y^2$
$x^2 + y^2 = 676$
Now substituting the value of x in equation (1)
$(34 - y)^2 + y^2 = 676$
$1156 + y^2 - 68y + y^2 = 676$
By further calculation
$2y^2 - 68y + 1156 - 676 = 0$
$2y^2 - 68y - 480 = 0$
Taking 2 as common
$2 (y^2 - 34y - 240) = 0$
$y^2 - 34y - 240 = 0$
It can be written as
$y^2 - 24y - 10y - 240 = 0$
Taking out the common terms
$y (y - 24) - 10 (y - 24) = 0$
$(y - 10) (y - 24) = 0$

Here
$y - 10 = 0$ or $y - 24 = 0$
$y = 10$ m or $y = 24$ m

Now substituting the value of y in equation (1)
$y = 10$ m, $x = 34 - 10 = 24$ m
$y = 24$ m, $x = 34 - 24 = 10$ m

Area in both cases = xy

$= 24 \times 10$ or $10 \times 24$
$= 240\ m^2$

Therefore, the area of the rectangular block is $240\ m^2$.

**40. A rectangle has twice the area of a square. The length of the rectangle is 12 cm greater and the width is 8 cm greater than 2 side of a square. Find the perimeter of the square.**
**Solution:**

Consider
Side of a square = x cm
Length of rectangle = (x + 12) cm
Breadth of rectangle = (x + 8) cm

We know that
Area of square = side × side = $x \times x = x^2\ cm^2$
Area of rectangle = l × b
Substituting the values
$= (x + 12)(x + 8)\ cm^2$

Based on the question
Area of rectangle = 2 × area of square
Substituting the values
$(x + 12)(x + 8) = 2 \times x^2$
It can be written as
$x(x + 8) + 12(x + 8) = 2x^2$
$x^2 + 8x + 12x + 96 = 2x^2$
$x^2 - 2x^2 + 8x + 12x + 96 = 0$
By further calculation
$-x^2 + 20x + 96 = 0$
$-(x^2 - 20x - 96) = 0$
$x^2 - 20x - 96 = 0$
We can write it as
$x^2 - 24x + 4x - 96 = 0$
$x(x - 24) + 4(x - 24) = 0$
$(x + 4)(x - 24) = 0$

Here
$x + 4 = 0$ or $x - 24 = 0$
$x = -4$ or $x = 24$ cm
Side of square = 24 cm

Perimeter of square = 4 × side
Substituting the values
$= 4 \times 24$
= 96 cm

**41. The perimeter of a square is 48 cm. The area of a rectangle is 4 cm² less than the area of the square. If the length of the rectangle is 4 cm greater than its breadth, find the perimeter of the rectangle.**
**Solution:**

It is given that
Perimeter of a square = 48 cm
Side = perimeter/4 = 48/4 = 12 cm

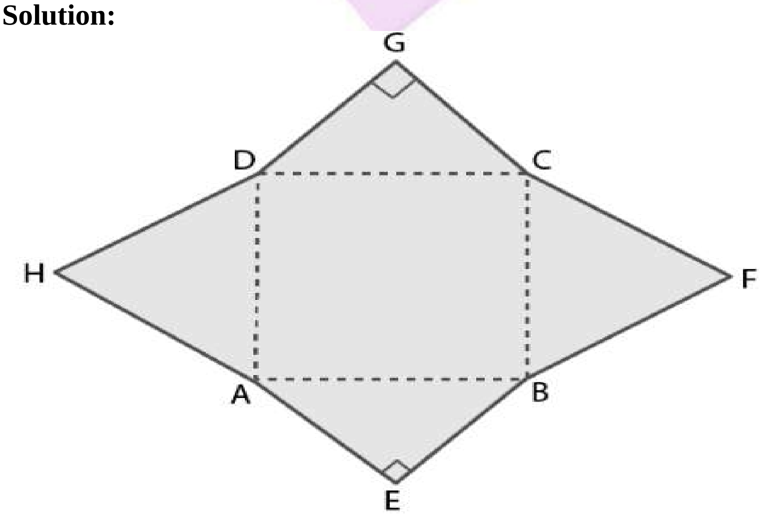
We know that
Area = $side^2 = 12^2 = 144\ cm^2$
Area of rectangle = 144 – 4 = 140 $cm^2$

Take breadth of rectangle = x cm
Length of rectangle = x + 4 cm
So the area = (x + 4) × x $cm^2$
Substituting the values
(x + 4) x = 140
By further calculation
$x^2 + 4x - 140 = 0$
$x^2 + 14x - 10x - 140 = 0$
Taking out the common terms
x (x + 14) – 10 (x + 14) = 0
(x + 14) (x – 10) = 0

Here
x + 14 = 0 where x = - 14
x – 10 = 0 where x = 10

Breadth = 10 cm
Length = 10 + 4 = 14 cm
Perimeter = 2 (l + b)
Substituting the values
= 2 (14 + 10)
= 2 × 24
= 48 cm

**42. In the adjoining figure, ABCD is a rectangle with sides AB = 10 cm and BC = 8 cm. HAD and BFC are equilateral triangle; AEB and DCG are right angled isosceles triangles. Find the area of the shaded region and the perimeter of the figure.**
**Solution:**



It is given that
ABCD is a rectangle with sides AB = 10 cm and BC = 8 cm
HAD and BFC are equilateral triangle with each side = 8 cm
AEB and DCG are right angled isosceles triangles with hypotenuse = 10 cm
Consider AE = EB = x cm

In triangle ABE
$AE^2 + EB^2 = AB^2$
Substituting the values
$x^2 + x^2 = 10^2$
$2x^2 = 100$
By further calculation
$x^2 = 100/2 = 50$
$x = \sqrt{50} = \sqrt{(25 \times 2)} = 5\sqrt{2}$ cm

We know that
Area of triangle AEB = Area of triangle GCD
It can be written as
$= ½ \times x \times x$
$= ½ x^2$ $cm^2$
Substituting the value of x
$= ½ \times 50$
$= 25$ $cm^2$

Area of triangle HAD = Area of BFC
It can be written as
$= \sqrt{3}/4 \times 8^2$
$= \sqrt{3}/4 \times 64$
$= 16\sqrt{3}$ $cm^2$

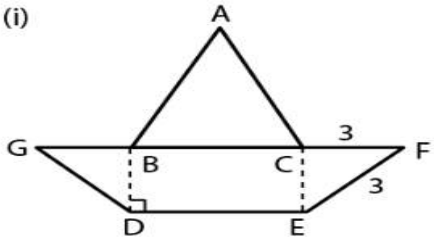
Area of shaded portion = Area of rectangle ABCD + 2 area of triangle AEB + 2 area of triangle BFC
Substituting the values
$= (10 \times 8 + 2 \times 25 + 2 \times 16\sqrt{3})$
By further calculation
$= 80 + 50 + 32\sqrt{3}$
So we get
$= (130 + 32\sqrt{3})$ $cm^2$

Here
Perimeter of the figure = AE + EB + BF + FC + CD + GD + DH + HA
It can be written as
= 4AE + 4BF
Substituting the values
$= 4 \times 5\sqrt{2} + 4 \times 8$
So we get
$= 20\sqrt{2} + 32$
$= (32 + 20\sqrt{2})$ cm

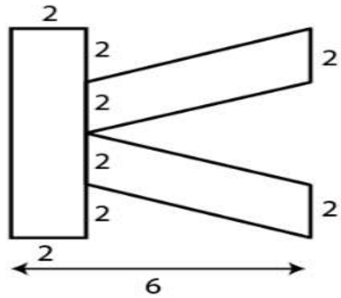
**43. (a) Find the area enclosed by the figure (i) given below, where ABC is an equilateral triangle and DEFG is an isosceles trapezium. All measurements are in centimetres.**

**(b) Find the area enclosed by the figure (ii) given below. AH measurements are in centimetres.**
**(c) In the figure (iii) given below, from a 24 cm × 24 cm piece of cardboard, a block in the shape of letter M is cut off. Find the area of the cardboard left over, all measurements are in centimetres.**

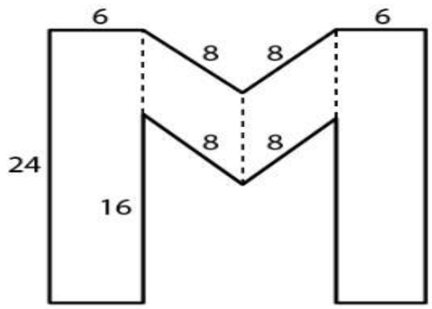
(i)




(ii)




(iii)




**Solution:**

(a) It is given that
ABC is an equilateral triangle and DEFG is an isosceles trapezium
EF = GD = 5 cm
DE = 6 cm
GF = GB + BC + CF
Substituting the values
= 3 + 6 + 3
= 12 cm
AB = AC = BC = 6 cm
Join BD and CE

In right triangle CEF
$CE^2 = EF^2 – CF^2$
Substituting the values
$= 5^2 - 3^2$
= 25 – 9
= 16
So we get
CE = √16 = 4 cm

Area of triangle ABC = $\sqrt{3}/4 \times 6^2$
By further calculation
= $\sqrt{3}/4 \times 36$
= $9\sqrt{3}$ $cm^2$

Area of trapezium DEFG = ½ (DE + GF) × CE
Substituting the values

= ½ × (6 + 12) × 4
By further calculation
= ½ × 18 × 4
= 36 $cm^2$

So the area of figure = 9√3 + 36
Substituting the values
= 9 × 1.732 + 36
= 15.59 + 36
= 51.59 $cm^2$

(b) We know that
Length of rectangle = 2 + 2 + 2 + 2 = 8 cm
Width of rectangle = 2 cm
Area of rectangle = l × b
Substituting the values
= 8 × 2
= 16 $cm^2$

Here
Area of each trap = ½ (2 + 2) × (6 – 2)
By further calculation
= ½ × 4 × 4
= 8 $cm^2$

So the total area = area of rectangle + area of 2 trapezium
Substituting the values
= 16 + 8 + 8
= 32 $cm^2$

(c) We know that
Length of each rectangle = 24 cm
Width of each rectangle = 6 cm
Area of each rectangle = l × b
Substituting the values
= 24 × 6
= 144 $cm^2$

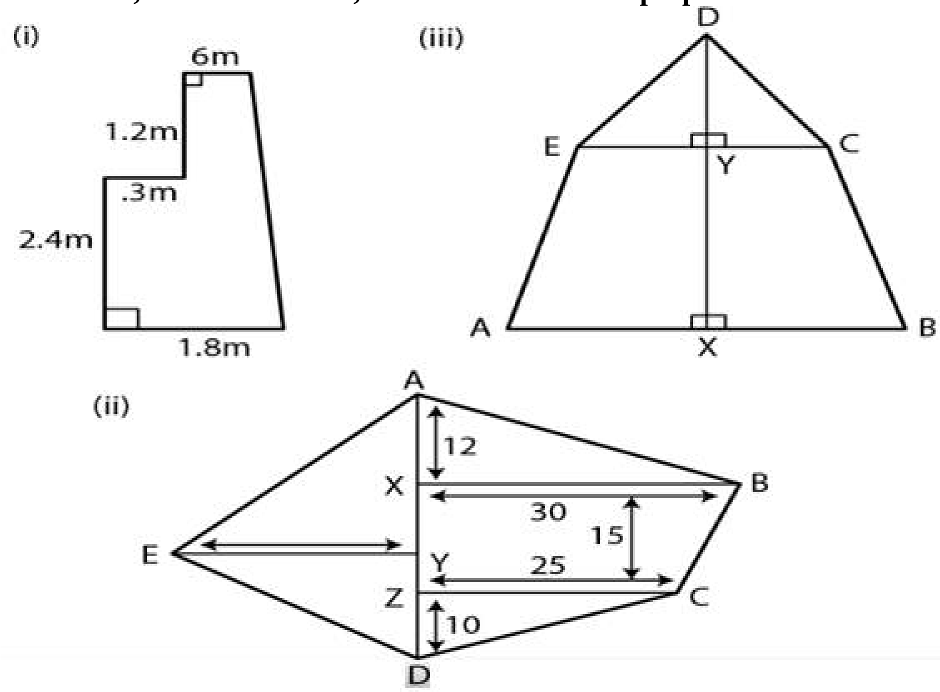
Base of each parallelogram = 8 cm
Height of each parallelogram = 6 cm
So the area of each parallelogram = 8 × 6 = 48 $cm^2$

Here
Area of the M-shaped figure = 2 × 144 + 2 × 48
So we get
= 288 + 96
= 384 $cm^2$

Area of the square cardboard = 24 × 24 = 576 $cm^2$

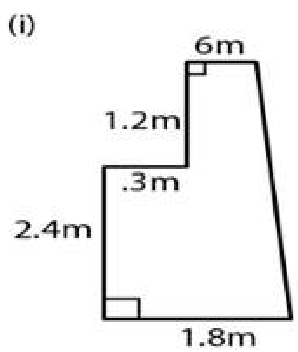
Area of the removing cardboard = 576 – 384 = 192 $cm^2$

**44. (a) The figure (i) given below shows the cross-section of the concrete structure with the measurements as given. Calculate the area of cross-section.**
**(b) The figure (ii) given below shows a field with the measurements given in metres. Find the area of the field.**
**(c) Calculate the area of the pentagon ABCDE shown in fig (iii) below, given that AX = BX = 6 cm, EY = CY = 4 cm, DE = DC = 5 cm, DX = 9 cm and DX is perpendicular to EC and AB.**




**Solution:**

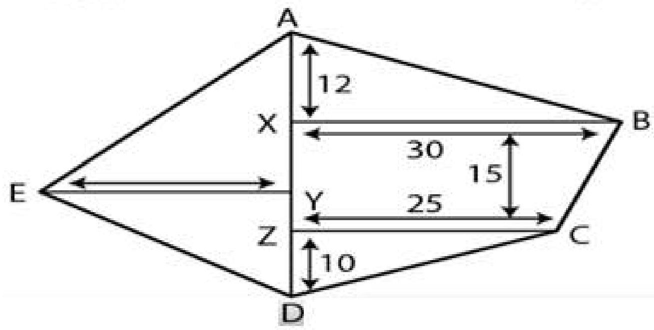
(a) From the figure (i)
AB = 1.8 m, CD = 0.6 m, DE = 1.2 m
EF = 0.3 m, AF = 2.4 m
Construct DE to meet AB in G
∠FEG = ∠GAF = $90^0$
So, AGEF is a rectangle




We know that
Area of given figure = Area of rectangle AGEF + Area of trapezium GBCD
It can be written as

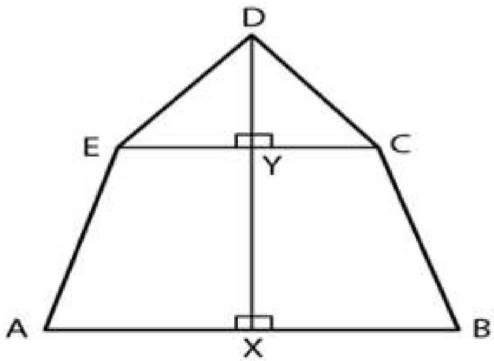
= l × b + ½ (sum of parallel sides × height)
= AF × AG + ½ (GB + CD) × DG
Substituting the values
= 2.4 × 0.3 + ½ [(AB – AG) + CD] × (DE + EG)
Here AG = FE and using EG = AF
= 0.72 + ½ [(1.8 – 0.3) + 0.6] × (1.2 + 2.4)
By further calculation
= 0.72 + ½ [1.5 + 0.6] × 3.6
= 0.72 + ½ × 2.1 × 3.6
So we get
= 0.72 + 2.1 × 1.8
= 0.72 + 3.78
= 4.5 $m^2$

(b) It is given that
ABCD is a pentagonal field
AX = 12 m, BX = 30 m, XZ = 15 m, CZ = 25 m,
DZ = 10 m, AD = 12 + 15 + 10 = 37 m, EY = 20 m




We know that
Area of pentagonal field ABCDE = Area of triangle ABX + Area of trapezium BCZX + Area of triangle CDZ + Area of triangle AED
It can be written as
= ½ × base × height + ½ (sum of parallel sides) × height + ½ × base × height + ½ × base × height
= ½ × BX × AX + ½ (BX + CZ) × XZ + ½ × CZ × DZ + ½ × AD × EY
Substituting the values
= ½ × 30 × 12 + ½ (30 + 25) × 15 + ½ × 25 × 10 + ½ × 37 × 20
By further calculation
= 15 × 12 + 7.5 × 55 + 25 × 5 + 37 × 10
So we get
= 180 + 412.5 + 125 + 370
= 1087.5 $m^2$

(c) It is given that
ABCDE is a pentagon
AX = BX = 6 cm, EY = CY = 4 cm
DE = DC = 5 cm, DX = 9 cm
Construct DX perpendicular to EC and AB




In triangle DEY
Using Pythagoras Theorem
$DE^2 = DY^2 + EY^2$
Substituting the values
$5^2 = DY^2 + 4^2$
$25 = DY^2 + 16$
$DY^2 = 25 - 16 = 9$
So we get
$DY = \sqrt{9} = 3$ cm

Here
Area of pentagonal field ABCDE = Area of triangle DEY + Area of triangle DCY + Area of trapezium EYXA + Area of trapezium CYXB
It can be written as
= ½ × base × height + ½ × base × height + ½ × (sum of parallel sides) × height + ½ × (sum of parallel sides) × height
= ½ × EY × DY + ½ × CY × DY + ½ × (EY + AX) × XY + ½ × (CY + BX) × XY
Substituting the values
= ½ × 4 × 3 + ½ × 4 × 3 + ½ × (4 + 6) × (DX – DY) + ½ (4 + 6) × (DX – DY)
By further calculation
= 2 × 3 + 2 × 2 + ½ × 10 × (9 – 3) + ½ × 10 × (9 – 3)
So we get
= 6 + 6 + 5 × 6 + 5 × 6
= 6 + 6 + 30 + 30
= 72 $cm^2$

**45. If the length and the breadth of a room are increased by 1 metre the area is increased by 21 square metres. If the length is increased by 1 metre and breadth is decreased by 1 metre the area is decreased by 5 square metres. Find the perimeter of the room.**
**Solution:**

Take length of room = x m
Breadth of room = y m
Here
Area of room = l × b = xy $m^2$

We know that
Length is increased by 1 m then new length = (x + 1) m
Breadth is increased by 1 m then new breadth = (y + 1) m

So the new area = new length × new breadth
Substituting the values
$= (x + 1)(y + 1)\ m^2$

Based on the question
$xy = (x + 1)(y + 1) – 21$
By further calculation
$xy = x(y + 1) + 1(y + 1) – 21$
$xy = xy + x + y + 1 – 21$
So we get
$0 = x + y + 1 – 21$
$0 = x + y – 20$
$x + y – 20 = 0$
$x + y = 20$ ….. (1)

Similarly
Length is increased by 1 metre then new length = (x + 1) metre
Breadth is decreased by 1 metre than new breadth = (y – 1) metre
So the new area = new length × new breadth
$= (x + 1)(y – 1)\ m^2$

Based on the question
$xy = (x + 1)(y – 1) + 5$
By further calculation
$xy = x(y – 1) + 1(y – 1) + 5$
$xy = xy – x + y – 1 + 5$
$0 = -x + y + 4$
So we get
$x – y = 4$ …… (2)

By adding equations (1) and (2)
$2x = 24$
$x = 24/2 = 12$ m

Now substituting the value of x in equation (1)
$12 + y = 20$
$y = 20 – 12 = 8$ m

Here
Length of room = 12 m
Breadth of room = 8 m
So the perimeter = 2 (l + b)
Substituting the values
$= 2(12 + 8)$
$= 2 × 20$
$= 40$ m

**46. A triangle and a parallelogram have the same base and same area. If the sides of the triangle are 26 cm, 28 cm and 30 cm and the parallelogram stands on the base 28 cm, find the height of the parallelogram.**
**Solution:**

It is given that
Sides of a triangle = 26 cm, 28 cm and 30 cm
We know that
s = (a + b + c)/ 2
Substituting the values
s = (26 + 28 + 30)/ 2
s = 84/2
s = 42 cm

Here

$$Area\ of\ \Delta = \sqrt{s(s-a)(s-b)(s-c)}$$

$$Substituting\ the\ values$$

$$= \sqrt{42(42-26)(42-28)(42-30)}$$

$$By\ further\ calculation$$

$$= \sqrt{42 \times 16 \times 14 \times 12}$$

$$= \sqrt{7 \times 6 \times 4 \times 4 \times 7 \times 2 \times 6 \times 2}$$

So we get
= 2 × 4 × 6 × 7
= 336 $cm^2$

We know that
Base = 28 cm
Height = Area/base
Substituting the values
= 336/28
= 12 cm

**47. A rectangle of area 105 $cm^2$ has its length equal to x cm. Write down its breadth in terms of x. Given that its perimeter is 44 cm, write down an equation in x and solve it to determine the dimensions of the rectangle.**
**Solution:**

It is given that
Area of rectangle = 105 $cm^2$
Length of rectangle = x cm

We know that
Area = length × breadth
Substituting the values
105 = x × breadth
x = 105/ x cm

Perimeter of rectangle = 44 cm
So we get
2 (l + b) = 44
2 (x + 105/x) = 44
By further calculation
$(x^2 + 105)/ x = 22$
By cross multiplication
$x^2 + 105 = 22x$
$x^2 – 22x + 105 = 0$
We can write it as
$x^2 – 15x – 7x + 105 = 0$
x (x – 15) – 7 (x – 15) = 0
(x – 7) (x – 15) = 0

Here
x – 7 = 0 or x – 15 = 0
x = 7 cm or x = 15 cm

If x = 7 cm,
Breadth = 105/7 = 15 cm
If x = 15 cm,
Breadth = 105/15 = 7 cm

Therefore, the required dimensions of rectangle are 15 cm and 7 cm.

**48. The perimeter of a rectangular plot is 180 m and its area is 1800 $m^2$. Take the length of plot as x m. Use the perimeter 180 m to write the value of the breadth in terms of x. Use the value of the length, breadth and the area to write an equation in x. Solve the equation to calculate the length and breadth of the plot.**
**Solution:**

It is given that
Perimeter of a rectangular plot = 180 m
Area of a rectangular plot = 1800 $m^2$
Take length of rectangle = x m

Here
Perimeter = 2 (length + breadth)
Substituting the values
180 = 2 (x + breadth)
180/2 = x + breadth
x + breadth = 90
Breadth = 90 – x m

We know that
Area of rectangle = l × b
Substituting the values
1800 = x × (90 – x)
$90x – x^2 = 1800$
It can be written as
$- (x^2 – 90x) = 1800$

$x^2 - 90x = - 1800$
By further calculation
$x^2 - 90x + 1800 = 0$
$x^2 - 60x - 30x + 1800 = 0$
$x (x - 60) - 30 (x - 60) = 0$
$(x - 30) (x - 60) = 0$

Here
$x - 30 = 0$ or $x - 60 = 0$
$x = 30$ or $x = 60$

If x = 30 m
Breadth = 90 – 30 = 60 m
If x = 60 m
Breadth = 90 – 60 = 30 m

Therefore, the required length of rectangle is 60 m and the breadth of rectangle is 30 m.

## EXERCISE 16.3

**1. Find the length of the diameter of a circle whose circumference is 44 cm.**
**Solution:**

Consider radius of the circle = r cm
Circumference = 2 πr

We know that
2 πr = 44
So we get
(2 × 22)/ 7 r = 44
By further calculation
r = (44 × 7)/ (2 × 22) = 7 cm

Diameter = 2r = 2 × 7 = 14 cm

**2. Find the radius and area of a circle if its circumference is 18π cm.**
**Solution:**

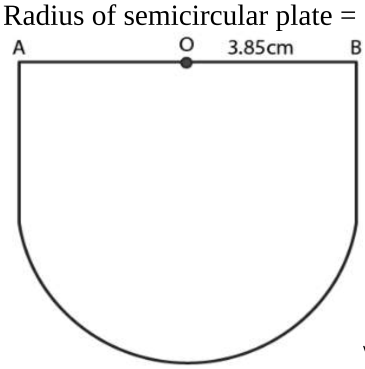
Consider the radius of the circle = r
Circumference = 2 πr

We know that
2 πr = 18π
So we get
2r = 18
r = 18/2 = 9 cm

Here
Area = $\pi r^2$
Substituting the value of r
= π × 9 × 9
= 81π $cm^2$

**3. Find the perimeter of a semicircular plate of radius 3.85 cm.**
**Solution:**

It is given that
Radius of semicircular plate = 3.85 cm

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We know that
Length of semicircular plat = $\pi r$
Perimeter = $\pi r + 2r = r(\pi + 2)$
Substituting the values
= $3.85 (22/7 + 2)$
By further calculation
= $3.85 \times 36/7$
= $0.55 \times 36$
= 19.8 cm

**4. Find the radius and circumference of a circle whose area is 144 $\pi$ $cm^2$.**
**Solution:**

It is given that
Area of a circle = $144 \pi\ cm^2$
Consider radius = r
$\pi r^2 = 144 \pi$
$r^2 = 144$
So we get
$r = \sqrt{144} = 12$ cm

Here
Circumference = $2 \pi r$
So we get
= $2 \times 12 \times \pi$
= $24\pi$ cm

**5. A sheet is 11 cm long and 2 cm wide. Circular pieces 0.5 cm in diameter are cut from it to prepare discs. Calculate the number of discs that can be prepared.**
**Solution:**

It is given that
Length of sheet = 11 cm
Width of sheet = 2 cm
We have to cut the sheet to a square of side 0.5 cm

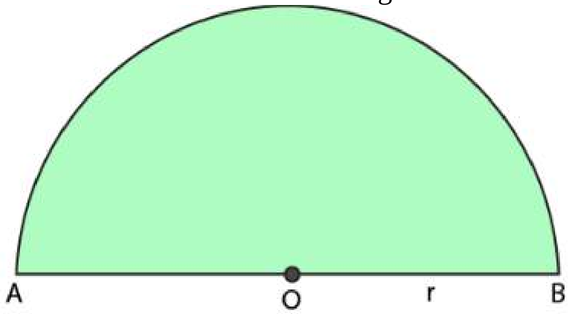
Here
Number of squares = $11/0.5 \times 2/0.5$
Multiply and divide by 10
= $(11 \times 10)/5 \times (2 \times 10)/5$
By further calculation
= $22 \times 4$
= 88

Hence, the number of discs will be equal to number of squares cut out = 88.

**6. If the area of a semicircular region is 77 $cm^2$, find its perimeter.**
**Solution:**

It is given that

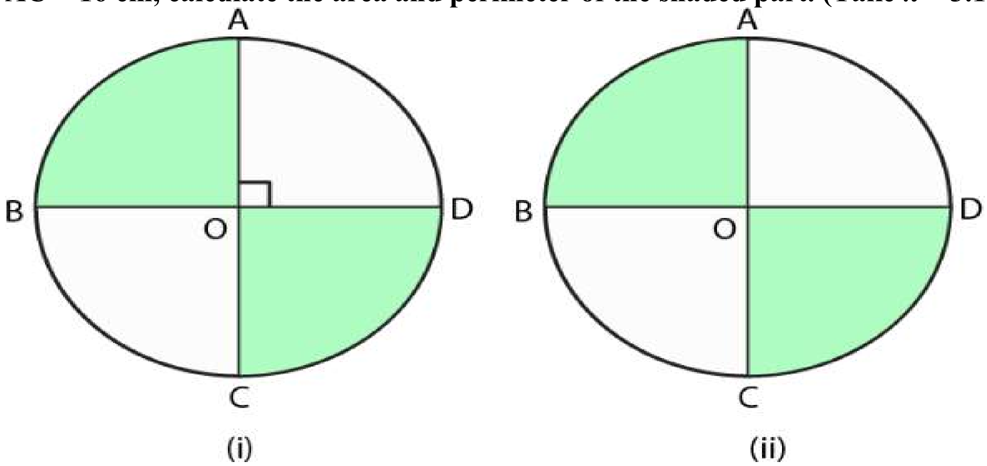
Area of a semicircular region = 77 $cm^2$
Consider r as the radius of the region




We know that
Area = ½ $\pi r^2$
½ $\pi r^2$ = 77
By further calculation
½ × 22/7 $r^2$ = 77
So we get
$r^2$ = (77 × 2 × 7)/ 22 = 49 = $7^2$
r = 7 cm

Here
Perimeter of the region = $\pi r + 2r$
By further calculation
= 22/7 × 7 + 2 × 7
So we get
= 22 + 14
= 36 cm

**7. (a) In the figure (i) given below, AC and BD are two perpendicular diameters of a circle ABCD. Given that the area of shaded portion is 308 $cm^2$, calculate**
**(i) the length of AC and**
**(ii) the circumference of the circle**
**(b) In the figure (ii) given below, AC and BD are two perpendicular diameters of a circle with centre O. If AC = 16 cm, calculate the area and perimeter of the shaded part. (Take π = 3.14)**




**Solution:**

(a) It is given that
Area of shaded portion = Area of semicircle = 308 $cm^2$
Consider r as the radius of circle
$\frac{1}{2} \pi r^2 = 308$
By further calculation
$\frac{1}{2} \times 22/7\ r^2 = 308$
$r^2 = (308 \times 2 \times 7)/ 22$
$r^2 = 196 = 14^2$
So r = 14 cm

(i) AC = 2r = 2 × 14 = 28 cm

(ii) We know that
Circumference of the circle = 2πr
Substituting the values
= 28 × 22/7
So we get
= 4 × 22
= 88 cm

(b) We know that
Diameter of circle = 16 cm
Radius of circle = 16/2 = 8 cm

Here
Area of shaded part = 2 × area of one quadrant
So we get
$= \frac{1}{2} \pi r^2$
Substituting the values
= ½ × 3.14 × 8 × 8
= 100.48 $cm^2$

We know that
Perimeter of shaded part = ½ of circumference + 4r
It can be written as
= ½ × 2πr + 4r
= πr + 4r
Taking r as common
= r (π + 4)
Substituting the values
= 8 (3.14 + 4)
= 8 × 7.14
= 57.12 cm

**8. A bucket is raised from a well by means of a rope which is wound round a wheel of diameter 77 cm. Given that the bucket ascends in 1 minute 28 seconds with a uniform speed of 1.1 m/sec, calculate the number of complete revolutions the wheel makes in raising the bucket.**
**Solution:**

It is given that

Diameter of wheel = 77 cm
So radius of wheel = 77/2 cm

We know that
Circumference of wheel = $2\pi r$
Substituting the values
= 2 × 22/7 × 77/2
= 242 cm

**9. The wheel of a cart is making 5 revolutions per second. If the diameter of the wheel is 84 cm, find its speed in km/hr. Give your answer correct to the nearest km.**
**Solution:**

It is given that
Diameter of wheel = 84 cm
Radius of wheel = 84/2 = 42 cm

Here
Circumference of wheel = $2\pi r$
Substituting the values
= 2 × 22/7 × 42
= 264 cm

So the distance covered in 5 reductions = 264 × 5 = 1320 cm
Time = 1 second

We know that
Speed of wheel = 1320/1 × (60 × 60)/ (100 × 1000)
= 47.25 km/hr
= 48 km/hr

**10. The circumference of a circle is 123.2 cm. Calculate:**
**(i) the radius of the circle in cm.**
**(ii) the area of the circle in $cm^2$, correct to the nearest $cm^2$.**
**(iii) the effect on the area of the circle if the radius is doubled.**
**Solution:**

It is given that
Circumference of a circle = 123.2 cm
Consider radius = r cm

(i) We know that
$2\pi r$ = 123.2
By further calculation
(2 × 22)/ 7 r = 1232/10
So we get
r = (1232 × 7)/ (10 × 2 × 22)
r = 19.6 cm

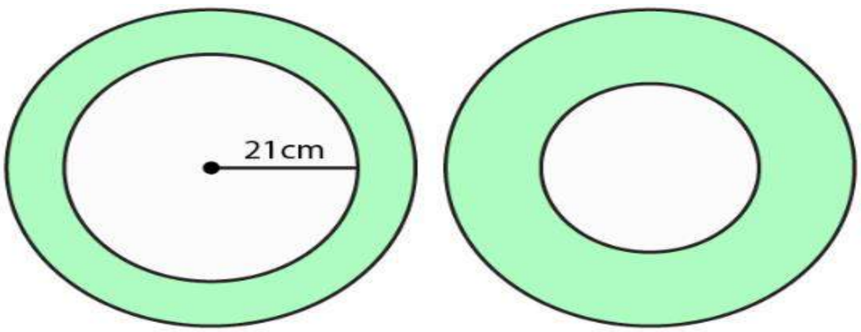
Therefore, radius of the circle is 19.6 cm

(ii) Here
Area of the circle = $\pi r^2$
Substituting the values
= 22/7 × 19.6 × 19.6
= 1207.36
= 1207 $cm^2$

(iii) We know that
If radius is doubled = 19.6 × 2 = 39.2 cm

So the area of circle = $\pi r^2$
Substituting the values
= 22/7 × 39.2 × 39.2
= 4829.44 $cm^2$
Effect on area = 4829.44/1207 = 4 times

**11. (a) In the figure (i) given below, the area enclosed between the concentric circles is 770 $cm^2$. Given that the radius of the outer circle is 21 cm, calculate the radius of the inner circle.**
**(b) In the figure (ii) given below, the area enclosed between the circumferences of two concentric circles is 346.5 $cm^2$. The circumference of the inner circle is 88 cm. Calculate the radius of the outer circle.**




(i) (ii)

**Solution:**

(a) It is given that
Radius of outer circle (R) = 21 cm
Consider r cm as the radius of inner circle

We know that
Area of the ring = $\pi (R^2 - r^2)$
Substituting the values
= 22/7 $(21^2 - r^2)$
= 22/7 $(441 - r^2)$
Area of the ring = 770 $cm^2$
So we get
22/7 $(441 - r^2)$ = 770
By further calculation
$441 - r^2$ = (770 × 7)/ 22 = 245
$r^2$ = 441 – 245 = 196
r = √196 = 14

Hence, the radius of inner circle is 14 cm.

(b) It is given that
Area of ring = 346.5 $cm^2$
Circumference of inner circle = 88 cm

We know that
Radius = (88 × 7)/ (2 × 22) = 14 cm
Consider R cm as the radius of outer circle
Area of ring = $\pi (R^2 – r^2)$
Substituting the values
= 22/7 $(R^2 – 14^2)$
= 22/7 $(R^2 – 196)$ $cm^2$

Area of ring = 346.5 $cm^2$
By equating we get
22/7 $(R^2 – 196)$ = 346.5
By further calculation
$R^2 – 196$ = (346.5 × 7)/ 22 = 110.25
$R^2$ = 110.25 + 196 = 306.25
So we get
R = √306.25 = 17.5

Hence, the radius of outer circle is 17.5 cm.

**12. A road 3.5 m wide surrounds a circular plot whose circumference is 44m. Find the cost of paving the road at Rs 50 per $m^2$.**
**Solution:**

It is given that
Circumference of circular plot = 44 m
Radius of circular plot = (44 × 7)/ (22 × 2) = 7 m
Width of the road = 3.5 m
So the radius of outer circle = 7 + 3.5 = 10.5 m

We know that
Area of road = $\pi (R^2 – r^2)$
Substituting the values
= 22/7 $(10.5^2 – 7^2)$
We can write it as
= 22/7 (10.5 + 7) (10 – 7)
= 22/7 × 17.5 × 3.5
= 192.5 $m^2$

Here
Rate of paving the road = Rs 50 per $m^2$
Total cost = 192.5 × 50 = Rs 9625

**13. The sum of diameters of two circles is 14 cm and the difference of their circumferences is 8 cm. Find the circumference of the two circles.**

**Solution:**

It is given that
Sum of the diameters of two circles = 14 cm
Consider R and r as the radii of two circles
$2R + 2r = 14$
Dividing by 2
$R + r = 7$ …… (1)

We know that
Difference of their circumferences = 8 cm
$2\pi R - 2\pi r = 8$
Taking out the common terms
$2\pi (R - r) = 8$
$(2 \times 22)/7 (R - r) = 8$
By further calculation
$R - r = (8 \times 7)/(2 \times 22) = 14/11$ ….. (2)

By adding both the equations
$2R = 7 + 14/11$
By taking LCM
$2R = (77 + 14)/11 = 91/11$
By further calculation
$R = 91/(11 \times 2) = 91/22$

From equation (1)
$R + r = 7$
Substituting the value of R
$91/22 + r = 7$
$r = 7 - 91/22$
Taking LCM
$r = (154 - 91)/22 = 63/22$

We know that
Circumference of first circle = $2\pi r$
Substituting the values
$= 2 \times 22/7 \times 91/22$
$= 26$ cm

Circumference of second circle = $2\pi R$
Substituting the values
$= 2 \times 22/7 \times 63/22$
$= 18$ cm

**14. Find the circumference of the circle whose area is equal to the sum of the areas of three circles with radius 2 cm, 3 cm and 6 cm.**
**Solution:**

It is given that
Radius of first circle = 2 cm

Area of first circle = $\pi r^2$
= $\pi (2)^2$
= $4 \pi$ $cm^2$

Radius of second circle = 3 cm
Area of first circle = $\pi r^2$
= $\pi (3)^2$
= $9 \pi$ $cm^2$

Radius of second circle = 6 cm
Area of first circle = $\pi r^2$
= $\pi (6)^2$
= $36 \pi$ $cm^2$

So the total area of the three circles = $4 \pi + 9 \pi + 36 \pi = 49 \pi$ $cm^2$
Area of the given circle = $49 \pi$ $cm^2$

We know that
Radius = $\sqrt{(49 \pi / \pi)} = \sqrt{49} = 7$ cm
Circumference = $2 \pi r = 2 \times 22/7 \times 7 = 44$ cm

**15. A copper wire when bent in the form of a square encloses an area of 121 $cm^2$. If the same wire is bent into the form of a circle, find the area of the circle.**
**Solution:**

It is given that
Area of square = 121 $cm^2$
So side = $\sqrt{121} = 11$ cm
Perimeter = $4a = 4 \times 11 = 44$ cm
Circumference of circle = 44 cm
Radius of circle = $(44 \times 7)/ (2 \times 22) = 7$ cm

We know that
Area of the circle = $\pi r^2$
Substituting the values
= $22/7 (7)^2$
So we get
= $22/7 \times 7 \times 7$
= 154 $cm^2$

**16. A copper wire when bent into an equilateral triangle has area 121 $\sqrt{3}$ $cm^2$. If the same wire is bent into the form of a circle, find the area enclosed by the wire.**
**Solution:**

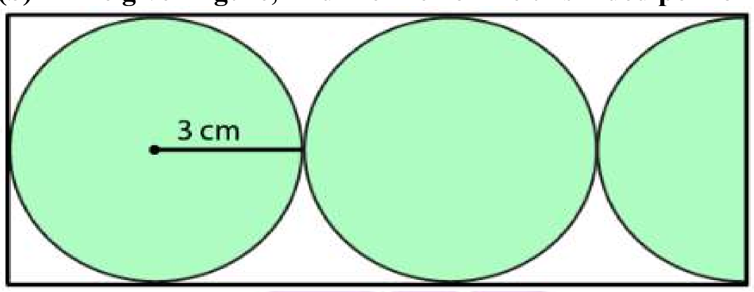
It is given that
Area of equilateral triangle = 121 $\sqrt{3}$ $cm^2$
Consider a as the side of triangle
Area = $\sqrt{3}/4\ a^2$
It can be written as
$\sqrt{3}/4\ a^2 = 121\sqrt{3}$

By further calculation
$a^2 = (121 \times \sqrt{3} \times 4)/ \sqrt{3}$
$a^2 = 484$
So we get
$a = \sqrt{484} = 22$ cm

Here
Length of the wire = 66 cm
Radius of the circle = $66/2\pi$
By further calculation
= $(66 \times 7)/ (2 \times 22)$
= 21/2 cm

We know that
Area of the circle = $\pi r^2$
By further calculation
= $22/7 \times (21/2)^2$
= $22/7 \times 21/2 \times 21/2$
So we get
= 693/2
= 346.5 $cm^2$

**17. (a) Find the circumference of the circle whose area is 16 times the area of the circle with diameter 7 cm.**
**(b) In the given figure, find the area of the unshaded portion within the rectangle. (Take π = 3.14)**




**Solution:**

(a) It is given that
Diameter of the circle = 7 cm
Radius of the circle = 7/2 cm

We know that
Area of the circle = $\pi r^2$
Substituting the values
= $22/7 \times 7/2 \times 7/2$
= 77/2 $cm^2$

Here
Area of bigger circle = $77/2 \times 16 = 616$ $cm^2$

Consider r as the radius
$\pi r^2 = 616$
We can write it as

$22/7\ r^2 = 616$
By further calculation
$r^2 = (616 \times 7)/ 22$
$r^2 = 196\ cm^2$
So we get
$r = \sqrt{196} = 14$ cm

Circumference = $2\pi r$
Substituting the values
$= 2 \times 22/7 \times 14$
= 88 cm

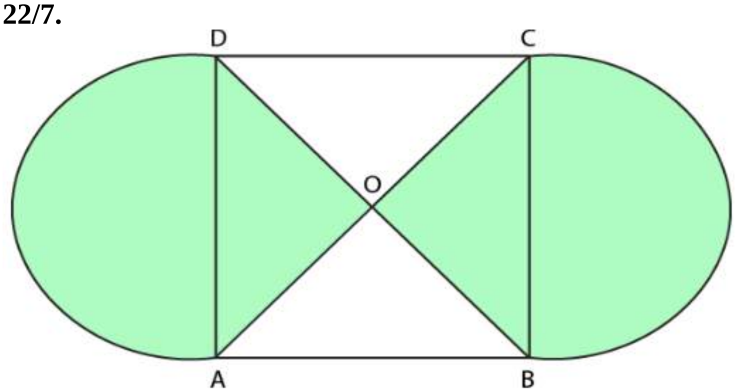
(b) It is given that
Radius of each circle = 3 cm
Diameter of each circle = $2 \times 3 = 6$ cm

Here
Length of rectangle (l) = 6 + 6 + 3 = 15 cm
Breadth of rectangle (b) = 6 cm
So the area of rectangle = $l \times b$
Substituting the values
$= 15 \times 6$
$= 90\ cm^2$

We know that
Area of 2 ½ circles = $5/2\ \pi r^2$
Substituting the values
$= 5/2 \times 3.14 \times 3 \times 3$
By further calculation
$= 5 \times 1.57 \times 9$
$= 70.65\ cm^2$

So the area of unshaded portion = 90 – 70.65
$= 19.35\ cm^2$

**18. In the adjoining figure, ABCD is a square of side 21 cm. AC and BD are two diagonals of the square. Two semi-circles are drawn with AD and BC as diameters. Find the area of the shaded region. Take $\pi$ = 22/7.**




**Solution:**

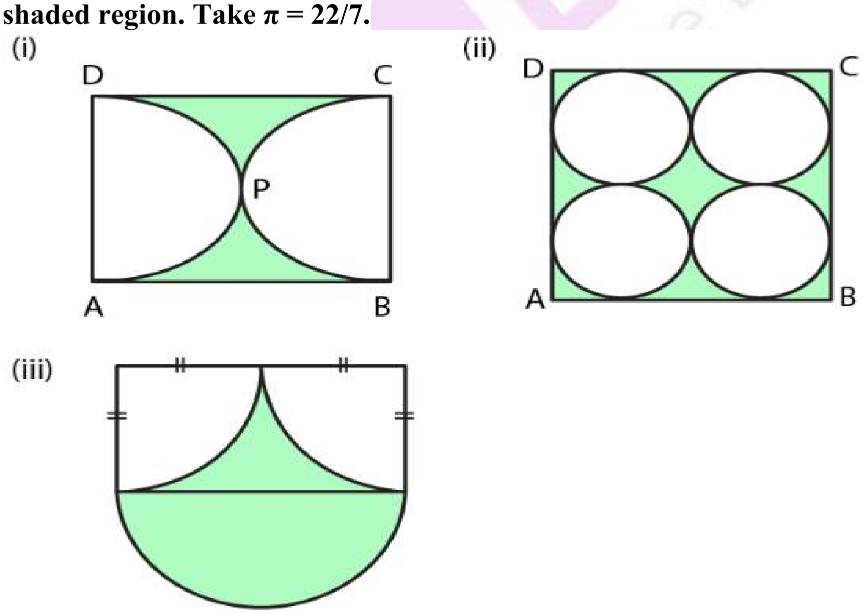
It is given that
Side of square = 21 cm
So the area of square = side$^2$ = $21^2$ = 441 cm$^2$

We know that
∠AOD + ∠COD + ∠AOB + ∠BOC = 441
Substituting the values
x + x + x + x = 441
4x = 441
So we get
x = 441/4 = 110.25 cm$^2$
Based on the question
We should find the area of shaded portion in square ABCD which is ∠AOD and ∠BOC
∠AOD + ∠BOC = 110.25 + 110.25 = 220.5 cm$^2$

Here
Area of two semicircle = $\pi r^2$
Substituting the values
= 22/7 × 10.5 × 10.5
= 346.50 cm$^2$

So the area of shaded portion = 220.5 + 346.5 = 567 cm$^2$

**19. (a) In the figure (i) given below, ABCD is a square of side 14 cm and APD and BPC are semicircles. Find the area and the perimeter of the shaded region.**
**(b) In the figure (ii) given below, ABCD is a square of side 14 cm. Find the area of the shaded region.**
**(c) In the figure (iii) given below, the diameter of the semicircle is equal to 14 cm. Calculate the area of the shaded region. Take π = 22/7.**




**Solution:**

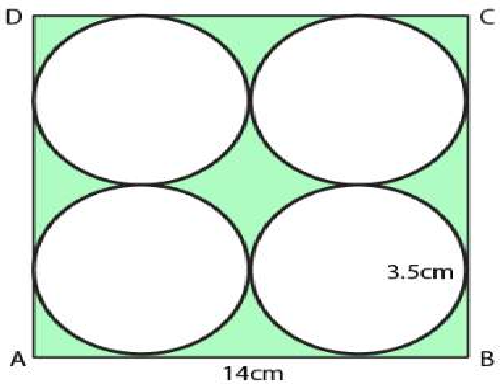
(a) It is given that
ABCD is a square of each side (a) = 14 cm
APD and BPC are semi-circle with diameter = 14 cm

Radius of each semi-circle (a) = 14/2 = 7 cm

(i) We know that
Area of square = $a^2 = 14^2 = 196\ cm^2$
Area of two semicircles = $2 \times \frac{1}{2} \pi r^2$
= $\pi r^2$
Substituting the values
= 22/7 × 7 × 7
= 154 $cm^2$
So the area of shaded portion = 196 – 154 = 42 $cm^2$

(ii) Here
Length of arcs of two semicircles = $2\pi r$
Substituting the values
= 2 × 22/7 × 7
= 44 cm
So the perimeter of shaded portion = 44 + 14 + 14 = 72 cm

(b) It is given that
ABCD is a square whose each side (a) = 14 cm
4 circles are drawn which touch each other and the sides of squares
Radius of each circle (r) = 7/2 = 3.5 cm

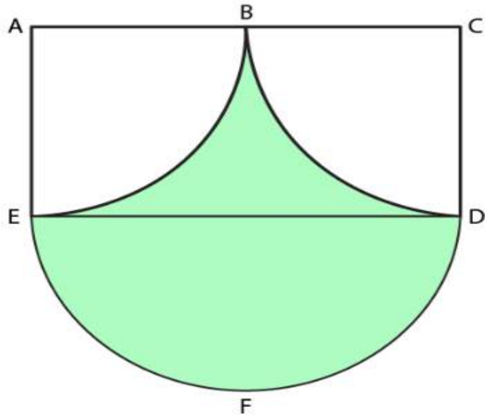



(i) We know that
Area of square ABCD = $a^2 = 14^2 = 196\ cm^2$
Area of 4 circles = $4 \times \pi r^2$
Substituting the values
= 4 × 22/7 × 7/2 × 7/2
= 154 $cm^2$
So the area of shaded portion = 196 – 154 = 42 $cm^2$

(ii) Here
Perimeter of 4 circles = $4 \times 2\pi r$
Substituting the values
= 4 × 2 × 22/7 × 7/2
= 88 cm
So the perimeter of shaded portion = perimeter of 4 circles + perimeter of square
Substituting the values
= 88 + 4 × 14
So we get

= 88 + 56
= 144 cm

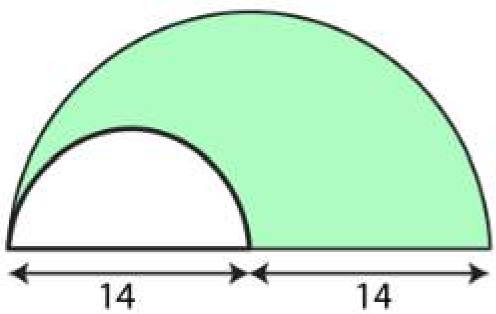
(c) We know that
Area of rectangle ACDE = ED × AE
Substituting the values
= 14 × 7
= 98 $cm^2$

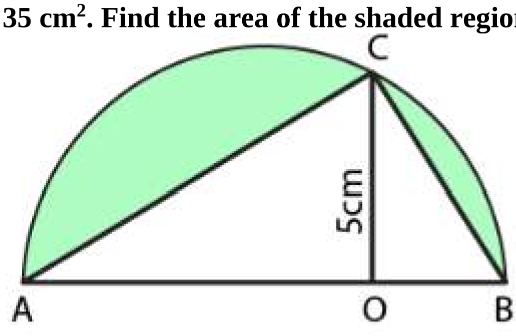



Here
Area of semicircle DEF = $\pi r^2/2$
Substituting the values
= (22 × 7 × 7)/ (7 × 2)
= 77 $cm^2$

So the area of shaded region = 77 + (98 – 2 × ¼ × 22/7 × 7 × 7)
= 77 + 21
= 98 $cm^2$

**20. (a) Find the area and the perimeter of the shaded region in figure (i) given below. The dimensions are in centimetres.**
**(b) In the figure (ii) given below, area of △ABC = 35 $cm^2$. Find the area of the shaded region.**




**Solution:**

(a) It is given that
There are 2 semicircles where the smaller is inside the larger
Radius of larger semicircles (R) = 14 cm
Radius of smaller circle (r) = 14/2 = 7 cm

(i) We know that
Area of shaded portion = Area of larger semicircle – Area of smaller circle
$= \frac{1}{2} \pi R^2 - \frac{1}{2} \pi r^2$
We can write it as
$= \frac{1}{2} \pi (R^2 - r^2)$
Substituting the values
$= \frac{1}{2} \times 22/7 (14^2 - 7^2)$
By further calculation
= 11/7 (14 + 7) (14 – 7)
So we get
= 11/7 × 21 × 7
$= 231 \text{ cm}^2$

(ii) Here
Perimeter of shaded portion = circumference of larger semicircle + circumference of smaller semicircle + radius of larger semicircle
$= \pi R + \pi r + R$
Substituting the values
= 22/7 × 14 + 22/7 × 7 + 14
By further calculation
= 44 + 22 + 14
= 80 cm

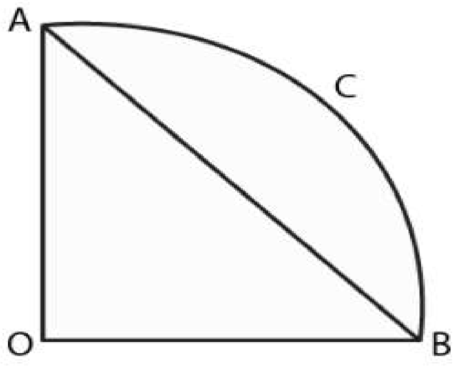
(b) We know that
Area of △ABC formed in a semicircle = 3.5 cm
Altitude CD = 5 cm
So the base AB = (area × 2)/ altitude
Substituting the values
= (35 × 2)/ 5
= 14 cm

Here
Diameter of semicircle = 14 cm
Radius of semicircle (R) = 14/2 = 7 cm

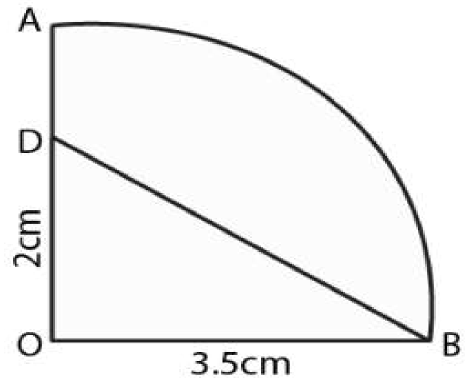
So the area of semicircle $= \frac{1}{2} \pi R^2$
Substituting the values
= ½ × 22/7 × 7 × 7
$= 77 \text{ cm}^2$

Area of shaded portion = Area of semicircle – Area of triangle
= 77 – 35
$= 42 \text{ cm}^2$

**21. (a) In the figure (i) given below, AOBC is a quadrant of a circle of radius 10m. Calculate the area of the shaded portion. Take π = 3.14 and give your answer correct to two significant figures.**
**(b) In the figure (ii) given below, OAB is a quadrant of a circle. The radius OA = 3.5 cm and OD = 2 cm. Calculate the area of the shaded portion.**




(i)




(ii)

**Solution:**

(a) In the figure
Shaded portion = Quadrant - △AOB
Radius of the quadrant = 10 m

Here
Area of quadrant = ¼ $\pi r^2$
Substituting the values
= ¼ × 3.14 × 10 × 10
By further calculation
= (3.14 × 100)/ 4
= 314/4
= 78.5 $m^2$

We know that
Area of △AOB = ½ × AO × OB
Substituting the values
= ½ × 10 × 10
= 50 $m^2$

So the area of shaded portion = 78.5 – 50 = 28.5 $m^2$

(b) In the figure
Radius of quadrant = 3.5 cm

(i) We know that
Area of quadrant = ¼ $\pi r^2$
Substituting the values
= ¼ × 22/7 × 3.5 × 3.5
= 9.625 $cm^2$

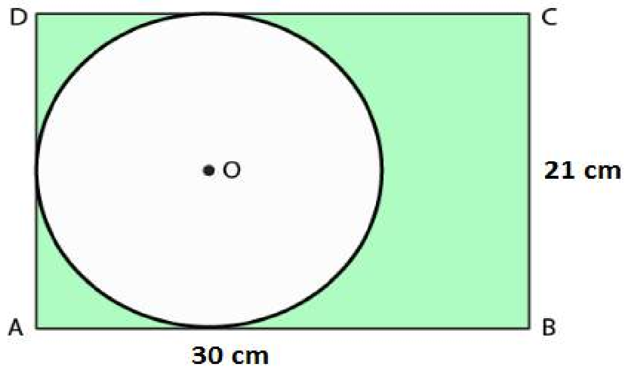
(ii) Here
Area of △AOD = ½ × AO × OD
Substituting the values
= ½ × 3.5 × 2
= 3.5 $cm^2$

So the area of shaded portion = Area of quadrant – Area of △AOD
Substituting the values
= 9.625 – 3.6
= 6.125 $cm^2$

**22. A student takes a rectangular piece of paper 30 cm long and 21 cm wide. Find the area of the biggest circle that can be cut out from the paper. Also find the area of the paper left after cutting out the circle. (Take π = 22/7)**
**Solution:**

It is given that
Length of rectangle = 30 cm
Width of rectangle = 21 cm

We know that
Area of rectangle = l × b
= 30 × 21
= 630 $cm^2$
So the radius of the biggest circle = 21/2 cm

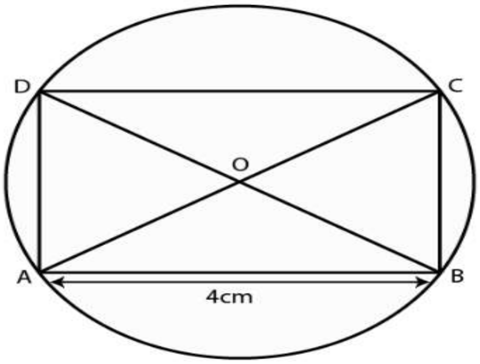



Here
Area of the circle = $\pi r^2$
Substituting the values
= 22/7 × 21/2 × 21/2
So we get
= 693/2
= 346.5 $cm^2$

So the area of remaining part = 630 – 346.5 = 283.5 $cm^2$

**23. A rectangle with one side 4 cm is inscribed in a circle of radius 2.5 cm. Find the area of the rectangle.**
**Solution:**

Consider ABCD as a rectangle
AB = 4 cm
Diameter of circle AC = 2.5 × 2 = 5 cm




Here

$BC = \sqrt{AC^2 - AB^2}$

$Substituting\ the\ values$

$= \sqrt{5^2 - 4^2}$

$= \sqrt{25 - 16}$

$= \sqrt{9}$

So we get

= 3 cm

We know that

Area of rectangle = AB × BC

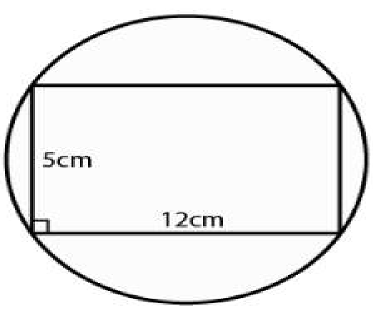
Substituting the values

= 4 × 3

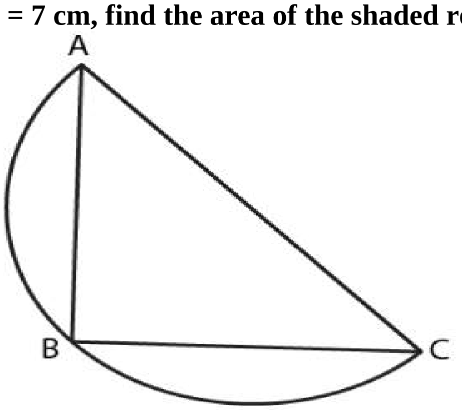
= 12 $cm^2$

**24. (a) In the figure (i) given below, calculate the area of the shaded region correct to two decimal places. (Take π = 3.142)**

**(b) In the figure (ii) given below, ABC is an isosceles right angled triangle with ∠ABC = $90^0$. A semicircle is drawn with AC as diameter. If AB = BC = 7 cm, find the area of the shaded region. Take π = 22/7.**




(i)




(ii)

**Solution:**

(a) We know that
ABCD is a rectangle which is inscribed in a circle of length = 12 cm
Width = 5 cm

$$AC = \sqrt{AB^2 - BC^2}$$

*Substituting the values*

$$= \sqrt{12^2 - 5^2}$$

$$= \sqrt{144 - 25}$$

$$= \sqrt{169}$$

= 13 cm

Diameter of circle = AC = 13 cm
Radius of circle = 13/2 = 6.5 cm

Here
Area of circle = $\pi r^2$
Substituting the values
= $3.142 \times (6.5)^2$
By further calculation
= 3.142 × 42.25
= 132.75 $cm^2$

Area of rectangle = l × b
Substituting the values
= 12 × 5
= 60 $cm^2$

So the area of the shaded portion = 132.75 – 60 = 72.75 $cm^2$

(b) We know that
Area of △ABC = ½ × AB × BC
Substituting the values
= ½ × 7 × 7
= 49/2 $cm^2$

Here
$AC^2 = AB^2 + BC^2$
Substituting
= 49 + 49
So we get
AC = 7√2
Radius of semi-circle = 7√2/ 2 cm

Area of semi-circle = $\pi/2 \times (7\sqrt{2}/ 2)^2$

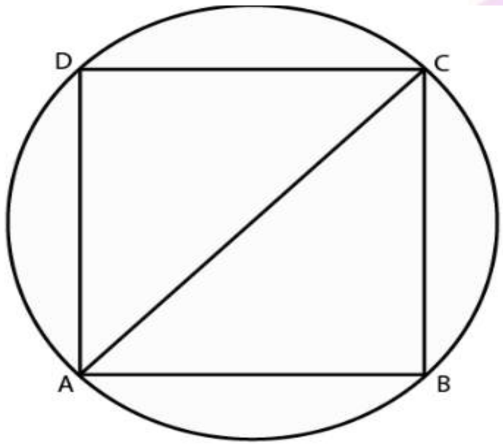
By further calculation
= ½ × 22/7 × 98/4
= 77/2 $cm^2$

Area of the shaded region = Area of the semi-circle – Area of △ABC
Substituting the values
= 77/2 – 49/2
= 28/2
= 14 $cm^2$

**25. A circular field has perimeter 660 m. A plot in the shape of a square having its vertices on the circumference is marked in the field. Calculate the area of the square field.**
**Solution:**

It is given that
Perimeter of circular field = 660 m
Radius of the field = 660/2 π
Substituting the values
= (660 × 7)/ (2 × 22)
= 105 m

Here
ABCD is a square which is inscribed in the circle where AC is the diagonal which is the diameter of the circular field

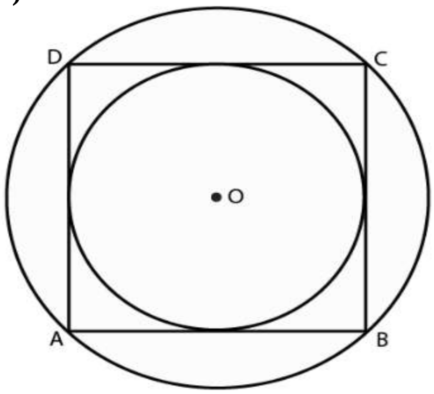



Consider a as the side of the square
AC = √2 a
a = AC/√2
Substituting the values
a = (105 × 2)/ √2
Multiply and divide by √2
a = (105 × 2 × √2)/ (√2 × √2)
By further calculation
a = (105 × 2 × √2)/ 2
a = 105 √2 m

We know that
Area of the square = $a^2$

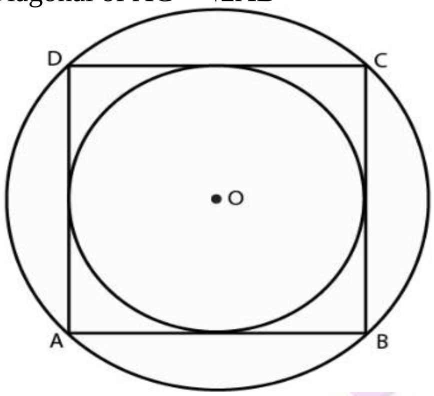
It can be written as
= $(105\sqrt{2})^2$
= $105\sqrt{2} \times 105\sqrt{2}$
= 22050 $m^2$

**26. In the adjoining figure, ABCD is a square. Find the ratio between**
**(i) the circumferences**
**(ii) the areas of the incircle and the circumcircle of the square.**




**Solution:**

Consider side of the square = 2a
Area = $(2a)^2 = 4a^2$
Diagonal of AC = √2AB

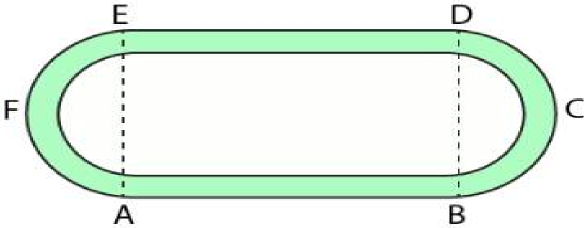



(i) We know that
Radius of the circumcircle = ½ AC
It can be written as
= ½ (√2 × AB)
Substituting the values
= √2/2 × 2a
= √2a
Circumference = 2 πr = 2 × π × √2a = 2√2 πa
Radius of incircle = AB = ½ × 2a = a
Circumference = 2 πr = 2 πa

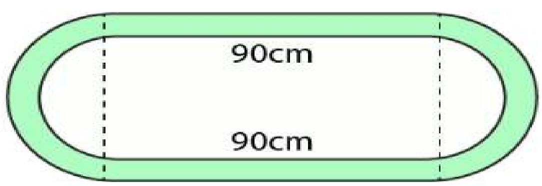
Here
Ratio between the circumference incircle and circumcircle = 2 πa: 2√2 πa
= 1: √2

(ii) We know that
Area of incircle = $\pi r^2 = \pi a^2$
Area of circumcircle = $\pi R^2$
$= \pi (\sqrt{2}a)^2$
$= \pi 2a^2$
$= 2 \pi a^2$
So the ratio = $\pi a^2 : 2 \pi a^2 = 1 : 2$

**27. (a) The figure (i) given below shows a running track surrounding a grassed enclosure PQRSTU. The enclosure consists of a rectangle PQST with a semicircular region at each end.**
**PQ = 200 m, PT = 70 m**



(i)



(ii)

**(i) Calculate the area of the grassed enclosure in m$^2$.**
**(ii) Given that the track is of constant width 7 m, calculate the outer perimeter ABCDEF of the track.**
**(b) In the figure (ii) given below, the inside perimeter of a practice running track with semi-circular ends and straight parallel sides is 312 m. The length of the straight portion of the track is 90 m. If the track has a uniform width of 2m throughout, find its area.**
**Solution:**

(a) It is given that
Length of PQ = 200 m
Width PT = 70 m

(i) We know that
Area of rectangle PQST = $l \times b$
$= 200 \times 70$
$= 14000$ m$^2$

Radius of each semi-circular part on either side of rectangle = 70/2 = 35 m
Area of both semi-circular parts = $2 \times \frac{1}{2} \pi r^2$
Substituting the values
= $22/7 \times 35 \times 35$
= 3850 m$^2$

So the total area of grassed enclosure = 1400 + 3850 = 17850 m$^2$

(ii) We know that
Width of track around the enclosure = 7 m
Outer length = 200 m
So the width = 70 + 7 × 2
= 70 + 14
= 84 m
Outer radius = 84/2 = 42 m

Here
Circumference of both semi-circular part = $2\pi r$
Substituting the values
= 2 × 22/7 × 42
= 264 m
Outer perimeter = 264 + 200 × 2
= 264 + 400
= 664 m

(b) It is given that
Inside perimeter = 312 m
Total length of the parallel sides = 90 + 90 = 180 m
Circumference of two semi-circles = 312 – 180 = 132 m

Here
Radius of each semi-circle = $132/2\pi$
So we get
= 66/3.14
= 21.02 m

Diameter of each semi-circle = $66/\pi \times 2$
So we get
= $132/\pi$
= 132/3.14
Multiply and divide by 100
= (132 × 100)/ 314
= 42.04 m

Width of track = 2 m
Outer diameter = 42.04 + 4 = 46.04 m
Radius = 46.04/2 = 23.02 m

We know that
Area of two semi-circles = $2 \times \frac{1}{2} \times \pi R^2$
= $\pi R^2$
Substituting the values
= $3.14 \times (23.02)^2$
= 3.14 × 23.02 × 23.02
= $1663.95 \text{ m}^2$

Area of rectangle = 90 × 46.04
= $4143.6 \text{ m}^2$

Total area = 1663.95 + 4143.60 = 5807.55 $m^2$

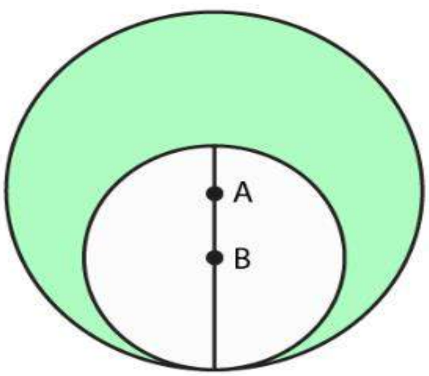
Area of two inner circles = 2 × ½ $\pi r^2$
Substituting the values
= 3.14 × 21.02 × 21.02
= 1387.38 $m^2$

Area of inner rectangle = 90 × 42.04
= 3783.6 $m^2$

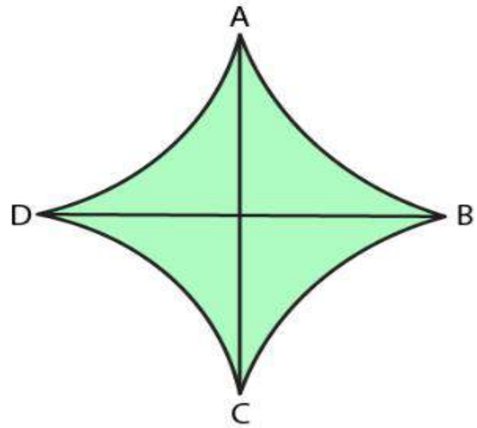
Total inner area = 3783.60 + 1387.38
= 5170.98 $m^2$

Here
Area of path = 5807.55 – 5170.98
= 636.57 $m^2$

**28. (a) In the figure (i) given below, two circles with centres A and B touch each other at the point C. If AC = 8 cm and AB = 3 cm, find the area of the shaded region.**
**(b) The quadrants shown in the figure (ii) given below are each of radius 7 cm. Calculate the area of the shaded portion.**



(i)



(ii)

**Solution:**

(a) It is given that
AC = 8 cm
BC = AC – AB = 8 – 3 = 5 cm

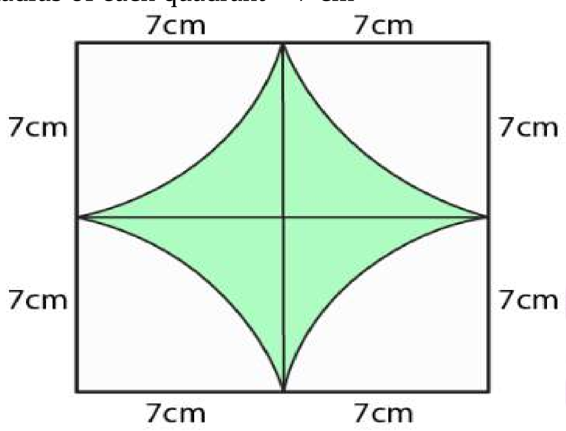
We know that
Area of big circle of radius AC = $\pi R^2$
Substituting the values
= 22/7 × 8 × 8
By further calculation
= 64 × 22/7 $cm^2$

Area of smaller circle = $\pi r^2$
Substituting the values

= 22/7 × 5 × 5
By further calculation
= (25 × 22)/ 7 $cm^2$

Here
Area of shaded portion = (64 × 22)/ 7 – (25 × 22)/ 7
Taking out the common terms
= 22/7 (64 – 25)
By further calculation
= 22/7 × 39
= 122.57 $cm^2$

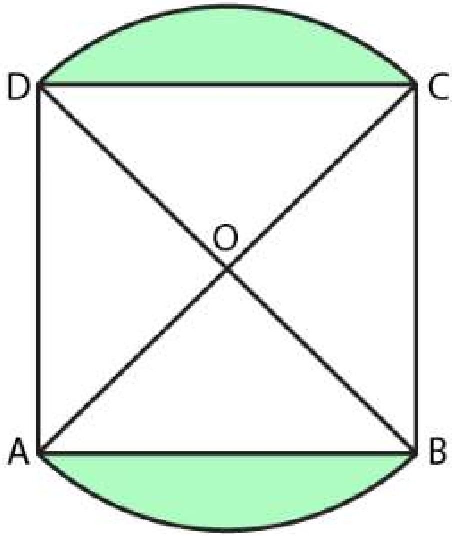
(b) We know that
Radius of each quadrant = 7 cm



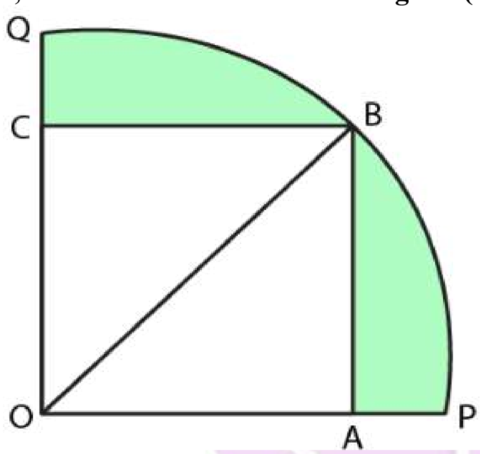
(ii)

Here
Area of shaded region = Area of square – 4 area of the quadrant
It can be written as
= $(side)^2 – 4 × ¼ \pi r^2$
Substituting the values
= $14^2$ – 22/7 × 7 × 7
By further calculation
= 196 – 154
= 42 $cm^2$

**29. (a) In the figure (i) given below, two circular flower beds have been shown on the two sides of a square lawn ABCD of side 56 m. If the centre of each circular flower bed is the point of intersection O of the diagonals of the square lawn, find the sum of the areas of the lawn and the flower beds.**



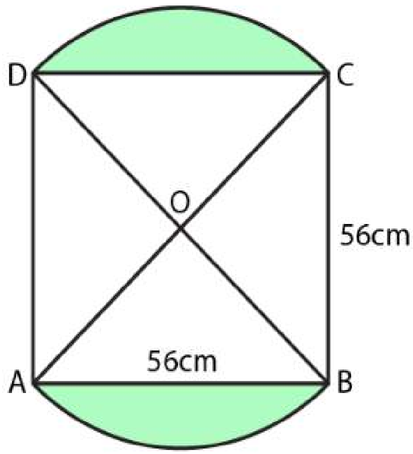

**(b) In the figure (ii) given below, a square OABC is inscribed in a quadrant OPBQ of a circle. If OA = 20 cm, find the area of the shaded region. ($\pi$ = 3.14)**




**Solution:**

(a) It is given that
Side of square lawn ABCD (a) = 56 cm
Area = $a^2 = 5^2 = 3136\ cm^2$

We know that
Length of the diagonal of the square = $\sqrt{2}$ a
= $\sqrt{2} \times 56$ cm
Radius of each quadrant = $(\sqrt{2} \times 56)/ 2$
= $28\sqrt{2}$ cm

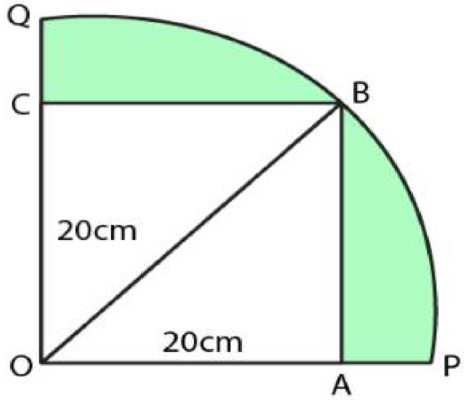



So the area of each segment = ¼ $\pi r^2$ – area of △OBC
Substituting the values
= ¼ × 22/7 × 28√2 × 28√2 – ½ × 28√2 × 28√2
Taking out the common terms
= 28√2 × 28√2 (1/4 × 22/7 – 1/2)
By further calculation
= 784 × 2 (11/14 – ½)
So we get
= 784 × 2 × 4/14
= 448 $cm^2$

Here
Area of two segments = 448 × 2 = 896 $cm^2$
So the total area of the lawn and beds = 3136 + 896 = 4032 $cm^2$

(b) In the figure
OPBQ is a quadrant and OABC is a square which is inscribed in a side of square = 20 cm
OB is joined

Here
OB = √2 a = √2 ×20 cm
Radius of quadrant = OB = 20√2cm

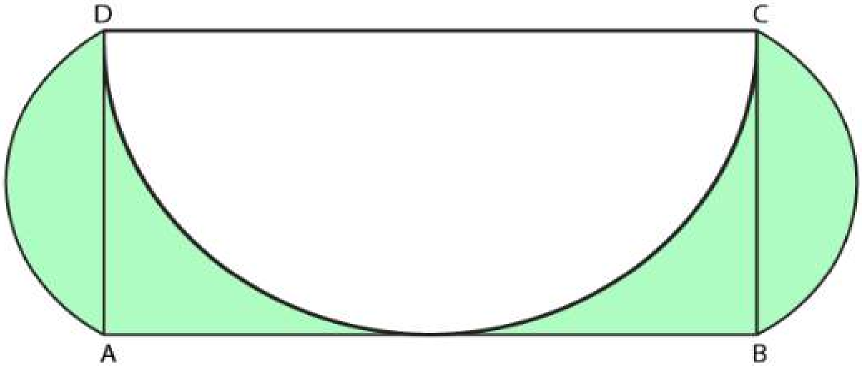



We know that
Area of quadrant = ¼ $\pi r^2$
Substituting the values

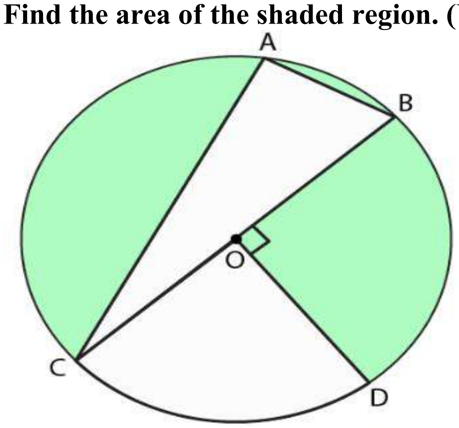
$= ¼ \times 3.14 \times (20\sqrt{2})^2$
By further calculation
$= ¼ \times 3.14 \times 800$
So we get
$= 314 \times 2$
$= 628\ cm^2$

Area of square $= a^2 = 20^2 = 400\ cm^2$
So the area of shaded portion $= 628 – 400 = 228\ cm^2$

**30. (a) In the figure (i) given below, ABCD is a rectangle, AB = 14 cm and BC = 7 cm. Taking DC, BC and AD as diameters, three semicircles are drawn as shown in the figure. Find the area if the shaded portion.**

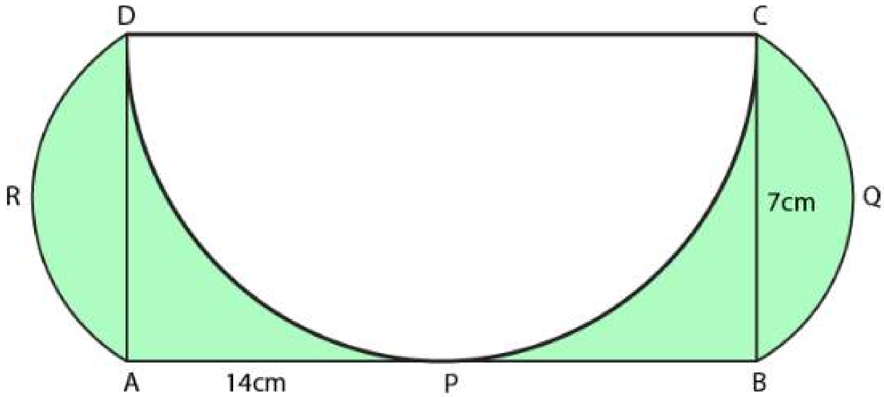



**(b) In the figure (ii) given below, O is the centre of a circle with AC = 24 cm, AB = 7 cm and ∠BOD = $90^0$. Find the area of the shaded region. (Use π = 3.14)**




**Solution:**

(a) It is given that
ABCD is a rectangle
Three semicircles are drawn with AB = 14 cm and BC = 7 cm



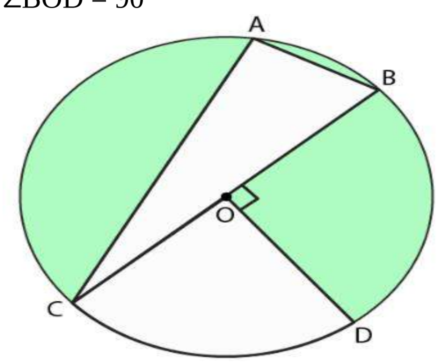

We know that
Area of rectangle ABCD = l × b
Substituting the values
= 14 × 7
= 98 $cm^2$

Radius of each outer semicircles = 7/2 cm
So the area = 2 × ½ $\pi r^2$
Substituting the values
= 22/7 × 7/2 × 7/2
= 77/2
= 38.5 $cm^2$

Here
Area of semicircle drawn on CD as diameter = ½ $\pi R^2$
Substituting the values
= ½ × 22/7 × $7^2$
By further calculation
= 11/7 × 7 × 7
= 77 $cm^2$

So the area of shaded region = 98 + 38.5 – 77
= 59.5 $cm^2$

(b) In the figure
AC = 24 cm
AB = 7 cm
∠BOD = $90^0$



In △ABC
Using Pythagoras theorem
$BC^2 = AC^2 + AB^2$
Substituting the values
$BC^2 = 24^2 + 7^2$
By further calculation
$BC = \sqrt{(576 + 49)} = \sqrt{625} = 25$ cm
So the radius of circle = 25/2 cm

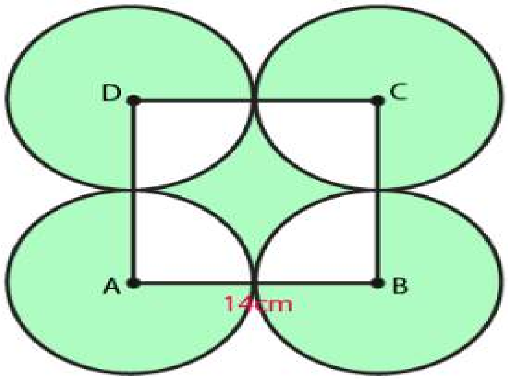
We know that
Area of △ABC = ½ × AB × AC
Substituting the values
= ½ × 7 × 24
= 84 $cm^2$

Area of quadrant COD = ¼ $\pi r^2$
Substituting the values
= ¼ × 3.14 × 25/2 × 25/2
By further calculation
= 1962.5/16
= 122.66 $cm^2$

Area of circle = $\pi r^2$
Substituting the values
= 3.14 × 25/2 × 25/2
By further calculation
= 1962.5/4
= 490.63 $cm^2$

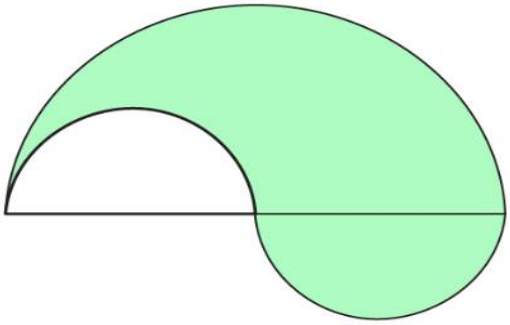
Area of shaded portion = Area of circle – (Area of △ABC + Area of quadrilateral COD)
Substituting the values
= 490.63 – (84 + 122.66)
By further calculation
= 490.63 – 206.66
= 283.97 $cm^2$

**31. (a) In the figure given below ABCD is a square of side 14 cm. A, B, C and D are centres of the equal circle which touch externally in pairs. Find the area of the shaded region.**




**(b) In the figure (ii) given below, the boundary of the shaded region in the given diagram consists of three**

**semicircular arcs, the smaller being equal. If the diameter of the larger one is 10 cm, calculate.**
**(i) the length of the boundary.**
**(ii) the area of the shaded region. (Take π to be 3.14)**



**Solution:**

(a) It is given that
Side of square ABCD = 14 cm
Radius of each circle drawn from A, B, C and D and touching externally in pairs = 14/2 = 7 cm

We know that
Area of square = $a^2$
Substituting the values
= 14 × 14
= 196 $cm^2$

Area of 4 sectors of $90^0$ each = 4 × π × $r^2$
Substituting the values
= 4 × 22/7 × 7 × 7 × ¼
= 154 cm

Area of each sector of $270^0$ angle = 3/4 $\pi r^2$
Substituting the values
= ¾ × 22/7 × 7 × 7
= 231/2
= 115.5 $cm^2$

Here
Area of 4 sectors = 115.5 × 4 = 462 $cm^2$
So the area of shaded portion = area of square + area of 4 bigger sector – area of 4 smaller sector
Substituting the values
= 196 + 462 – 154
= 658 – 154
= 504 $cm^2$

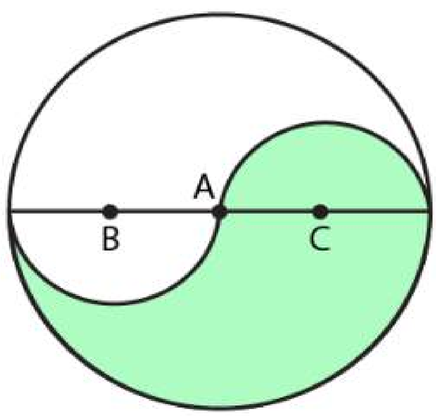
(b) We know that
Radius of big semi-circle = 10/2 = 5 cm
Radius of each smaller circle = 5/2 cm

(i) Length of boundary = circumference of bigger semi-circle + 2 circumference of smaller semi-circles
It can be written as

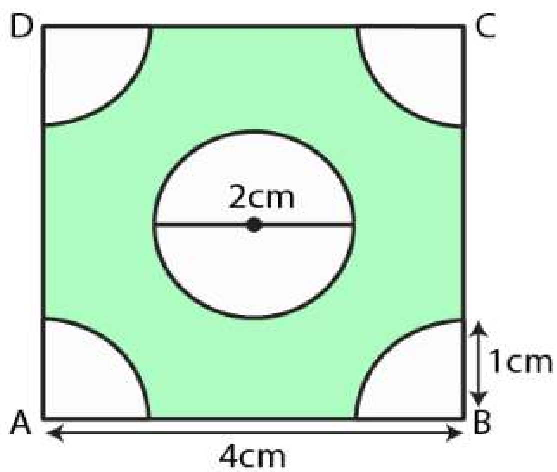
= πR + πr + πr
= 3.14 (R + 2r)
Substituting the values
= 3.14 (5 + 2 × 5/2)
By further calculation
= 3.14 × 10
= 31.4 cm

(ii) Here
Area of shaded region = area of bigger semi-circle + area of one smaller semi-circle – area of other smaller semi-circle
We know that
Area of bigger semi-circle = ½ $\pi R^2$
Substituting the values
= 3.14/2 × 5 × 5
= 1.57 × 25
= 39.25 cm

**32. (a) In the figure (i) given below, the points A, B and C are centres of arcs of circles of radii 5 cm, 3 cm and 2 cm respectively. Find the perimeter and the area of the shaded region. (Take π = 3.14)**
**(b) In the figure (ii) given below, ABCD is a square of side 4 cm. At each corner of the square a quarter circle of radius 1 cm, and at the centre a circle of diameter 2 cm are drawn. Find the perimeter and the area of the shaded region. Take π = 3.14**



(i)



(ii)

**Solution:**

(a) It is given that
Radius of bigger circle = 5 cm
Radius of small circle ($r_1$) = 3 cm
Radius of smaller circle ($r_2$) = 2 cm

(i) We know that
Perimeter of shaded region = circumference of bigger semi-circle + circumference of small semi-circle + circumference of smaller semi-circle
It can be written as

$= \pi R + \pi r_1 + \pi r_2$
$= \pi (R + r_1 + r_2)$
Substituting the values
$= \pi (5 + 3 + 2)$
$= 3.14 \times 10$
$= 31.4 \text{ cm}^2$

(ii) We know that
Area of shaded region = area of bigger semi-circle + area of smaller semi-circle – area of small semicircle
It can be written as
$= ½ \pi R^2 + ½ \pi r_2^2 – ½ \pi r_1^2$
$= ½ \pi (R^2 + r_2^2 – r_1^2)$
Substituting the values
$= ½ \pi (5^2 + 2^2 – 3^2)$
By further calculation
$= ½ \pi (25 + 4 – 9)$
$= ½ \pi \times 20$
So we get
$= 10 \times 3.14$
$= 31.4 \text{ cm}^2$

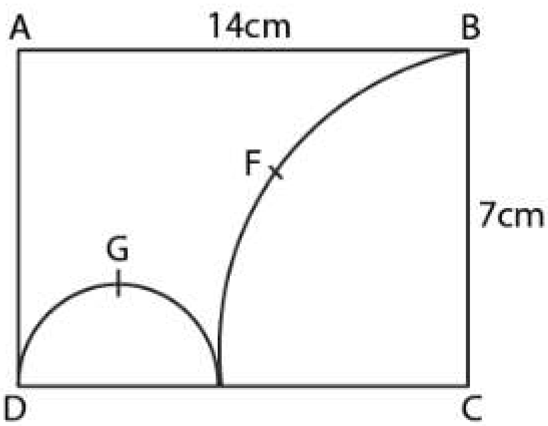
(b) We know that
Side of square ABCD = 4 cm
Radius of each quadrant circle = 1 cm
Radius of circle in the square = 2/2 = 1 cm

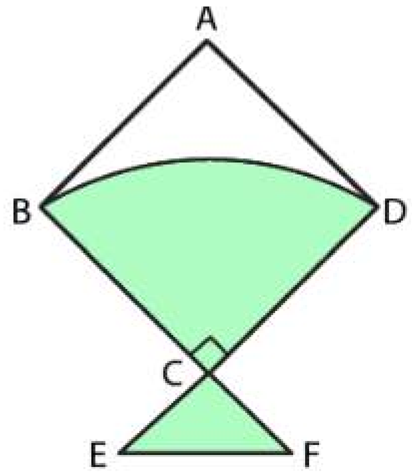
(i) Here
Perimeter of shaded region = circumference of 4 quadrants + circumference of circle + 4 × ½ side of square
It can be written as
$= 4 \times ¼ (2 \pi r) + 2 \pi r + 4 \times 2$
By further calculation
$= 2 \pi r + 2 \pi r + 8$
$= 4 \pi r + 8$
So we get
$= 4 \times 3.14 \times 1 + 8$
$= 12.56 + 8$
$= 20.56$ cm
(ii) Area of shaded region = area of square – area of 4 quadrants – area of circle
It can be written as
$= \text{side}^2 – 4 \times ¼ \pi r^2 – \pi r^2$
$= 4^2 – \pi r^2 - \pi r^2$
By further calculation
$= 16 - 2\pi r^2$
So we get
$= 16 – 2 \times 3.14 \times 1^2$
$= 16 – 6.28$
$= 9.72 \text{ cm}^2$

**33. (a) In the figure given below, ABCD is a rectangle. AB = 14 cm, BC = 7 cm. From the rectangle, a quarter circle BFEC and a semicircle DGE are removed. Calculate the area of the remaining piece of the**

**rectangle. (Take π = 22/7)**

**(b) The figure (ii) given below shows a kite, in which BCD is in the shape of a quadrant of circle of radius 42 cm. ABCD is a square and △CEF is an isosceles right angled triangle whose equal sides are 6 cm long. Find the area of the shaded region.**




**Solution:**

(a) Here

Area of remaining piece = area of rectangle ABCD – area of semicircle DGE – area of quarter BFEC

Substituting the values

$= 14 \times 7 - \frac{1}{2} \times \pi (7/2)^2 - \frac{1}{4} \pi \times 7^2$

By further calculation

$= 14 \times 7 - \frac{1}{2} \times 22/7 \times 7/2 \times 7/2 - \frac{1}{4} \times 22/7 \times 7 \times 7$

So we get

$= 98 - 77/4 - 154/4$

$= 98 - 19.25 - 38.5$

$= 98 - 57.75$

$= 40.25 \text{ cm}^2$

(b) In the given figure

ABCD is a square of side = radius of quadrant = 42 cm

△CEF is an isosceles right triangle with each side = 6 cm

Area of shaded portion = area of quadrant + area of isosceles right triangle

It can be written as

$= \frac{1}{4} \pi r^2 + \frac{1}{2} EC \times FC$

Substituting the values

$= \frac{1}{4} \times 22/7 \times 42 \times 42 + \frac{1}{2} \times 6 \times 6$

By further calculation

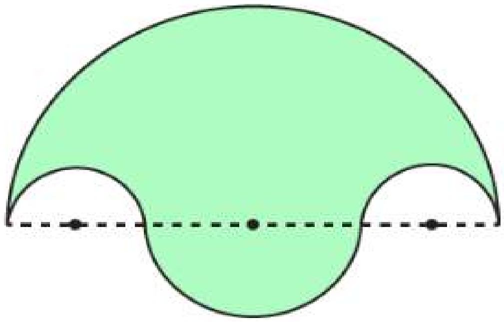
$= 1386 + 18$

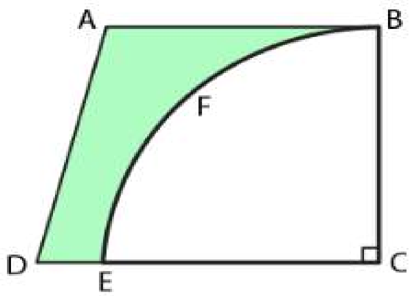
$= 1404 \text{ cm}^2$

**34. (a) In the figure (i) given below, the boundary of the shaded region in the given diagram consists of four semicircular arcs, the smallest two being equal. If the diameter of the largest is 14 cm and of the smallest is 3.5 cm, calculate**

**(i) the length of the boundary.**

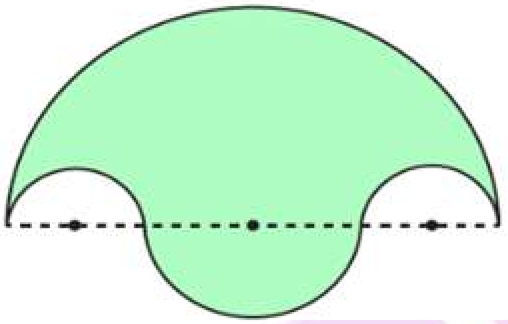
**(ii) the area of the shaded region.**






**(b) In the figure (ii) given below, a piece of cardboard, in the shape of a trapezium ABCD, AB || CD and ∠BOD = 90$^0$, quarter circle BFEC is removed. Given AB = BC = 3.5 cm and DE = 2 cm. Calculate the area of the remaining piece of the cardboard.**
**Solution:**

(a) (i) We know that
Length of boundary = Circumference of bigger semi-circle + Circumference of small semi-circle + 2 × circumference of the smaller semi-circles

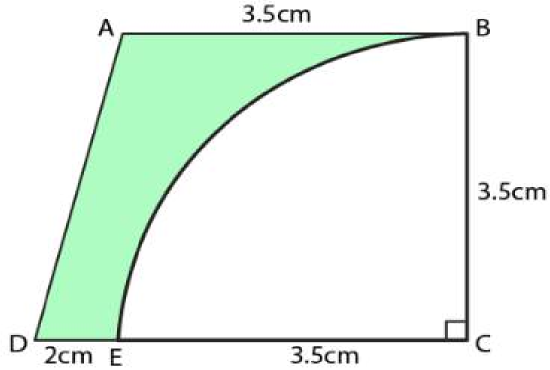


It can be written as
$= \pi R + \pi r_1 + 2 \times \pi r_2$
$= \pi (R + r_1) + 2\pi r_2$
Substituting the values
= 22/7 (7 + 3.5) + 2 × 22/7 × 3.5/2
By further calculation
= 22/7 × 10.5 + 11
So we get
= 33 + 11
= 44 cm

(ii) We know that
Area of shaded region = Area of bigger semicircle + area of small semicircle – 2 × area of smaller semicircles
It can be written as
$= ½ \pi (7)^2 + ½ \pi (3.5)^2 – 2 \times ½ \pi (1.75)^2$
By further calculation
= ½ × 22/7 × 7 × 7 + ½ × 22/7 × 3.5 × 3.5 – 22/7 × 1.75 × 1.75
So we get
= 77 + 19.25 – 9.625
= 86.625 cm$^2$

(b) Here

ABCD is a trapezium in which AB || DC and ∠C = $90^0$



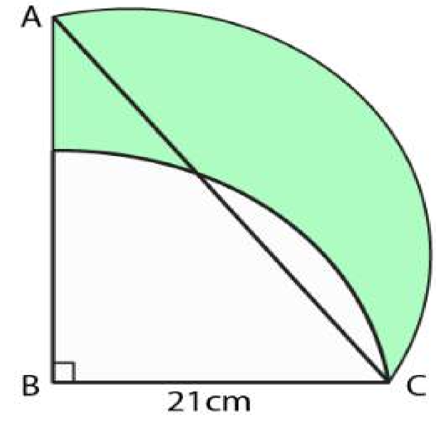

AB = BC = 3.5 cm and DE = 2 cm
Radius of quadrant = 3.5 cm

We know that
Area of trapezium = ½ (AB + DC) × BC
Substituting the values
= ½ (3.5 + 3.5 + 2) × 3.5
By further calculation
= ½ (9 × 3.5)
= 4.5 × 3.5
= 15.75 $cm^2$

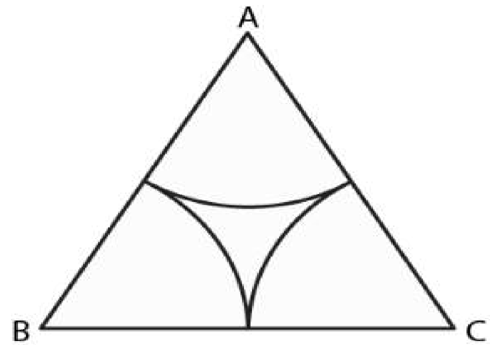
So the area of quadrant = ¼ $\pi r^2$
Substituting the values
= ¼ × 22/7 × 3.5 × 3.5
= 9.625 $cm^2$

Area of shaded portions = 15.75 – 9.625 = 6.125 $cm^2$

**35. (a) In the figure (i) given below, ABC is a right angled triangle, ∠B = $90^0$, AB = 28 cm and BC = 21 cm. With AC as diameter a semi-circle is drawn and with BC as radius a quarter circle is drawn. Find the area of the shaded region correct to two decimal places.**
**(b) In the figure (ii) given below, ABC is an equilateral triangle of side 8 c. A, B and C are the centers of circular arcs of equal radius. Find the area of the shaded region correct upto 2 decimal places. (Take π = 3.142 and √3 = 1.732)**




(i)




(ii)

**Solution:**

(a) In right △ABC
∠B = $90^0$
Using Pythagoras theorem
$AC^2 = AB^2 + BC^2$
Substituting the values
$= 28^2 + 21^2$
= 784 + 441
= 1225
So we get
AC = √1225 = 35 cm

Here
Radius of semi-circle (R) = 35/2
Radius of quadrant (r) = 21 cm

So the area of shaded region = area of △ABC + area of semi-circle – area of quadrant
$= ½ × 28 × 21 + ½\ πR^2 – ¼\ r^2$
Substituting the values
= 294 + ½ × 22/7 × 35/2 × 35/2 – ¼ × 22/7 × 21 × 21
By further calculation
= 294 + 1925/4 – 693/2
= 294 + 481.25 – 346.5
So we get
= 775.25 – 346.50
$= 428.75\ cm^2$

(b) We know that
△ABC is an equilateral triangle of side 8 cm
A, B, C are the centres of three circular arcs of equal radius
Radius = 8/2 = 4 cm

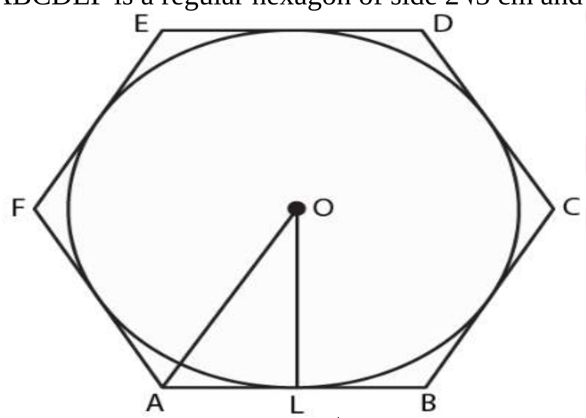
Here
Area of △ABC = $√3/4a^2$
Substituting the values

$= \sqrt{3}/4 \times 8 \times 8$
$= \sqrt{3}/4 \times 64$
So we get
$= 16\sqrt{3} cm^2$
Substituting the value of $\sqrt{3}$
$= 16 \times 1.732$
$= 27.712\ cm^2$

So the area of 3 equal sectors of $60^0$ whose radius is 4 cm $= 3 \times \pi r^2 \times 60/360$
By further calculation
$= 3 \times 3.142 \times 4 \times 4 \times 1/6$
So we get
$= 3.142 \times 8$
$= 25.136\ cm^2$
Area of shaded region $= 27.712 - 25.136 = 2.576 = 2.58\ cm^2$

**36. A circle is inscribed in a regular hexagon of side 2√3 cm. Find**
**(i) the circumference of the inscribed circle**
**(ii) the area of the inscribed circle**
**Solution:**

It is given that
ABCDEF is a regular hexagon of side $2\sqrt{3}$ cm and a circle is inscribed in it with O as the centre



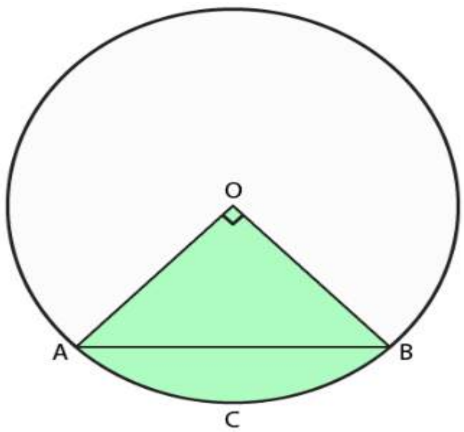

Radius of inscribed circle $= \sqrt{3}/2 \times$ side of regular hexagon
Substituting the values
$= \sqrt{3}/2 \times 2\sqrt{3}$
= 3 cm

(i) We know that
Circumference of the circle $= 2\pi r$
Substituting the values
$= 2\pi \times 3$
By further calculation
$= (6 \times 22)/ 7$
$= 132/7$ cm

(ii) Area of the circle $= \pi r^2$
Substituting the values

= π × 3 × 3
By further calculation
= (9 × 22)/ 7
= 198/7 $cm^2$

**37. In the figure (i) given below, a chord AB of a circle of radius 10 cm subtends a right angle at the centre O. Find the area of the sector OACB and of the major segment. Take π = 3.14.**
**Solution:**




It is given that
Radius of the circle = 10 cm
Angle at the centre subtended by a chord AB = $90^0$

We know that
Area of sector OACB = $\pi r^2$ × 90/360
Substituting the values
= 3.14 × 10 × 10 × 90/360
So we get
= 314 × ¼
= 78.5 $cm^2$
Here
Area of △OAB = ½ × 10 × 10 = 50 $cm^2$

Area of minor segment = Area of sector △ACB – Area of △OAB
Substituting the values
= 78.5 – 50
= 28.5 $cm^2$

Area of circle = $\pi r^2$
Substituting the values
= 3.14 × 10 × 10
= 314 $cm^2$

Area of major segment = area of circle – area of minor segment
Substituting the values
= 314 – 28.5
= 285.5 $cm^2$

## EXERCISE 16.4

**1. Find the surface area and volume of a cube whose one edge is 7 cm.**
**Solution:**

It is given that
One edge of cube a = 7 cm

We know that
Surface area of cube = $6a^2$
Substituting the values
= $6 (7)^2$
= 6 × 7 × 7
= 294 $cm^2$

Volume of cube = $a^3$
Substituting the values
= $7^3$
= 7 × 7 × 7
= 343 $cm^3$

**2. Find the surface area and the volume of a rectangular solid measuring 5 m by 4 m by 3 m. Also find the length of a diagonal.**
**Solution:**

In a rectangular solid
l = 5 m, b = 4 m and h = 3 m

Here
Surface area of rectangular solid = 2 (lb + bh + lh)
Substituting the values
= 2 (5 × 4 + 4 × 3 + 5 × 3)
By further calculation
= 2 (20 + 12 + 15)
= 2 × 47
= 94 sq. m

Volume of rectangular solid = l × b × h
Substituting the values
= 5 × 4 × 3
= 60 $m^3$

We know that

$$Length\ of\ diagonal = \sqrt{l^2 + b^2 + h^2}$$

$$Substituting\ the\ values$$

$$= \sqrt{5^2 + 4^2 + 3^2}$$

$$So\ we\ get$$

$$= \sqrt{25 + 16 + 9}$$

$$= \sqrt{50}$$

$$= \sqrt{25 \times 2}$$

It can be written as
= 5 √2 m
Substituting the value of √2
= 5 × 1.414
= 7.07 m

Therefore, the length of diagonal is 7.07 m.

**3. The length and breadth of a rectangular solid are respectively 25 cm and 20 cm. If the volume is 7000 $cm^3$, find its height.**
**Solution:**

It is given that
Length of rectangular solid = 25 cm
Breadth of rectangular solid = 20 cm
Volume of rectangular solid = 7000 $cm^3$

Consider height of rectangular solid = h cm
Here
Volume = l × b × h
Substituting the values
7000 = 25 × 20 × h
By further calculation
25 × 20 × h = 7000
h = 7000/ (25 × 20)
So we get
h = 700/ (25 × 2)
h = 350/25
By division
h = 70/5
h = 14 cm

Therefore, height of rectangular solid is 14 cm.

**4. A class room is 10 m long, 6 m broad and 4 m high. How many students can it accommodate if one student needs 1.5 $m^2$ of floor area? How many cubic metres of air will each student have?**
**Solution:**

The given dimensions of class room are
Length (l) = 10 m
Breadth (b) = 6 m
Height (h) = 4 m

We know that
Floor area of class room = l × b
Substituting the values
= 10 × 6
= 60 $m^2$

Here
One student needs 1.5 $m^2$ floor area
So the number of students = 60/1.5
Multiply and divide by 10
= (60 × 10)/ 15
= 600/15
= 40 students

Volume of class room = l × b × h
Substituting the values
= 10 × 6 × 4
= 240 $m^3$

So the cubic metres of air for each student = volume of classroom/ number of students
Substituting the values
= 240/40
= 6 $m^3$

**5. (a) The volume of a cuboid is 1440 $cm^3$. Its height is 10 cm and the cross-section is a square. Find the side of the square.**
**(b) The perimeter of one face of a cube is 20 cm. Find the surface area and the volume of the cube.**
**Solution:**

(a) It is given that
Volume of cuboid = 1440 $cm^3$
Height of cuboid = 10 cm

We know that
Volume of cuboid = area of square × height
Substituting the values
1440 = area of square × 10
By further calculation
Area of square = 1440/10 = 144 $cm^2$

Here

Side × side = 144
So we get
Side = √144 = 12 cm

Therefore, the side of square is 12 cm.

(b) It is given that
Perimeter of one face of a cube = 20 cm
Perimeter of one face of a cube = 4 × side

We can write it as
20 = 4 × side
By further calculation
Side = 20/4 = 5 cm

Here
Area of one face = side × side
Substituting the values
= 5 × 5
= 25 $cm^2$
Area of 6 faces = 6 × 25 = 150 $cm^2$

So the volume of cube = side × side × side
Substituting the values
= 5 × 5 × 5
= 125 $cm^3$

**6. Mary wants to decorate her Christmas tree. She wants to place the tree on a wooden box covered with coloured papers with pictures of Santa Claus. She must know the exact quantity of paper to buy for this purpose. If the box has length 80 cm, breadth 40 cm and height 20 cm respectively, then how many square sheets of paper of side 40 cm would she require?**
**Solution:**

It is given that
Length of box (l) = 80 cm
Breadth (b) = 40 cm
Height (h) = 20 cm

We know that
Surface area of the box = 2 (lh + bh + hl)
Substituting the values
= 2 (80 × 40 + 40 × 20 + 20 × 80)
By further calculation
= 2 (320 + 800 + 1600)
= 2 × 5600
= 11200 $cm^2$

So the area of square sheet = $side^2$
= $40^2$
= 1600 $cm^2$

Here
Number of sheets = area of box/ area of one sheet
Substituting the values
= 11200/1600
= 7

**7. The volume of a cuboid is 3600 $cm^3$ and its height is 12 cm. The cross-section is a rectangle whose length and breadth are in the ratio 4: 3. Find the perimeter of the cross-section.**
**Solution:**

It is given that
Volume of a cuboid = 3600 $cm^3$
Height of cuboid = 12 cm

We know that
Volume of cuboid = Area of rectangle × height
Substituting the values
3600 = area of rectangle × 12
By further calculation
Area of rectangle = 3600/ 12
Area of rectangle = 300 $cm^2$ ….. (1)

Here
Ratio of length and breadth of rectangle = 4: 3
Consider
Length of rectangle = 4x
Breadth of rectangle = 3x

Area of rectangle = length × breadth
Substituting the values
Area of rectangle = 4x × 3x
So we get
Area of rectangle = $12x^2$ $cm^2$ ….. (2)

Using equations (1) and (2)
$12x^2 = 300$
$x^2 = 300/12$
So we get
$x^2 = 25$
$x = \sqrt{25} = 5$

Here
Length of rectangle = 4 × 5 = 20 cm
Breadth of rectangle = 3 × 5 = 15 cm

Perimeter of the cross section = 2 (l + b)
Substituting the values
= 2 (20 + 15)
= 2 × 35
= 70 cm

**8. The volume of a cube is 729 $cm^3$. Find its surface area and the length of a diagonal.**
**Solution:**

It is given that
Volume of a cube = 729 $cm^3$
We can write it as
side × side × side = 729
$(side)^3 = 729$
So we get
$side = \sqrt[3]{729} = \sqrt[3]{9 \times 9 \times 9}$
Side = 9 cm

We know that
Surface area of cube = 6 $(side)^2$
Substituting the values
= $6 \times (9)^2$
= 6 × 9 × 9
= 486 $cm^2$

So the length of a diagonal = √3 × side
Substituting the value
= √3 × 9
= 1.73 × 9
= 15.57 cm

**9. The length of the longest rod which can be kept inside a rectangular box is 17 cm. If the inner length and breadth of the box are 12 cm and 8 cm respectively, find its inner height.**
**Solution:**

Consider h m as the inner height
It is given that
Length of longest rod inside a rectangular box = 17 cm which is same as diagonal of rectangular box

$$17 = \sqrt{l^2 + b^2 + h^2}$$

*Substituting the values*

$$17 = \sqrt{12^2 + 8^2 + h^2}$$

By squaring on both sides
$17^2 = 12^2 + 8^2 + h^2$
By further calculation
$289 = 144 + 64 + h^2$
$289 = 208 + h^2$
So we get
$h^2 + 208 = 289$
$h^2 = 289 - 208 = 81$
h = √81 = 9 cm

Therefore, the inner height of rectangular box is 9 cm.

**10. A closed rectangular box has inner dimensions 90 cm by 80 cm by 70 cm. Calculate its capacity and the area of tin-foil needed to line its inner surface.**
**Solution:**

It is given that
Inner length of rectangular box = 90 cm
Inner breadth of rectangular box = 80 cm
Inner height of rectangular box = 70 cm

We know that
Capacity of rectangular box = volume of rectangular box = $l \times b \times h$
Substituting the values
$= 90 \times 80 \times 70$
$= 504000\ cm^3$

Here
Required area of tin foil = $2 (lb + bh + lh)$
Substituting the values
$= 2 (90 \times 80 + 80 \times 70 + 90 \times 70)$
By further calculation
$= 2 (7200 + 5600 + 6300)$
So we get
$= 2 \times 19100$
$= 38200\ cm^2$

**11. The internal measurements of a box are 20 cm long, 16 cm wide and 24 cm high. How many 4 cm cubes could be put into the box?**
**Solution:**

It is given that
Volume of box = 20 cm × 16 cm × 14 cm
Volume of cubes = 4 cm × 4 cm × 4 cm

We know that
Number of cubes put into the box = volume of box/ volume of cubes
Substituting the values
$= (20 \times 16 \times 24)/ (4 \times 4 \times 4)$
$= 5 \times 4 \times 6$
$= 120$

Therefore, 120 cubes can be put into the box.

**12. The internal measurements of a box are 10 cm long, 8 cm wide and 7 cm high. How many cubes of side 2 cm can be put into the box?**
**Solution:**

It is given that
Length of box = 10 cm
Breadth of box = 8 cm
Height of box = 7 cm

We know that
3 number of cubes of side 2 cm can be put in box
i.e. height of box is 7 cm so only 3 cubes can be put height wise

**13. A certain quantity of wood costs Rs 250 per m$^3$. A solid cubical block of such wood is bought for Rs 182.25. Calculate the volume of the block and use the method of factors to find the length of one edge of the block.**
**Solution:**

It is given that
Cost of Rs 250 for 1 m$^3$ wood
Cost of Rs 1 for 1/250 m$^3$ wood
Cost of Rs 182.25 for 182.25/250 m$^3$ wood

Here
Quantity of wood = 182.25/250 m$^3$
Multiply and divide by 100
= 18225/ (250 × 100)
So we get
= 18225/ (25 × 1000)
= 729/ 1000
= 0.729 m$^3$

We know that
Volume of given block = 0.729 m$^3$
Consider the length of one edge of block = x m
So we get
$x^3 = 0.729$ m$^3$
Now taking cube root on both sides

$$x = \sqrt[3]{0.729} = \sqrt[3]{\frac{729}{1000}}$$

*It can be written as*

$$= \sqrt{\frac{3 \times 3 \times 3 \times 3 \times 3 \times 3}{2 \times 2 \times 2 \times 5 \times 5 \times 5}}$$

| | |
|---|---|
| 3 | 729 |
| 3 | 243 |
| 3 | 81 |
| 3 | 27 |
| 3 | 9 |
| 3 | 3 |
| | 1 |

| | |
|---|---|
| 2 | 1000 |
| 2 | 500 |
| 2 | 250 |
| 5 | 125 |
| 5 | 25 |
| 5 | 5 |
| | 1 |

So we get
= (3 × 3)/ (2 × 5)
= 9/10
= 0.9 m

Therefore, the length of one edge of the block is 0.9 m.

**14. A cube of 11 cm edge is immersed completely in a rectangular vessel containing water. If the dimensions of the base of the vessel are 15 cm × 12 cm, find the rise in the water level in centimetres correct to 2 decimal places, assuming that no water over flows.**
**Solution:**

It is given that
Edge of cube = 11 cm
Volume of cube = $edge^3$
Substituting the values
= $11^3$
= 11 × 11 × 11
= 1331 $cm^3$

We know that
The dimensions of the base of the vessel are 15 cm × 12 cm
Consider the rise in the water level = h cm
So the volume of cube = volume of vessel
Substituting the values
1331 = 15 × 12 × h
By further calculation
h = 1331/ (15 × 12)
So we get
h = 1331/ 180 = 7.39 cm

Therefore, the rise in the water level is 7.39 cm.

**15. A rectangular container, whose base is a square of side 6 cm, stands on a horizontal table and holds water upto 1 cm from the top. When a cube is placed in the water and is completely submerged, the water rises to the top and 2 $cm^3$ of water over flows, calculate the volume of the cube.**
**Solution:**

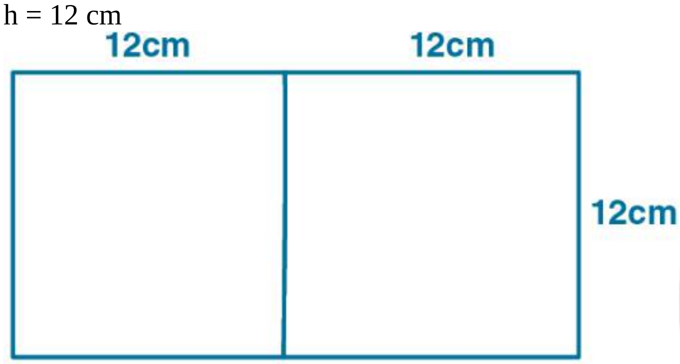
If the base of rectangular container is a square
l = 6 cm and b = 6 cm
When a cube is placed in it, water rises to top i.e. through height 1 cm and 2 $cm^3$ of water overflows


We know that
Volume of cube = Volume of water displaced
Substituting the values

= 6 × 6 × 1 + 2
= 36 + 2
= 38 $cm^3$

**16. (a) Two cubes, each with 12 cm edge, are joined end to end. Find the surface area of the resulting cuboid.**
**(b) A solid cube of side 12 cm is cut into eight cubes of equal volume. What will be the side of the new cube? Also, find the ratio between the surface area of the original cube and the sum of the surface areas of the new cubes.**
**Solution:**

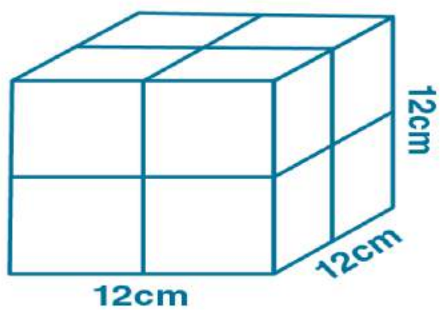
(a) We know that
By joining two cubes end to end a cuboid is formed whose dimensions are
l = 12 + 12 = 24 cm
b = 12 cm
h = 12 cm




Here
Total surface area of cuboid = 2 (lb + bh + hl)
Substituting the values
= 2 (24 × 12 + 12 × 12 + 12 × 24)
By further calculation
= 2 (288 + 144 + 288)
So we get
= 2 × 720
= 1440 $cm^2$

(b) We know that
Side of a cube = 12 cm

Here
Volume = $side^3 = 12^3 = 1728\ cm^3$



If cut into 8 equal cubes
Volume of each cube = 1728/8 = 216 $cm^3$
$side = \sqrt[3]{216} = \sqrt[3]{6 \times 6 \times 6} = 6cm$

Surface area of original cube = 6 × $side^2$
Substituting the values
= 6 × $12^2$
= 6 × 144
= 864 $cm^2$

Surface area of one smaller cube = 6 × $6^2$
So we get
= 6 × 36
= 216 $cm^2$

Surface area of 8 cube = 216 × 8
= 1728 $cm^2$

So the ratio between their areas = 864: 1728 = 1: 2

**17. A cube of a metal of 6 cm edge is melted and cast into a cuboid whose base is 9 cm × 8 cm. Find the height of the cuboid.**
**Solution:**

It is given that
Edge of melted cube = 6 cm
Volume of melted cube = 6 cm × 6 cm × 6 cm = 216 $cm^3$
Dimensions of cuboid are
Length = 9 cm
Breadth = 8 cm
h cm is the height

We know that
Volume of cuboid = l × b × h
Substituting the values
= 9 × 8 × h
= 72 h $cm^3$

Here
Volume of cuboid = Volume of melted metal cube
Substituting the values
72h = 216
h = 216/72 = 3 cm

Therefore, the height of cuboid is 3 cm.

**18. The area of a playground is 4800 $m^2$. Find the cost of covering it with gravel 1 cm deep, if the gravel costs Rs 260 per cubic metre.**
**Solution:**

It is given that
Area of playground = 4800 $m^2$
We can write it as
l × b = 4800

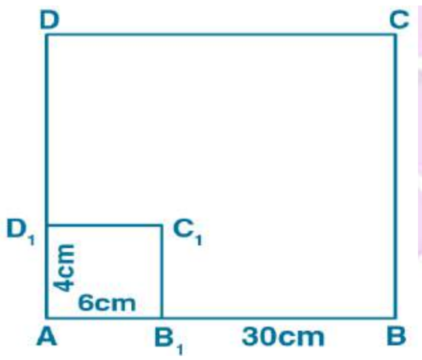
We know that
Depth of level = 1 cm
h = 1 cm = 1/100 m

Here
Volume of gravel = l × b × h
Substituting the values
= 4800 × 1/100
= 48 $m^3$

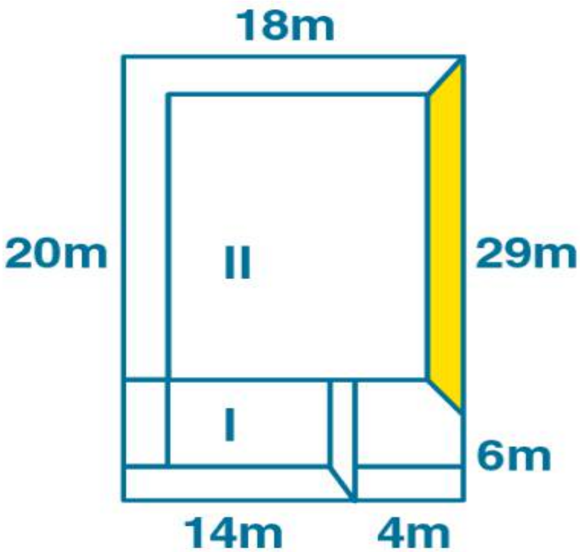
Cost of gravel = Rs 260 per cubic metre
So the total cost = 260 × 48 = Rs 12480

**19. A field is 30 m long and 18 m broad. A pit 6 m long, 4 m wide and 3 m deep is dug out from the middle of the field and the earth removed is evenly spread over the remaining area of the field. Find the rise in the level of the remaining part of the field in centimetres correct to two decimal places.**
**Solution:**

Consider ABCD is a field
Let ABCD be a part of the field where a pit is dug
Here
Volume of the earth dug out = 6 × 4 × 3 = 72 $m^3$
h m is the level raised over the field uniformly




Now divide the raised level of the field into parts I and II
Volume of part I = 14 × 6 × h = 84h $m^3$
Volume of part II = 24 × 18 × h = 432h $m^3$
Total volume of part I and II = [84h + 432h] = 516h $m^3$




We know that
516 = volume of earth dug out
Substituting the values
516 = 72
So we get
h = 72/516 = 0.1395 m
Multiply by 100
h = 0.1395 × 100
h = 13.95 cm

Therefore, the level has been raised by 13.95 cm.

**20. A rectangular plot is 24 m long and 20 m wide. A cubical pit of edge 4 m is dug at each of the four corners of the field and the soil removed is evenly spread over the remaining part of the plot. By what height does the remaining plot get raised?**
**Solution:**

It is given that
Length of plot (l) = 24 m
Width of plot (b) = 20 m
So the area of plot = l × b = 24 × 20 = 480 $m^2$

We know that
Side of cubical pit = 4 m
Volume of each pit = $4^3$ = 64 $m^3$

Here
Volume of 4 pits at the corners = 4 × 64 = 256 $m^3$
Area of surface of 4 pits = $4a^2$
= 4 × $4^2$
= 64 $m^2$
So the area of remaining plot = 480 – 64 = 416 $m^2$
Height of the soil spread over the remaining plot = 256/416 = 8/13 m

**21. The inner dimensions of a closed wooden box are 2 m, 1.2 m and 0.75 m. The thickness of the wood is 2.5 cm. Find the cost of wood required to make the box if 1 $m^3$ of wood costs Rs 5400.**
**Solution:**

It is given that
Inner dimensions of wooden box are 2 m, 1.2 m and 0.75 m
Thickness of the wood = 2.5 cm
So we get
= 25/10 cm
It can be written as
= 25/10 × 1/100
= 1/10 × ¼
So we get
= 1/40
= 0.025 m

So the external dimensions of wooden box are
(2 + 2 × 0.025), (1.2 + 2 × 0.025), (0.75 + 2 × 0.025)
By further calculation
= (2 + 0.05), (1.2 + 0.05), (0.75 + 0.5)
= 2.05, 1.25, 0.80

Here
Volume of solid = External volume of box – Internal volume of box
Substituting the values
= 2.05 × 1.25 × 0.80 – 2 × 1.2 × 0.75
By further calculation
= 2.05 – 1.80
= 0.25 $m^3$

Cost = Rs 5400 for 1 $m^3$
So the total cost = 5400 × 0.25
Multiply and divide by 100
= 5400 × 25/100
= 54 × 25
= Rs 1350

**22. A cubical wooden box of internal edge 1 m is made of 5 cm thick wood. The box is open at the top. If the wood costs Rs 9600 per cubic metre, find the cost of the wood required to make the box.**
**Solution:**

It is given that
Internal edge of cubical wooden box = 1 m
Thickness of wood = 5 cm

We know that
External length = 1 m + 10 cm = 1.1 m
Breadth = 1 m + 10 m = 1.1 m
Height = 1 m + 5 cm = 1.05 m

Here
Volume of the wood used = Outer volume – Inner volume
Substituting the values
$= 1.1 \times 1.1 \times 1.05 - 1 \times 1 \times 1$
By further calculation
$= 1.205 - 1$
$= 0.2705\ m^3$
Cost of $1\ m^3$ = Rs 9600
So the cost of $0.2705\ m^3 = 9600 \times 0.2705$
= Rs 2596.80

**23. A square brass plate of side x cm is 1 mm thick and weighs 4725 g. If one cc of brass weights 8.4 gm, find the value of x.**
**Solution:**

It is given that
Side of square brass plate = x cm
Here l = x cm and b = x cm
Thickness of plate = 1 mm = 1/10 cm

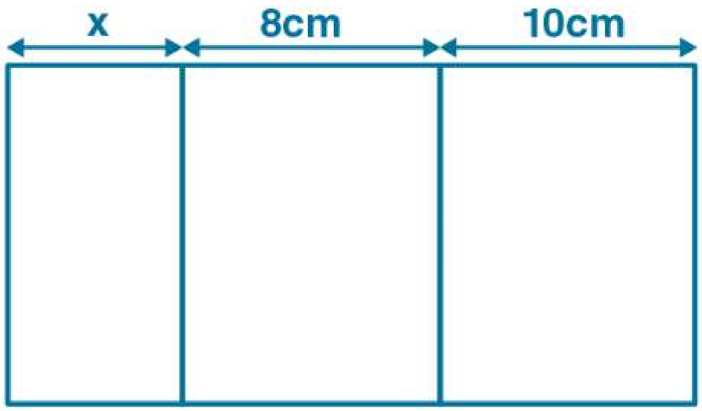
We know that
Volume of the plate = l × b × h
Substituting the values
$= x \times x \times 1/10$
$= x^2/ 10\ cm^3$ ….. (1)

Here
8.4 gm weight brass having volume = 1 cc
1 gm weight brass having volume = 1/8.4 cc
So the 4725 gm weight brass having volume = 4725 × 1/8.4 = 562.5 cc
Volume of plate = 562.5 cc = $562.5\ cm^3$ …. (2)

Using both the equations
$x^2/10 = 562.5$
By cross multiplication
$x^2 = 562.5 \times 10 = 5625$
Here
$x = \sqrt{5625} = 75$ cm

Therefore, the value of x is 75 cm.

**24. Three cubes whose edges are x cm, 8 cm and 10 cm respectively are melted and recast into a single cube of edge 12 cm. Find x.**
**Solution:**




It is given that
Edges of three cubes are x cm, 8 cm and 10 cm
So the volumes of these cubes are $x^3$, $8^3$ and $10^3$ i.e. $x^3$, 512 $cm^3$ and 1000 $cm^3$

We know that
Edges of new cube formed = 12 cm
Volume of new cube = $12^3 = 1728$ $cm^3$

Based on the question
$x^3 + 512 + 1000 = 1728$
By further calculation
$x^3 + 1512 = 1728$
$x^3 = 216$
It can be written as
$x^3 = 6 \times 6 \times 6$
So we get
x = 6 cm

**25. The area of cross-section of a pipe is 3.5 $cm^2$ and water is flowing out of pipe at the rate of 40 cm/s. How much water is delivered by the pipe in one minute?**
**Solution:**

It is given that
Area of cross-section of pipe = 3.5 $cm^2$
Speed of water = 40 cm/sec
Length of water column in 1 sec = 40 cm

We know that
Volume of water flowing in 1 second = Area of cross section × length
Substituting the values
$= 3.5 \times 40$
$= 35 \times 4$
$= 140$ $cm^3$
So the volume of water flowing in 1 minute i.e. 60 sec = $140 \times 60$ $cm^3$

Here
1 litre = 1000 $cm^3$

So we get

Volume = (140 × 60)/ 100

= (14 × 6)/ 10

= 84/10

= 8.4 litres

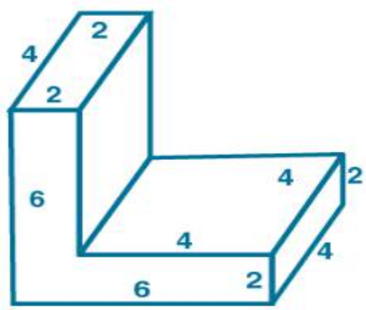
**26. (a) The figure (i) given below shows a solid of uniform cross-section. Find the volume of the solid. All measurements are in cm and all angles in the figure are right angles.**

**(b) The figure (ii) given below shows the cross section of a concrete wall to be constructed. It is 2 m wide at the top, 3.5 m wide at the bottom and its height is 6 m and its length is 400 m. Calculate**

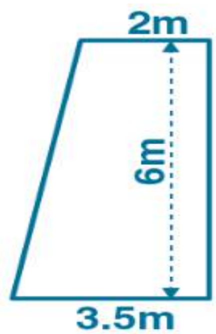
**(i) the cross sectional area and**

**(ii) volume of concrete in the wall.**

**(c) The figure (iii) given below show the cross section of a swimming pool 10 m broad, 2 m deep at one end and 3 m deep at the other end. Calculate the volume of water it will hold when full, given that its length is 40 m.**



(i)



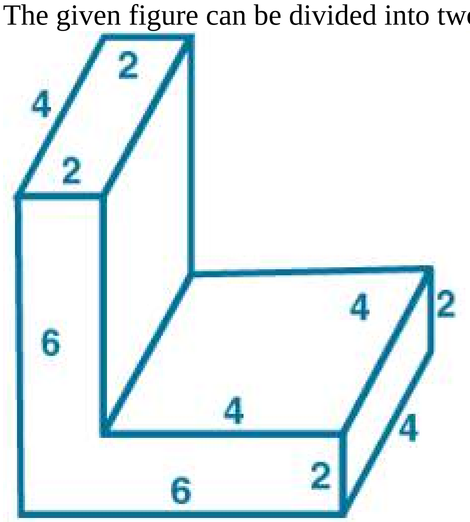
(ii)

(iii)

**Solution:**

(a) We know that

The given figure can be divided into two cuboids of dimensions 4 cm, 4 cm, 2 cm, 4 cm, 2 cm and 6 cm



Volume of solid = 4 × 4 × 2 + 4 × 2 × 6
= 32 + 48
= 80 $cm^3$

(b) We know that
Figure (ii) is a trapezium with parallel sides 2 m and 3.5 m
(i) Area of cross section = ½ (sum of parallel sides) × height
Substituting the values
= ½ (2 + 3.5) × 6
By further calculation
= ½ × 5.5 × 6
So we get
= 5.5 × 3
= 16.5 $m^2$

(ii) Volume of concrete in the wall = Area of cross section × length
Substituting the values
= 16.5 × 400
= 165 × 40
= 6600 $m^3$

(c) We know that
From figure (iii) we know that it is trapezium with parallel sides 2 m and 3m

Here
Area of cross section = ½ (sum of parallel sides) × height
Substituting the values
= ½ (2 + 3) × 10
By further calculation
= ½ × 5 × 10
= 5 × 5
= 25 $m^2$

So the volume of water it will hold when full = area of cross section × height
= 25 × 40
= 1000 $m^3$

**27. A swimming pool is 50 metres long and 15 metres wide. Its shallow and deep ends are 1 ½ metres and 14 ½ metres deep respectively. If the bottom of the pool slopes uniformly, find the amount of water required to fill the pool.**
**Solution:**

It is given that
Length of swimming pool = 50 m
Width of swimming pool = 15 m
Its shallow and deep ends are 1 ½ m and 5 ½ m deep

We know that
Area of cross section of swimming pool = ½ (sum of parallel sides) × width
Substituting the values

$= \frac{1}{2} (1 \frac{1}{2} + 4 \frac{1}{2}) \times 15$

By further calculation

$= \frac{1}{2} (3/2 + 9/2) \times 15$

So we get

$= \frac{1}{2} [(3 + 9)/ 2] \times 15$

$= \frac{1}{2} \times 12/2 \times 15$

$= \frac{1}{2} \times 6 \times 15$

$= 3 \times 15$

$= 45 \text{ m}^2$

Here

Amount of water required to fill pool = Area of cross section × length

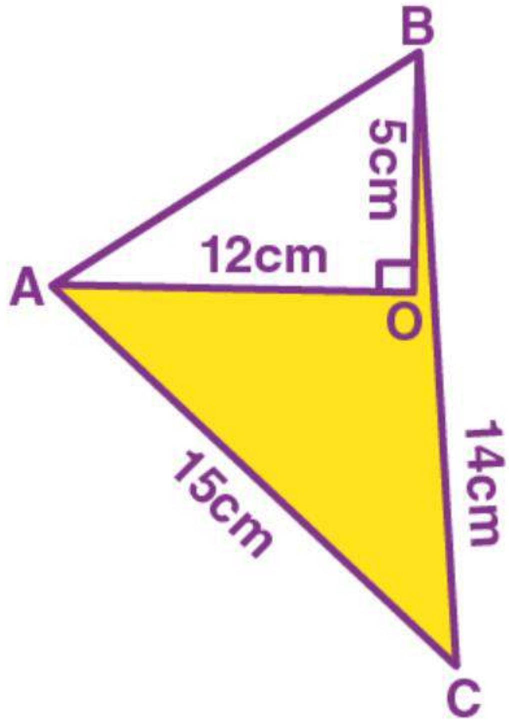
$= 45 \times 50$

$= 2250 \text{ m}^3$

## CHAPTER TEST

**Take π = 22/7, unless stated otherwise.**

**1. (a) Calculate the area of the shaded region.**




**(b) If the sides of a square are lengthened by 3 cm, the area becomes 121 $cm^2$. Find the perimeter of the original square.**

**Solution:**

(a) From the figure,
OA is perpendicular to BC
It is given that
AC = 15 cm, AO = 12 cm, BO = 5 cm, BC = 14 cm
OC = BC – BO = 14 – 5 = 9 cm

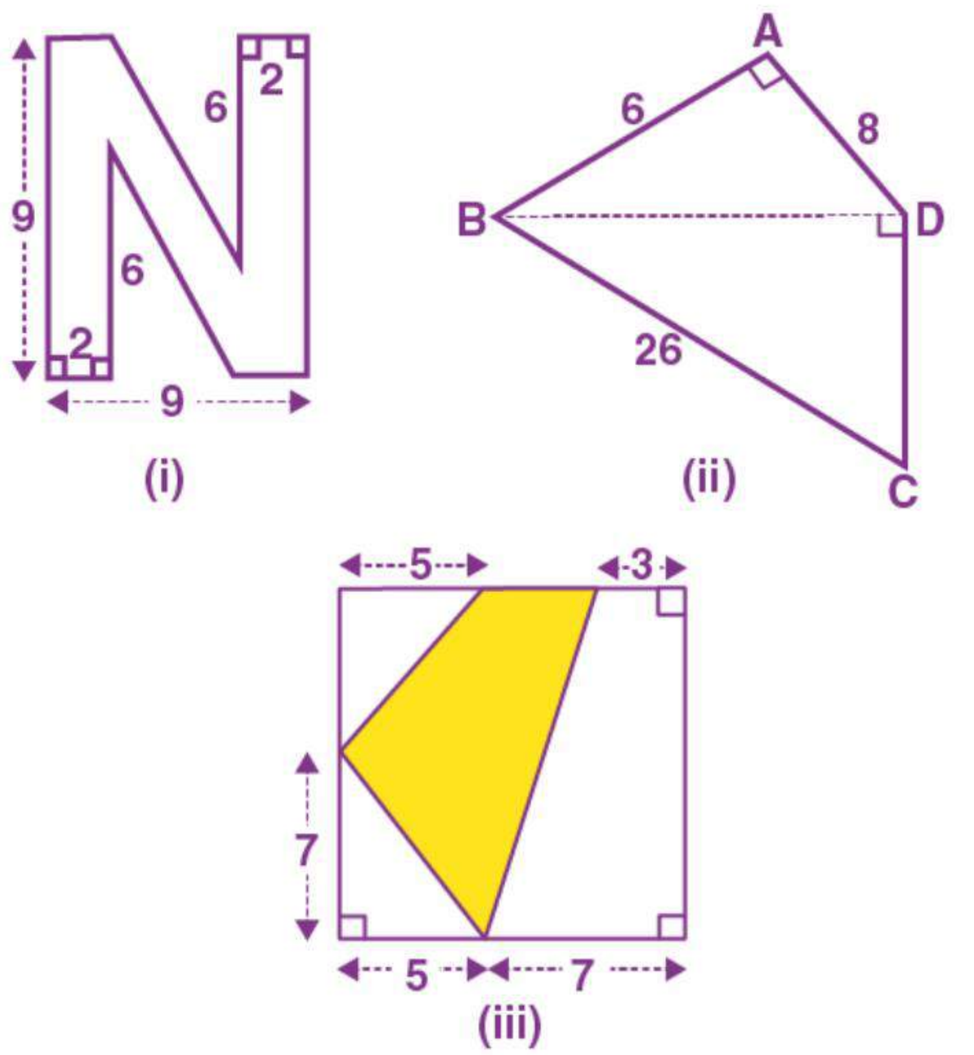
Here
Area of right ∆AOC = ½ × base × altitude
Substituting the values
= ½ × 9 × 12
= 54 $cm^2$

(b) Consider the side of original square = x cm
So the length of given square = (x + 3) cm

We know that
Area = side × side
Substituting the values
121 = (x + 3) (x + 3)
It can be written as

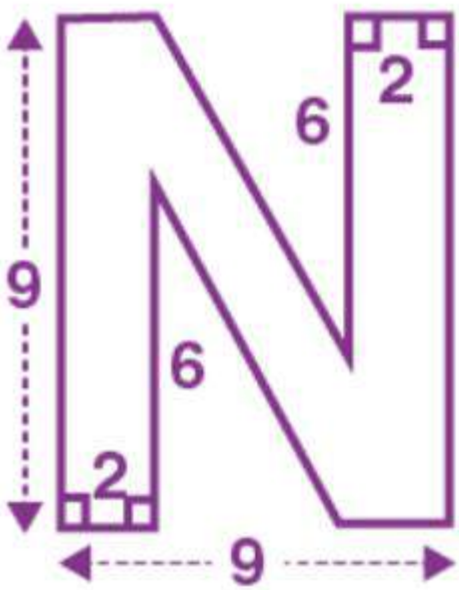
$11^2 = (x + 3)^2$
By further calculation
$11 = x + 3$
$x = 11 – 3$
$x = 8$ cm

**2. (a) Find the area enclosed by the figure (i) given below. All measurements are in centimetres.**
**(b) Find the area of the quadrilateral ABCD shown in figure (ii) given below. All measurements are in centimetres.**
**(c) Calculate the area of the shaded region shown in figure (iii) given below. All measurements are in metres.**



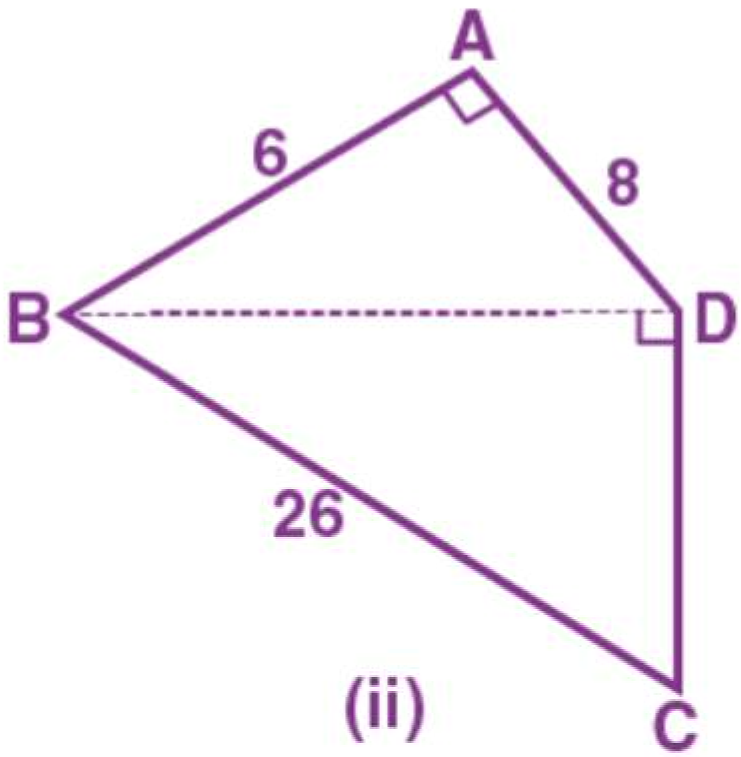

**Solution:**

(a) We know that




Area of figure (i) = Area of ABCD – Area of both triangles
Substituting the values
= (9 × 9) – (½ × 5 × 6 ) × 2
By further calculation
= 81 – (15 × 2)
So we get
= 81 – 30
= 51 $cm^2$

(b) In △ABD



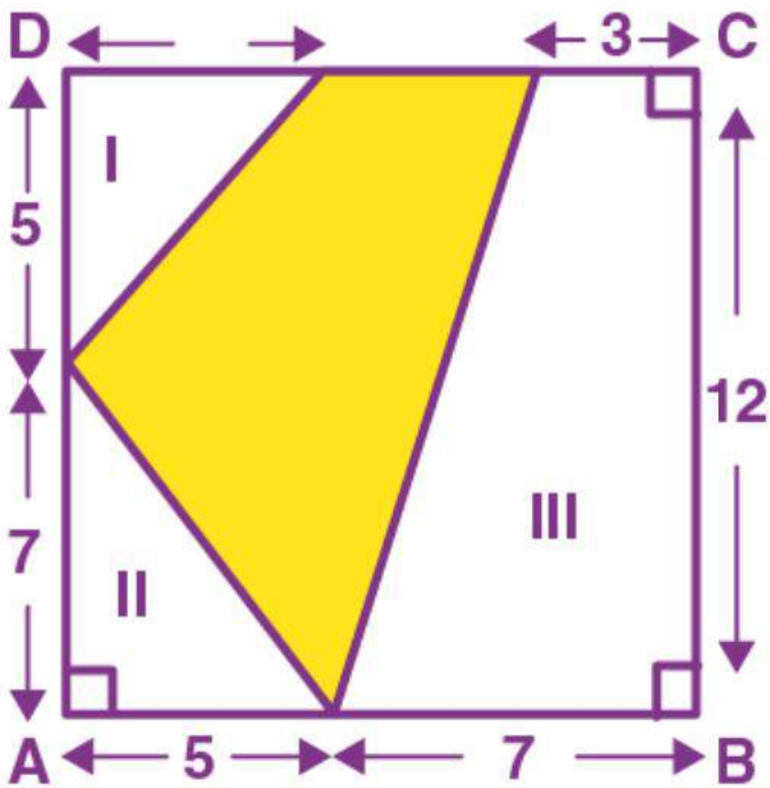

Using Pythagoras theorem
$BD^2 = AB^2 + AD^2$
Substituting the values
$BD^2 = 6^2 + 8^2$
$BD^2 = 36 + 64$
So we get
$BD^2 = 100$
BD = 10 cm

In $\triangle$BCD
Using Pythagoras theorem
$BC^2 = BD^2 + CD^2$
Substituting the values
$26^2 = 10^2 + CD^2$
$676 = 100 + CD^2$
By further calculation
$CD^2 = 676 – 100 = 576$
CD = $\sqrt{576}$
CD = 24 cm

Here
Area of the given figure = Area of $\triangle$ABD + Area of $\triangle$BCD
We can write it as
Area of the given figure = ½ × base × height + ½ × base × height
Area of the given figure = ½ × AB × AD + ½ × CD × BD
Substituting the values

Area of the given figure = ½ × 6 × 8 + ½ × 24 × 10
So we get
Area of the given figure = 3 × 8 + 12 × 10
= 24 + 120
= 144 $cm^2$

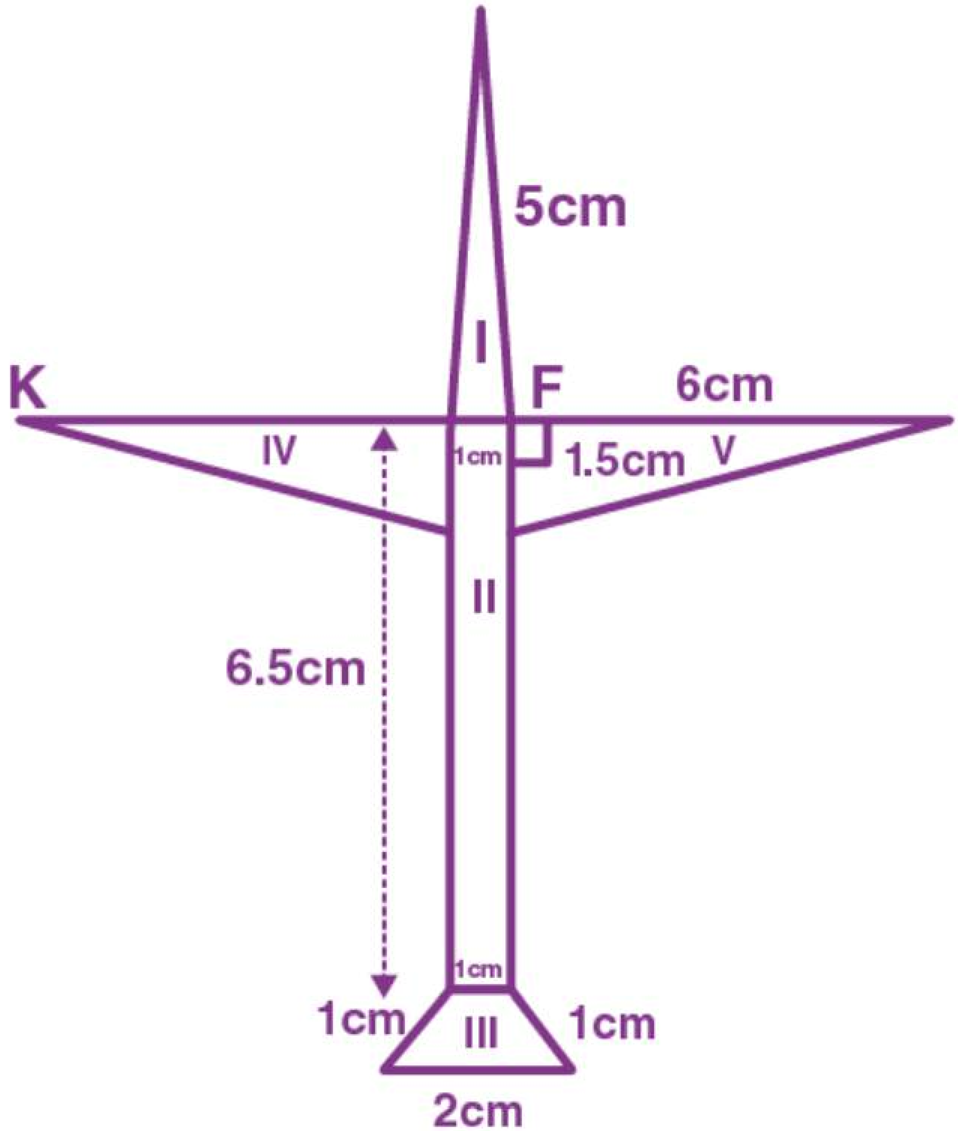
(c) We know that




Area of the figure (iii) = Area of ABCD – (Area of 1st part + Area of 2nd part + Area of 3rd part)
It can be written as
= (AB × BC) – [(1/2 × base × height) + (1/2 × base × height) + ½ (sum of parallel side × height)]
Substituting the values
= (12 × 12) – [1/2 × 5 × 5 + ½ × 5 × 7 + ½ (7 + 3) × 12]
By further calculation
= 144 – [25/2 + 35/2 + 10 × 6]
= 144 – (60/2 + 60)
= 144 – (30 + 60)
So we get
= 144 – 90
= 54 $m^2$

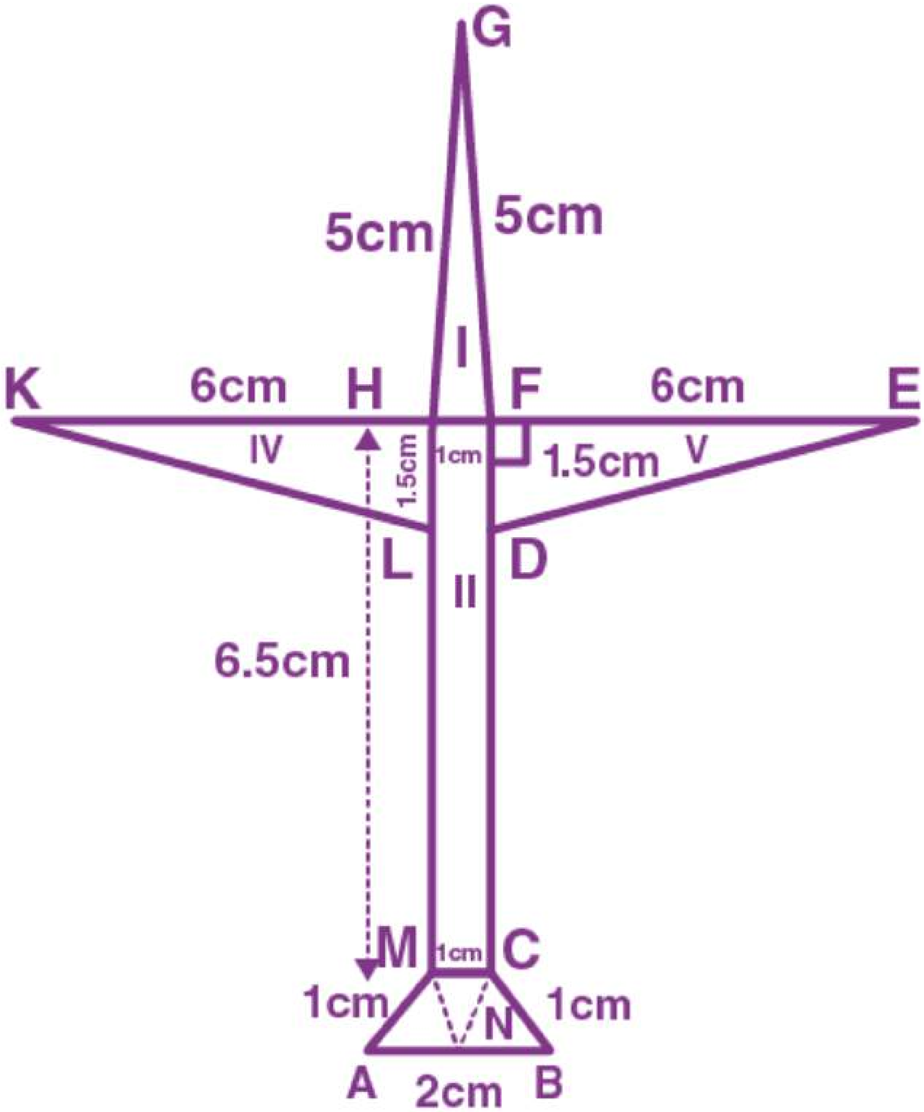
Therefore, the required area of given figure = 54 $m^2$.

**3. Asifa cut an aeroplane from a coloured chart paper (as shown in the adjoining figure). Find the total area of the chart paper used, correct to 1 decimal place.**




**Solution:**

Here the whole figure of an aeroplane has 5 figures i.e. three triangles, one rectangle and one trapezium
Consider M as the midpoint of AB
AM = MB = 1 cm




Now join MN and CN

$\triangle$AMN, $\triangle$NCB and $\triangle$MNC are equilateral triangles having 1 cm side each

Area of $\triangle$GHF

$$s = \frac{a+b}{c}$$

$$s = \frac{5+5+1}{2}$$

$$s = \frac{11}{2}$$

$$We\,know\,that$$

$$Area = \sqrt{s(s-a)(s-b)(s-c)}$$

$$Substituting\,the\,values$$

$$= \sqrt{\frac{11}{2}(\frac{11}{2}-5)(\frac{11}{2}-5)(\frac{11}{2}-1)}$$

$$By\,further\,calculation$$

$$= \sqrt{\frac{11}{2} \times \frac{1}{2} \times \frac{1}{2} \times \frac{9}{2}}$$

$$So\,we\,get$$

$$= \sqrt{\frac{11 \times 9}{16}}$$

$$= \frac{3}{4}\sqrt{11}$$

Here
= ¾ × 3.316
= 3 × 0.829
= 2.487
= 2.48 $cm^2$

Area of rectangle II (MCFH) = l × b
Substituting the values
= 6.5 × 1
= 6.5 $cm^2$

Area of ∆ III + IV = 2 × ½ × 6 × 1.5 = 9 $cm^2$

Area of three equilateral triangles formed trapezium III = 3 × √3/4 × $1^2$
= ¾ × 1.732
= 3 × 0.433

= 1.299
= 1.3 $cm^2$

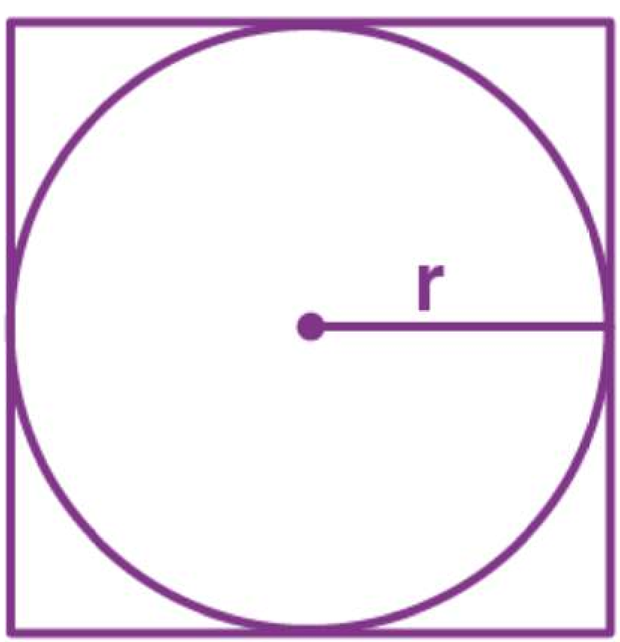
So we get
Total area = 2.48 + 6.50 + 9 + 1.30
= 19.28
= 19.3 $cm^2$

**4. If the area of a circle is 78.5 $cm^2$, find its circumference. (Take $\pi$ = 3.14)**
**Solution:**

It is given that
Area of a circle = 78.5 $cm^2$
Consider r as the radius
$r^2$ = Area/π
Substituting the values
$r^2$ = 78.50/3.14
$r^2 = 25 = 5^2$
So we get
r = 5 cm

Here
Circumference = 2 πr
Substituting the values
= 2 × 3.14 × 5
= 31.4 cm

**5. From a square cardboard, a circle of biggest area was cut out. If the area of the circle is 154 $cm^2$, calculate the original area of the cardboard.**
**Solution:**

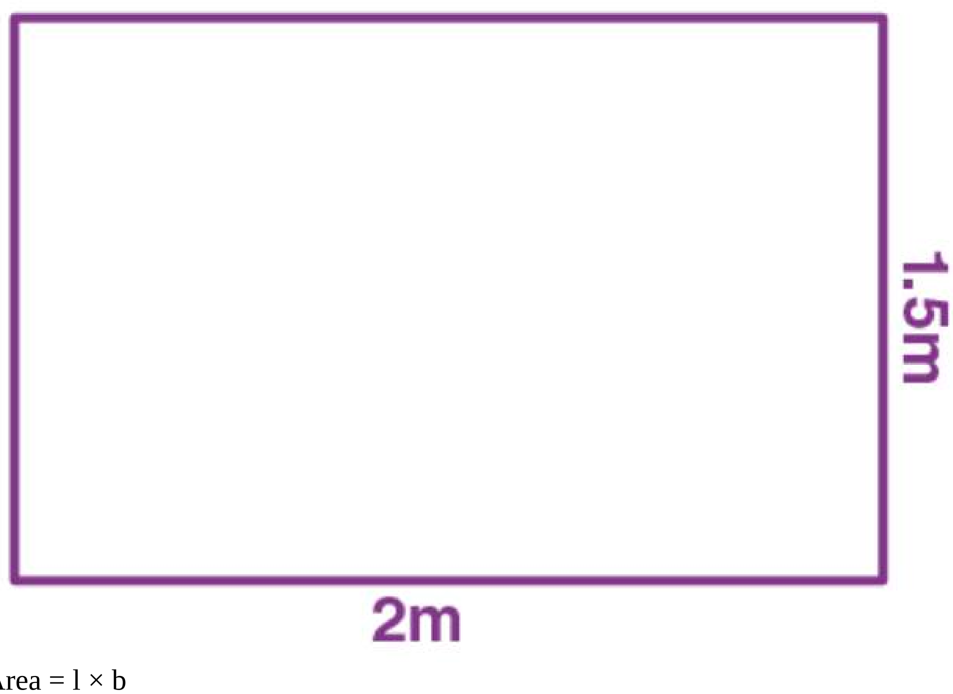


It is given that
Area of circle cut out from the square board = 154 $cm^2$
Consider r as the radius
$\pi r^2 = 154$
$22/7\ r^2 = 154$
By further calculation
$r^2 = (154 \times 7)/ 22 = 49 = 7^2$
r = 7 cm

We know that
Side of square = 7 × 2 = 14 cm
So the area of the original cardboard = $a^2$
= $14^2$
= 196 $cm^2$

**6. (a) From a sheet of paper of dimensions 2 m × 1.5 m, how many circles of radius 5 cm can be cut? Also find the area of the paper wasted. Take π = 3.14.**
**(b) If the diameter of a semi-circular protractor is 14 cm, then find its perimeter.**
**Solution:**

(a) It is given that
Length of sheet of paper = 2 m = 200 cm
Breadth of sheet = 1.5 m = 150 cm




Area = l × b
Substituting the values
= 200 × 150
= 30000 $cm^2$

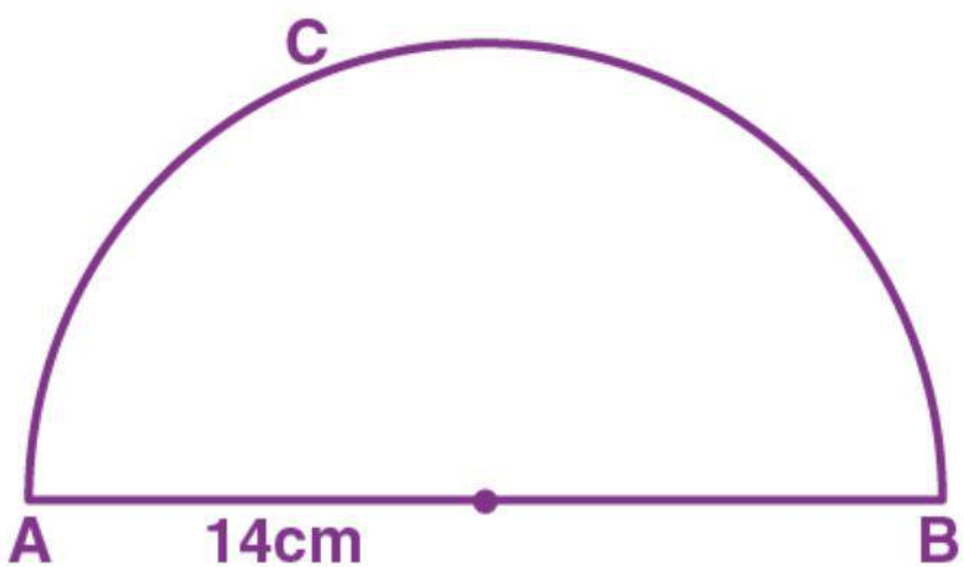
We know that

Radius of circle = 5 cm
Number of circles in lengthwise = 200/ (5 × 2) = 20
Number of circles in widthwise = 150/10 = 15
So the number of circles = 20 × 15 = 300

Here
Area of one circle = $\pi r^2$
Substituting the values
= 3.14 × 5 × 5 $cm^2$

Area of 300 circles = 300 × 314/100 × 25 = 23550 $cm^2$
So the area of remaining portion = area of square – area of 300 circles
= 30000 – 23550
= 6450 $cm^2$

(b) It is given that
Diameter of semicircular protractor = 14 cm

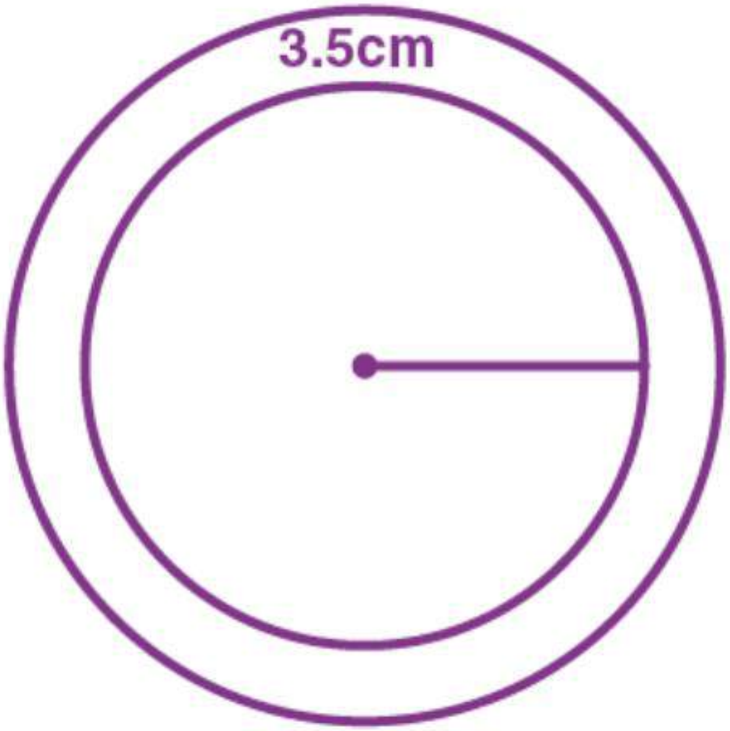



We know that
Perimeter = ½ πd + d
Substituting the values
= ½ × 22/7 × 14 + 14
= 22 + 14
= 36 cm

**7. A road 3.5 m wide surrounds a circular park whose circumference is 88 m. Find the cost of paving the road at the rate of ₹ 60 per square metre.**
**Solution:**

It is given that
Width of the road = 3.5 m

Circumference of the circular park = 88 m
Consider r as the radius of the park
$2\pi r = 88$

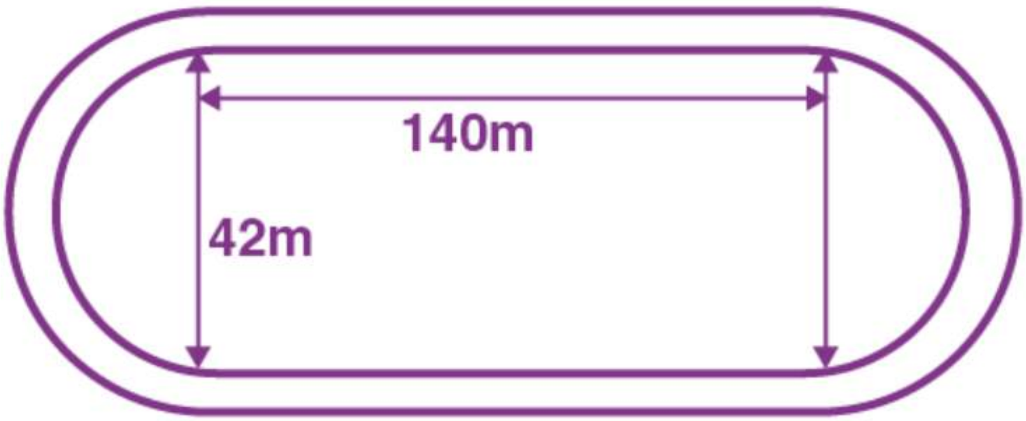



Substituting the values
$2 \times 22/7\ r = 88$
By further calculation
$r = (88 \times 7)/(2 \times 22) = 14$ m

Here
Outer radius (R) = 14 + 3.5 = 17.5 m
Area of the path = 22/7 × (17.5 + 14) (17.5 – 14)
We know that
$\pi (R^2 - r^2) = 22/7\ [(17.5)^2 - (14)^2]$
By further calculation
= 22/7 (17.5 + 14) (17.5 – 14)
= 22/7 × 31.5 × 3.5
= 246.5 $m^2$

It is given that
Rate of paving the road = ₹ 60 per $m^2$
So the total cost = 60 × 346.5 = ₹ 20790

**8. The adjoining sketch shows a running track 3.5 m wide all around which consists of two straight paths and two semicircular rings. Find the area of the track.**



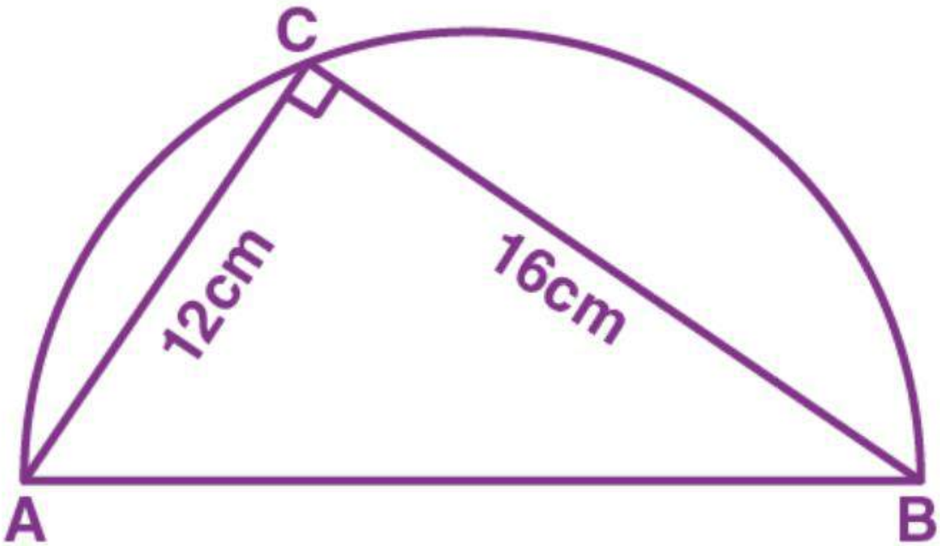

**Solution:**

It is given that
Width of track = 3.5 m
Inner length of rectangular base = 140 m
Width = 42 m
Outer length of rectangular base = 140 + 2 × 3.5
= 140 + 7
= 147 m
Width = 42 + 2 × 3.5
= 42 + 7
= 49 m

We know that
Radius of inner semicircle (r) = 42/2 = 21 m
Outer radius (R) = 21 + 3.5 = 24.5 m

Here
Area of track = 2 (140 × 3.5) + 2 × ½ π ($R^2 - r^2$)
Substituting the values
= 2 (490) + 22/7 [$(24.5)^2 - (21)^2$]
By further calculation
= 980 + 22/7 (24.5 + 21) (24.5 – 21)
= 980 + 22/7 × 45.5 × 3.5
So we get
= 980 + 500.5
= 1480.5 $m^2$

**9. In the adjoining figure, O is the centre of a circular arc and AOB is a line segment. Find the perimeter and the area of the shaded region correct to one decimal place. (Take π = 3.142)**
**Hint. Angle in a semicircle is a right angle.**




**Solution:**

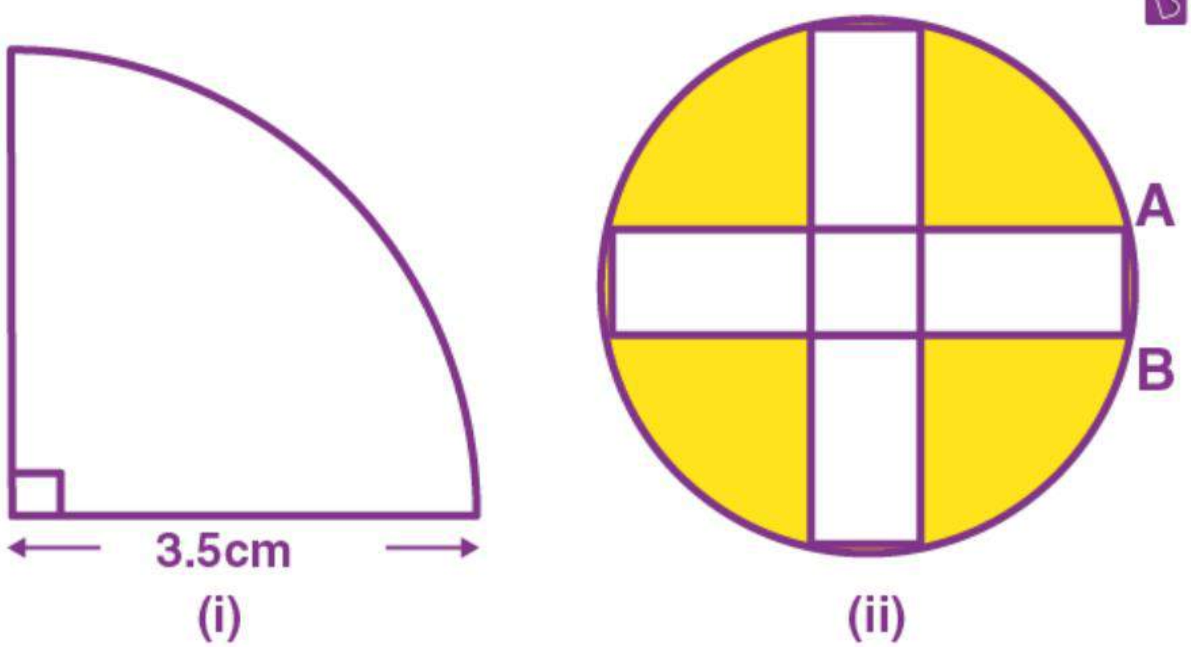
We know that
In a semicircle $\angle ACB = 90^0$
$\triangle$ ABC is a right-angled triangle
Using Pythagoras theorem
$AB^2 = AC^2 + BC^2$
Substituting the values
$= 12^2 + 16^2$
$= 144 + 256$
$= 400$
$AB^2 = (20)^2$
AB = 20 cm
Radius of semicircle = 20/2 = 10 cm

(i) We know that
Area of shaded portion = Area of semicircle – Area of $\triangle$ ABC
It can be written as
$= ½ \pi r^2 – (AC \times BC)/ 2$
Substituting the values
$= ½ \times 3.142 (10)^2 – (12 \times 16)/2$
By further calculation
= 314.2/2 – 96
= 157.1 – 96
$= 61.1 \text{ cm}^2$

(ii) Here
Perimeter of shaded portion = circumference of semicircle + AC + BC
It can be written as
$= \pi r + 12 + 16$
$= 3.142 \times 10 + 28$

So we get
= 31.42 + 28
= 59.42 cm
= 59.4 cm

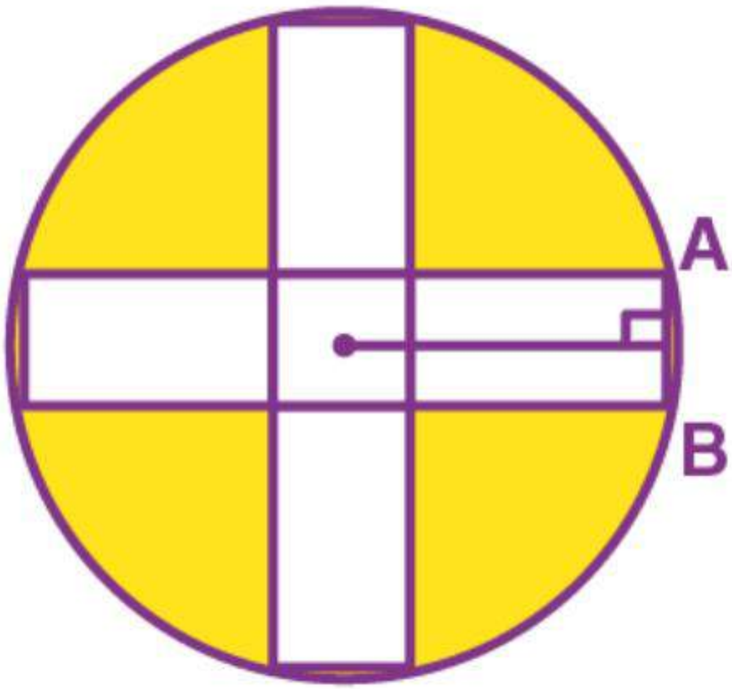
**10. (a) In the figure (i) given below, the radius is 3.5 cm. Find the perimeter of the quarter of the circle.**
**(b) In the figure (ii) given below, there are five squares each of side 2 cm.**
**(i) Find the radius of the circle.**
**(ii) Find the area of the shaded region. (Take $\pi$ = 3.14).**




**Solution:**

(a) It is given that
Radius of quadrant = 3.5 cm
Perimeter = 2r + ¼ × 2 πr
= 2r + ½ × πr
Substituting the values
= 2 × 3.5 + ½ × 22/7 × 3.5
So we get
= 7 + 5.5
= 12.5 cm

(b) From the figure




OB = 2 + 1 = 3 cm
AB = 1 cm
Using Pythagoras theorem
OA = $\sqrt{OB^2 + AB^2}$
Substituting the values
OA = $\sqrt{(3)^2 + (1)^2}$
= $\sqrt{9 + 1}$
= $\sqrt{10}$
So the radius of the circle = $\sqrt{10}$ cm

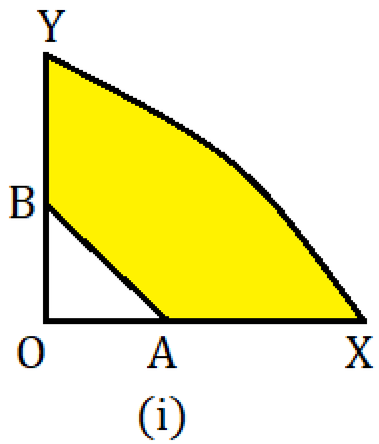
We know that
Area of the circle = $\pi r^2$
Substituting the values
= $3.14 \times (\sqrt{10})^2$
= $3.14 \times 10$
= 31.4 $cm^2$

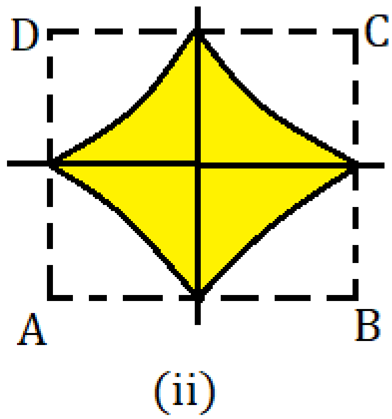
Area of 5 square of side 2 cm each = $2^2 \times 5$
= $4 \times 5$
= 20 $cm^2$

So the area of shaded portion = 31.4 – 20 = 11.4 $cm^2$

**11. (a) In the figure (i) given below, a piece of cardboard in the shape of a quadrant of a circle of radius 7 cm is bounded by the perpendicular radii OX and OY. Points A and B lie on OX and OY respectively such that OA = 3 cm and OB = 4 cm. The triangular part OAB is removed. Calculate the area and the perimeter of the remaining piece.**

**(b) In the figure (ii) given below, ABCD is a square. Points A, B, C and D are centres of quadrants of circles of the same radius. If the area of the shaded portion is 21 3/7 cm$^2$, find the radius of the quadrants.**




**Solution:**

(a) It is given that
Radius of quadrant = 7 cm
OA = 3 cm, OB = 4 cm
AX = 7 – 3 = 4 cm
BY = 7 – 4 = 3 cm
We know that
$AB^2 = OA^2 + OB^2$
Substituting the values
$= 3^2 + 4^2$
= 9 + 16
= 25
So we get
AB = √25 = 5 cm
(i) Area of shaded portion = ¼ $\pi r^2$ – ½ OA × OB
Substituting the values
= ¼ × 22/7 × $7^2$ – ½ × 3 × 4
= ¼ × 22/7 × 49 – 6
By further calculation
= 77/2 – 6
= 65/2
= 32.5 cm$^2$

(ii) Perimeter of shaded portion = ¼ × 2 πr + AX + BY + AB
Substituting the values
= ½ × 22/7 × 7 + 4 + 3 + 5
= 11 + 12
= 23 cm

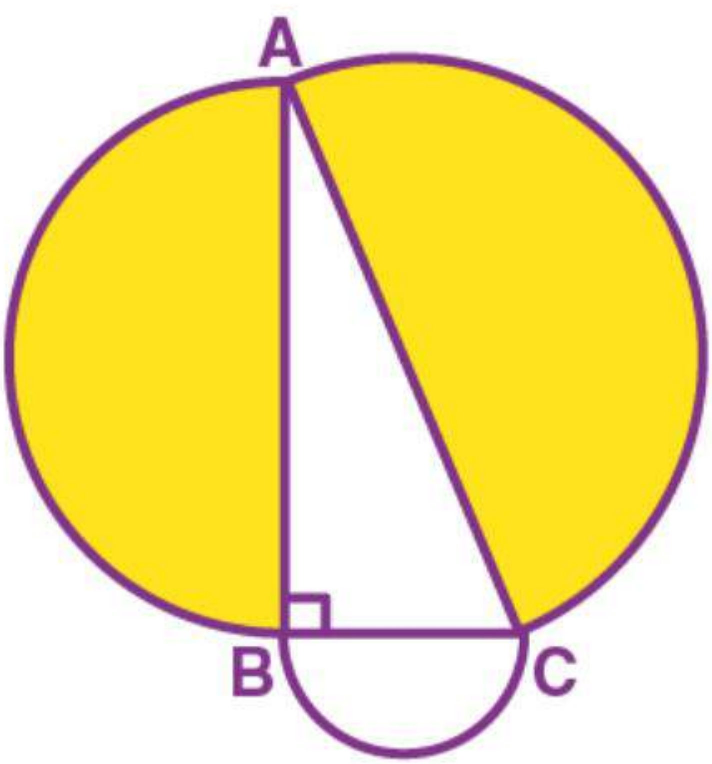
(b) We know that
ABCD is a square with centres A, B, C and D quadrants drawn.
Consider a as the side of the square
Radius of each quadrant = a/2

Here
Area of shaded portion = $a^2 – 4 \times [¼\ \pi(a/2)^2]$
We can write it as
$= a^2 – 4 \times ¼\ \pi\ a^2/4$
Substituting the values
$= a^2 – 22/7 \times a^2/4$
So we get
$= a^2 – 11a^2/14$
$= 3a^2/14$

Here
Area of shaded portion = 21 3/7 = 150/7 $cm^2$
By equating both we get
$3a^2/14 = 150/7$
On further calculation
$a^2 = 150/7 \times 14/3$
$a^2 = 100 = 10^2$
a = 10 cm

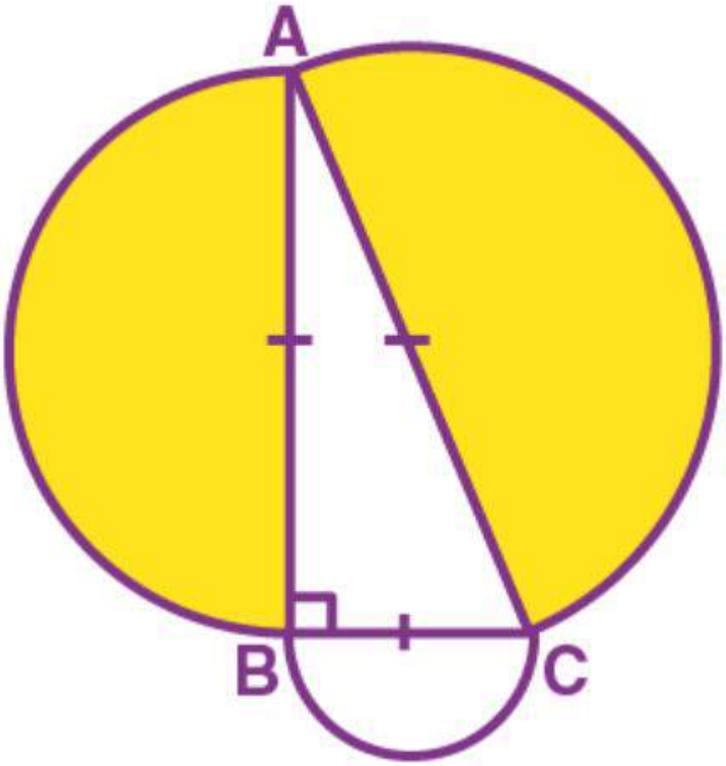
So the radius of each quadrant = a/2 = 10/2 = 5 cm

**12. In the adjoining figure, ABC is a right angled triangle right angled at B. Semicircles are drawn on AB, BC and CA as diameter. Show that the sum of areas of semicircles drawn on AB and BC as diameter is equal to the area of the semicircle drawn on CA as diameter.**




**Solution:**

It is given that
ABC is a right angled triangle right angled at B
Using Pythagoras theorem
$AC^2 = AB^2 + BC^2$ ……(i)




Area of semicircle on AC as diameter = $\frac{1}{2} \pi (AC/2)^2$
So we get
$= \frac{1}{2} \pi \times AC^2/4$
$= \pi AC^2/8$

Area of semicircle on AB as diameter = $\frac{1}{2} \pi (AB/2)^2$
So we get
$= \frac{1}{2} \pi \times AB^2/4$
$= \pi AB^2/8$

Area of semicircle on BC as diameter = $\frac{1}{2} \pi (BC/2)^2$
So we get
$= \frac{1}{2} \pi \times BC^2/4$
$= \pi BC^2/8$

We know that
$\pi AB^2/8 + \pi BC^2/8 = \pi/8 (AB^2 + BC^2)$
From equation (i)
$= \pi/8 (AC^2)$
$= \pi AC^2/8$

Therefore, it is proved.

**13. The length of minute hand of a clock is 14 cm. Find the area swept by the minute hand in 15 minutes.**
**Solution:**

It is given that
Radius of hand = 14 cm
So the area swept in 15 minutes = $\pi r^2 \times 15/60$
By further calculation
= 22/7 × 14 × 14 × ¼
= 154 $cm^2$

**14. Find the radius of a circle if a $90^0$ arc has a length of 3.5 π cm. Hence, find the area of the sector formed by this arc.**
**Solution:**

It is given that
Length of arc of the sector of a circle = 3.5 π cm
Angle at the centre = $90^0$

We know that
Radius of the arc = 3.5 π/2 π × 360/90
So we get
= (3.5 × 4)/2
= 7 cm

Area of the sector = $\pi r^2 \times 90^0/360^0$
By further calculation
= 22/7 × 7 × 7 × ¼
= 77/2
= 38.5 $cm^2$

**15. A cube whose each edge is 28 cm long has a circle of maximum radius on each of its face painted red. Find the total area of the unpainted surface of the cube.**
**Solution:**

It is given that
Edge of cube = 28 cm
Surface area = 6 $a^2$
Substituting the value
= 6 × $(28)^2$
= 6 × 28 × 28
= 4704 $cm^2$

Diameter of each circle = 28 cm
So the radius = 28/2 = 14 cm

We know that
Area of each circle = $\pi r^2$
Substituting the values

= 22/7 × 14 × 14
= 616 $cm^2$

Area of such 6 circles drawn on 6 faces of cube = 616 × 6 = 3696 $cm^2$
Here
Area of remaining portion of the cube = 4704 – 3696 = 1008 $cm^2$

**16. Can a pole 6.5 m long fit into the body of a truck with internal dimensions of 3.5 m, 3 m and 4 m?**
**Solution:**

No, a pole 6.5 m long cannot fit into the body of a truck with internal dimensions of 3.5 m, 3 m and 4 m
Length of pole = 6.5 m
Internal dimensions of truck are 3.5 m, 3 m and 4 m
The internal dimensions are less than the length of pole. So the pole cannot fit into the body of truck with given dimensions.

**17. A car has a petrol tank 40 cm long, 28 cm wide and 25 cm deep. If the fuel consumption of the car averages 13.5 km per litre, how far can the car travel with a full tank of petrol?**
**Solution:**

It is given that
Capacity of car tank = 40 cm × 28 cm × 25 cm = (40 × 28 × 25) $cm^3$
Here 1000 $cm^3$ = 1 litre
So we get
= (40 × 28 × 25)/ 1000 litre
Average of car = 13.5 km per litre

We know that
Distance travelled by car = (40 × 28 × 25)/ 1000 × 13.5
Multiply and divide by 10
= (40 × 25) × 28/ 1000 × 135/10
So we get
= (1 × 28)/ 1 × 135/10
= (14 × 135)/5
= 14 × 27
= 378 km

Therefore, the car can travel 378 km with a full tank of petrol.

**18. An aquarium took 96 minutes to completely fill with water. Water was filling the aquarium at a rate of 25 litres every 2 minutes. Given that the aquarium was 2 m long and 80 cm wide, compute the height of the aquarium.**
**Solution:**

We know that
Water filled in 2 minutes = 25 litres
Water filled in 1 minute = 25/2 litres
Water filled in 96 minutes = 25/2 × 96
= 25 × 48
= 1200 litres

So the capacity of aquarium = 1200 litres ….. (1)

Here
Length of aquarium = 2m = 2 × 100 = 200 cm
Breadth of aquarium = 80 cm
Consider h cm as the height of aquarium
So the capacity of aquarium = 200 × 80 × h $cm^3$
We can write it as
= (200 × 80 × h)/ 1000 litre
= 1/5 × 80 × h litre
= 16 h litre ….. (2)

Using equation (1) and (2)
16h = 1200
So we get
h = 1200 / 16
h = 75 cm

Therefore, height of aquarium = 75 cm.

**19. The lateral surface area of a cuboid is 224 $cm^2$. Its height is 7 cm and the base is a square. Find**
**(i) a side of the square, and**
**(ii) the volume of the cuboid.**
**Solution:**

It is given that
Lateral surface area of a cuboid = 224 $cm^2$
Height of cuboid = 7 cm
Base is square
Consider x cm as the length of cuboid
x cm as the breadth of cuboid (Since the base is square both length and breadth are same)

Here
Lateral surface area = 2 (l + b) × h
Substituting the values
224 = 2 (x + x) × 7
By further calculation
224 = 2 × 2x × 7
224 = 28x
So we get
28x = 224
x = 224/28 = 8 cm

(i) Side of the square = 8 cm

(ii) We know that
Volume of the cuboid = l × b × h
Substituting the values
= 8 × 8 × 7
= 448 $cm^3$

**20. If the volume of a cube is V $m^3$, its surface area is S $m^2$ and the length of a diagonal is d metres, prove that 6√3 V = Sd.**

**Solution:**

We know that

Volume of cube = (V) = $(Side)^3$

Consider a as the side of cube

V = $a^3$ and S = $6a^2$

Diagonal (d) = √3. a

Sd = $6a^2$ × √3a = 6√3$a^3$

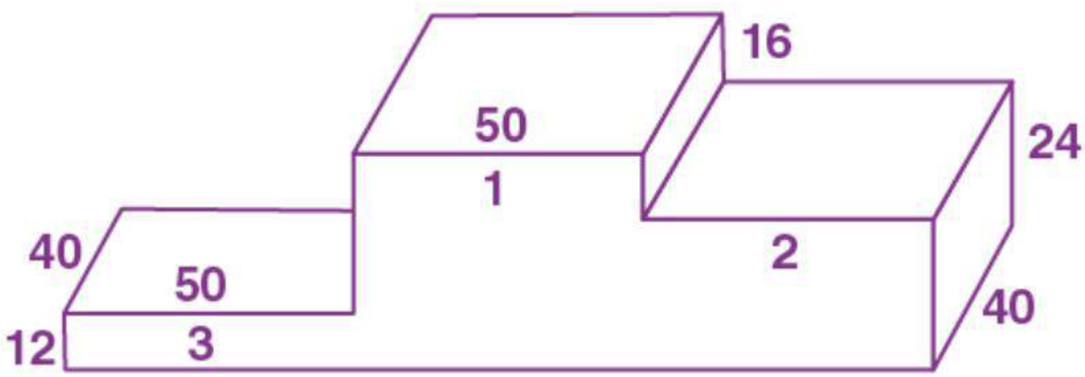
Here V = $a^3$

So we get

Sd = 6√3V

Therefore, 6√3V = Sd.

**21. The adjoining figure shows a victory stand, each face is rectangular. All measurements are in centimetres. Find its volume and surface area (the bottom of the stand is open).**




**Solution:**

Three parts are indicated as 3, 1 and 2 in the figure

We know that

Volume of part (3) = 50 × 40 × 12 = 24000 $cm^3$

Volume of part (1) = 50 × 40 × (16 + 24)

By further calculation

= 50 × 40 × 40

= 80000 $cm^3$

Volume of part (2) = 50 × 40 × 24 = 48000 $cm^3$

So the total volume = 24000 + 8000 + 48000 = 153000 $cm^3$

We know that

Total surface area = Area of front and back + Area of vertical faces + Area of top faces

Substituting the values

$= 2 (50 \times 12 + 50 \times 40 + 50 \times 24)\ cm^2 + (12 \times 40 + 28 \times 40 + 16 \times 40 + 24 \times 40)\ cm^2 + 3 (50 \times 40)\ cm^2$
By further calculation
$= 2 (600 + 2000 + 1200)\ cm^2 + (480 + 1120 + 640 + 960)\ cm^2 + (3 \times 2000)\ cm^2$
$= 2 (3800) + 3200 + 6000\ cm^2$
So we get
= 7600 + 3200 + 6000
$= 16800\ cm^2$

**22. The external dimensions of an open rectangular wooden box are 98 cm by 84 cm by 77 cm. If the wood is 2 cm thick all around, find**
**(i) the capacity of the box**
**(ii) the volume of the wood used in making the box, and**
**(iii) the weight of the box in kilograms correct to one decimal place, given that 1 $cm^3$ of wood weighs 0.8 g.**
**Solution:**

It is given that
External dimensions of open rectangular wooden box = 98 cm, 84 cm and 77 cm
Thickness = 2 cm
So the internal dimensions of open rectangular wooden box = (98 – 2 × 2) cm, (84 – 2 × 2) cm and (77 – 2) cm
= (98 – 4) cm, (84 – 4) cm, 75 cm
= 94 cm, 80 cm, 75 cm

(i) We know that
Capacity of the box = 94 cm × 80 cm × 75 cm
$= 564000\ cm^3$

(ii) Internal volume of box $= 564000\ cm^3$
External volume of box $= 98\ cm \times 84\ cm \times 77\ cm = 633864\ cm^3$
So the volume of wood used in making the box $= 633864 - 564000 = 69864\ cm^3$

(iii) Weight of 1 $cm^3$ wood = 0.8 gm
So the weight of 69864 $cm^3$ wood = 0.8 × 69864 gm
By further calculation
= (0.8 × 69864)/ 1000 kg
= 55891.2/1000 kg
= 55.9 kg (correct to one decimal place)

**23. A cuboidal block of metal has dimensions 36 cm by 32 cm by 0.25 m. It is melted and recast into cubes with an edge of 4 cm.**
**(i) How many such cubes can be made?**
**(ii) What is the cost of silver coating the surfaces of the cubes at the rate of ₹ 1.25 per square centimetre?**
**Solution:**

It is given that
Dimensions of cuboidal block = 36 cm, 32 cm and 0.25 m
We can write it as
= 36 cm × 32 cm × (0.25 × 100) cm
$= (36 \times 32 \times 25)\ cm^3$
Volume of cube having edge 4 cm $= 4 \times 4 \times 4 = 64\ cm^3$

(i) We know that
Number of cubes = Volume of cuboidal block/ Volume of one cube
Substituting the values
$= (36 \times 32 \times 25)/ 64$
$= (36 \times 25)/ 2$
So we get
$= 18 \times 25$
$= 250$

(ii) Here
Total surface area of one cube $= 6(a)^2$
Substituting the values
$= 6 (4)^2$
$= 6 \times 4 \times 4$
$= 96\ cm^2$
So the total surface area of 450 cubes $= 450 \times 96 = 43200\ cm^2$

Given
Cost of silver coating the surface for $1\ cm^2$ = ₹ 1.25
Cost of silver coating the surface for $43200\ cm^2 = 43200 \times 1.25$ = ₹ 54000

**24. Three cubes of silver with edges 3 cm, 4 cm and 5 cm are melted and recast into a single cube. Find the cost of coating the surface of the new cube with gold at the rate of ₹ 3.50 per square centimetre.**
**Solution:**

We know that
Volume of first cube = $edge^3$
Substituting the values
$= (3\ cm)^3$
$= 3 \times 3 \times 3$
$= 27\ cm^3$

Volume of second cube = $edge^3$
Substituting the values
$= (4\ cm)^3$
$= 4 \times 4 \times 4$
$= 64\ cm^3$

Volume of third cube = $edge^3$
Substituting the values
$= (5\ cm)^3$
$= 5 \times 5 \times 5$
$= 125\ cm^3$
So the total volume $= 27 + 64 + 125 = 216\ cm^3$

Make new cube whose volume $= 216\ cm^3$
So we get
$Edge^3 = 216\ cm^3$
$Edge^3 = (6\ cm)^3$
Edge = 6 cm

Surface area of new cube = 6 $(\text{edge})^2$
Substituting the values
= 6 $(6)^2$
= 6 × 6 × 6
= 216 $cm^2$

Given
Cost of coating the surface for 1 $cm^2$ = ₹ 3.50
So the cost of coating the surface for 216 $cm^2$ = 3.50 × 216 = ₹ 756