

Chapter 19. Mensuration I

Ex 19.1

Answer 4.

$$\text{Circumference} = 396 \text{ m}$$

$$2\pi r = 396$$

$$2 \times \frac{22}{7} \times r = 396 \text{ m}$$

$$r = 396 \text{ m} \times \frac{7}{22} \times \frac{1}{2}$$

$$r = 63 \text{ m}$$

$$\text{Area} = \pi r^2$$

$$= \frac{22}{7} \times 63 \times 63$$

$$= 12474 \text{ m}^2$$

$$\text{Area of the circular field} = 12474 \text{ m}^2$$

Answer 5.

$$\text{Area} = \pi r^2$$

$$\pi r^2 = 81\pi$$

$$r^2 = 81$$

$$r = 9 \text{ cm}$$

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

$$= 2 \times \pi \times 9$$

$$= 18\pi \text{ cm}$$

$$\text{Circumference} = 18\pi \text{ cm}$$

Answer 6.

Diameter of the wheel = 1.4 m

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

$$\begin{aligned} &= \frac{22}{7} \times 1.4 \\ &= 4.4\text{m} \end{aligned}$$

$$\text{Circumference} = 8.8 \text{ m}$$

$$\text{Distance travelled} = 2.2 \text{ km} = 2200 \text{ m}$$

$$\text{No. of revolutions} =$$

$$\begin{aligned} &= \frac{2200}{4.4} \\ &= 500 \end{aligned}$$

Wheel makes 500 revolutions in travelling 2.2 km

Answer 7.

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

$$\begin{aligned} &= \frac{22}{7} \times 70 \\ &= 220\text{cm} = 2.2\text{m} \end{aligned}$$

$$\text{Circumference} = 2.2 \text{ m}$$

$$\text{No. of revolutions} = 10 \text{ per second}$$

$$\text{No. of revolutions per hour} = 10 \times 60 \times 60 = 36000$$

$$\text{Distance covered in one hour} = 36000 \times 2.2 = 79200\text{m / hour}$$

$$\text{Speed of the car in km/hour} = \frac{79200}{1000} = 79.2\text{km / hour}$$

$$\text{Speed} = 79.2 \text{ km/hr}$$

Answer 8.

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

$$= \frac{22}{7} \times 140$$

$$= 440\text{cm} = 4.4\text{m}$$

$$\text{Circumference} = 4.4 \text{ m}$$

$$\text{Distance travelled in one hour} = 66\text{km} = 66000\text{m}$$

$$\text{Distance travelled in one minute} = \frac{66000}{60} = 1100\text{m}$$

$$\text{No. of revolutions in one minute} =$$

$$\frac{\text{Distance}}{\text{circumference}}$$

$$= \frac{1100}{4.4}$$

$$= 250$$

$$\text{No. of revolutions made by each wheel} = 250 \text{ rpm.}$$

Answer 9.

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

$$= \frac{22}{7} \times 42$$

$$= 132\text{cm} = 1.32\text{m}$$

$$\text{Circumference} = 1.32\text{m}$$

$$\text{No. of revolutions} = 9 \text{ per second}$$

$$\text{No. of revolutions per hour} = 9 \times 60 \times 60 = 32400$$

$$\text{Distance covered in one hour} = 32400 \times 1.32 = 42768\text{m/hour}$$

$$\text{Speed of the wheel in km/hour} =$$

$$\frac{42768}{1000} = 42.768\text{km/hour} = 43\text{km/hr}$$

$$\text{Speed} = 43 \text{ km/hr}$$

Answer 10.

Diameter of the wheel = 35 cm

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

$$\begin{aligned} &= \frac{22}{7} \times 35 \\ &= 110\text{cm} \end{aligned}$$

$$\text{Circumference} = 110 \text{ cm}$$

$$\text{Time taken by the bucket} = 2 \text{ min.} = 2 \times 60 = 120 \text{ seconds}$$

$$\text{Speed of the rope} = 1.1 \text{ m/s}$$

$$\text{Length of the rope} = 120 \times 1.1 = 132\text{m}$$

$$\text{No. of revolutions} = \frac{132 \times 100}{110} = 120$$

$$\text{No. of revolutions made by rope} = 120$$

Answer 11.

$$\text{Circumference} = 280 \text{ cm} = 2.8\text{m}$$

$$\text{Distance travelled} = 490 \text{ m}$$

$$\text{No. of revolutions} = \frac{490}{2.8} = 175$$

$$\text{Roller takes 175 revolutions in moving 490 m}$$

Answer 12.

$$\text{Diameter} = 4\frac{5}{11} \text{ cm} = \frac{49}{11} \text{ cm}$$

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

$$\begin{aligned} &= \frac{22}{7} \times \frac{49}{11} \\ &= 14 \text{ cm} \end{aligned}$$

$$\text{Circumference} = 14 \text{ cm} = 0.14 \text{ m}$$

$$\text{Distance travelled} = 6.3 \text{ km} = 6300 \text{ m}$$

$$\text{No. of revolutions} = \frac{6300}{0.14} = 45000$$

Wheel takes 45000 revolutions in moving 6.3 km

Answer 13.

Let r cm be the radius of inner circle.

$$\text{Radius of outer circle} = (r+1) \text{ cm}$$

$$\text{Area of circular ring} = \text{Area of outer circle} - \text{area of inner circle}$$

$$\Rightarrow \pi(r+1)^2 - \pi r^2 = 88$$

$$\Rightarrow \pi(r^2 + 2r + 1) - \pi r^2 = 88$$

$$\Rightarrow \pi r^2 + 2\pi r + \pi - \pi r^2 = 88$$

$$\Rightarrow \frac{22}{7}(2r + 1) = 88$$

$$\Rightarrow 2r + 1 = 88 \times \frac{7}{22}$$

$$\Rightarrow 2r + 1 = 28$$

$$\Rightarrow 2r = 27$$

$$\Rightarrow r = \frac{27}{2} = 13.5 \text{ cm}$$

$$(r+1) = 13.5 + 1 = 14.5 \text{ cm}$$

Therefore, radii are 13.5 cm and 14.5 cm.

Answer 14.

Area between two concentric circles = Area of larger circle – area of smaller circle

$$\text{Area of circle} = \pi r^2$$

$$\text{Radius of bigger circle} = r_1 = 13 \text{ cm}$$

$$\text{Radius of smaller circle} = r_2 = 6 \text{ cm}$$

$$\text{Required Area} = \pi r_1^2 - \pi r_2^2$$

$$\begin{aligned} &= \left(\frac{22}{7} \times 13 \times 13 \right) - \left(\frac{22}{7} \times 6 \times 6 \right) \\ &= 531.1429 - 113.1429 \\ &= 418 \text{ cm}^2 \end{aligned}$$

$$\text{Hence, required area} = 418 \text{ cm}^2$$

Answer 16.

$$\text{Area of the square} = 484 \text{ cm}^2$$

$$\text{Side of the square} = \sqrt{484} = 22 \text{ cm}$$

$$\text{Perimeter of the square} = 4 \times 22 = 88 \text{ cm}$$

$$\text{Perimeter of square} = \text{perimeter of circle}$$

$$2\pi r = 88$$

$$r = 88 \times \frac{7}{22} \times \frac{1}{2}$$

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

$$\text{Radius of circle} = 14 \text{ cm}$$

$$\text{Area of circle} = \pi r^2$$

$$\begin{aligned} &= \frac{22}{7} \times 14 \times 14 \\ &= 616 \text{ cm}^2 \end{aligned}$$

$$\text{Hence, area of the circle} = 616 \text{ cm}^2$$

Answer 17.

$$\text{Area of equilateral triangle} = 121\sqrt{3}\text{ cm}^2$$

$$\Rightarrow \frac{s^2\sqrt{3}}{4} = 121\sqrt{3}$$

$$\Rightarrow s^2 = 484$$

$$\Rightarrow s = 22\text{ cm}$$

$$\text{Side of the triangle} = 22\text{ cm}$$

$$\text{Perimeter of the triangle} = 3 \times 22 = 66\text{ cm}$$

$$\text{Perimeter of the circle} = \text{perimeter of the triangle}$$

$$\Rightarrow 2\pi r = 66$$

$$\Rightarrow r = 66 \times \frac{7}{22} \times \frac{1}{2}$$

$$\Rightarrow r = 10.5\text{ cm}$$

$$\text{Radius of circle} = 10.5\text{ cm}$$

$$\text{Area of circle} = \pi r^2$$

$$= \frac{22}{7} \times 10.5 \times 10.5$$

$$= 346.5\text{ cm}^2$$

$$\text{Hence, area of the circle} = 346.5\text{ cm}^2$$

Answer 18.

Area of the circle with radius 7 cm = πr^2

$$\begin{aligned} &= \frac{22}{7} \times 7 \times 7 \\ &= 154 \text{ cm}^2 \end{aligned}$$

Area of new circle = 25 x area of the circle with radius 7 cm

$$\begin{aligned} &= 25 \times 154 \text{ cm}^2 \\ &= 3850 \text{ cm}^2 \end{aligned}$$

Therefore,

$$\begin{aligned} \pi R^2 &= 3850 \\ R^2 &= 3850 \times \frac{7}{22} \\ R^2 &= 1225 \\ R &= 35 \text{ cm} \end{aligned}$$

Radius of new circle = 35 cm

Circumference of new circle = $2\pi R$

$$\begin{aligned} &= 2 \times \frac{22}{7} \times 35 \\ &= 220 \text{ cm} \end{aligned}$$

Hence, Circumference of new circle = 220 cm

Answer 19.

$$\text{Area of the square} = 484 \text{ m}^2$$

$$\text{Side of the square} = \sqrt{484} = 22\text{m}$$

$$\text{Perimeter of the square} = 4 \times 22 = 88\text{m}$$

$$\text{Perimeter of square} = \text{circumference of circle}$$

$$2\pi r = 88$$

$$r = 88 \times \frac{7}{22} \times \frac{1}{2}$$

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

$$\text{Radius of circle} = 14 \text{ m}$$

$$\text{Area of circle} = \pi r^2$$

$$= \frac{22}{7} \times 14 \times 14$$

$$= 616\text{m}^2$$

$$\text{Hence, area of the circle} = 616 \text{ m}^2$$

Answer 20.

Radius of the circle = 42 cm

Area of the circle = πr^2

$$\begin{aligned} &= \frac{22}{7} \times 42 \times 42 \\ &= 5544 \text{ cm}^2 \end{aligned}$$

Area of the circle = 5544 cm²

Circumference of the circle = $2\pi r$

$$\begin{aligned} &= 2 \times \frac{22}{7} \times 42 \\ &= 264 \text{ cm} \end{aligned}$$

Perimeter of the square = Circumference of the circle = 264 cm

$$4 \times \text{side} = 264$$

$$\text{side} = \frac{264}{4} = 66 \text{ cm}$$

Side of square = 66 cm

Area of square = side² = 66 × 66 = 4356 cm²

Area of the circle : Area of square = $\frac{5544}{4356} = \frac{14}{11}$

Side of square = 66 cm

Area of the circle : Area of square = 14 : 11

Answer 21.

$$\text{Area of garden} = 5544 \text{ m}^2$$

Radius of circular garden =

$$\pi r^2 = 5544$$

$$r^2 = 5544 \times \frac{7}{22}$$

$$r^2 = 1764$$

$$r = 42 \text{ m}$$

Radius of circular garden = 42 m

Radius of garden with surrounding road = $R = 42 + 7 \text{ m} = 49 \text{ m}$

Area of garden with surrounding road = πR^2

$$= \frac{22}{7} \times 49 \times 49$$

$$= 7546 \text{ m}^2$$

Area of garden with surrounding road = 7546 m²

Area of road = Area of garden with surrounding road – area of garden

$$= 7546 - 5544 \text{ m}^2$$

$$= 2002 \text{ m}^2$$

Area of road = 2002 m²

Cost of tarring one sq m = Rs. 150

Cost of tarring area of road = Rs. (150 × 2002) = Rs 3,00,300

Cost of tarring the road = Rs. 3,00,300

Answer 22.

Circumference of the plot = 176 m

Radius of the circular plot =

$$2\pi r = 176$$

$$r = 176 \times \frac{7}{22} \times \frac{1}{2}$$

$$r = 28\text{m}$$

Radius of circular plot = 28 m

Area of circular plot = πr^2

$$= \frac{22}{7} \times 28 \times 28$$

$$= 2464\text{m}^2$$

Area of circular plot = 2464 m²

Radius of circular plot with surrounding road = $R = (28 + 4.2) \text{ m} = 32.2 \text{ m}$

Area of circular plot with surrounding road = πR^2

$$= \frac{22}{7} \times 32.2 \times 32.2$$

$$= 3258.64\text{m}^2$$

Area of circular plot with surrounding road = 3258.64 m²

Area of road = Area of circular plot with surrounding road - Area of circular plot

$$= (3258.64 - 2464) \text{ m}^2$$

$$= 794.64 \text{ m}^2$$

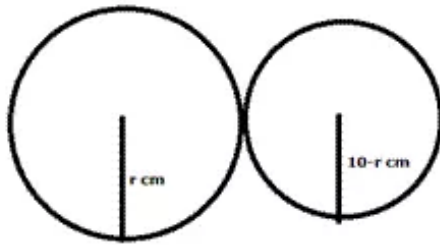
Area of road = 794.64 m²

Cost of paving one sq m = Rs. 75

Cost of paving the road = Rs (75 x 794.64) = Rs. 59,598

Cost of paving the road = Rs. 59,598

Answer 23.



Let r be radius of one circle, so the radius of other circle is $(10-r)$

Sum of the areas = $\pi r^2 + \pi(10-r)^2$

$$\Rightarrow \pi r^2 + \pi(10-r)^2 = 58\pi$$

$$\Rightarrow \pi r^2 + \pi(100 - 20r + r^2) = 58\pi$$

$$\Rightarrow r^2 + 100 - 20r + r^2 = 58$$

$$\Rightarrow 2r^2 + 100 - 20r - 58 = 0$$

$$\Rightarrow 2r^2 - 20r + 42 = 0$$

$$\Rightarrow r^2 - 10r + 21 = 0$$

$$\Rightarrow (r-7)(r-3) = 0$$

$$\Rightarrow r = 7, r = 3$$

Therefore, radii of the two circles is 7cm and 3 cm

Answer 24.

Sum of the diameters = 112 cm

$$\text{Therefore, sum of the radii} = \frac{112}{2} \text{ cm} = 56 \text{ cm}$$

If r is the radius of one circle, radius of other circle is $(56-r)$

$$\text{Sum of the areas} = \pi r^2 + \pi(56-r)^2$$

$$\Rightarrow \pi r^2 + \pi(56-r)^2 = 5236$$

$$\Rightarrow \pi r^2 + \pi(3136 - 112r + r^2) = 5236$$

$$\Rightarrow (r^2 + 3136 - 112r + r^2) \times \frac{22}{7} = 5236$$

$$\Rightarrow 2r^2 - 112r + 3136 = 1666$$

$$\Rightarrow 2r^2 - 112r + 3136 - 1666 = 0$$

$$\Rightarrow 2r^2 - 112r + 1470 = 0$$

$$\Rightarrow r^2 - 56r + 735 = 0$$

$$\Rightarrow (r - 35)(r - 21) = 0$$

$$\Rightarrow r = 35, r = 21$$

Therefore, radii of the two circles is 35 cm and 21 cm

Answer 25.

The sum of the radii = 10.5 cm

$$r_1 + r_2 = 10.5 \text{ cm} \dots\dots\dots(i)$$

The difference of circumferences = 13.2 cm

$$2\pi(r_1 - r_2) = 13.2$$

$$r_1 - r_2 = \frac{13.2}{2\pi}$$

$$r_1 - r_2 = \frac{13.2 \times 7}{2 \times 22}$$

$$r_1 - r_2 = 2.1 \dots\dots\dots(ii)$$

Adding (i) and (ii)

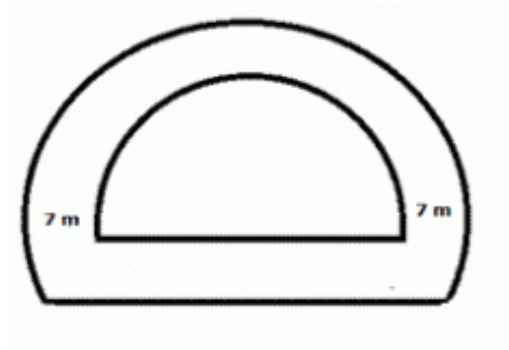
$$2r_1 = 12.6$$

$$r_1 = 6.3 \text{ cm}$$

$$\text{Therefore, } r_2 = (10.5 - 6.3) \text{ cm} = 4.2 \text{ cm}$$

Hence, the two radii are 6.3 cm and 4.2 cm

Answer 26.



Diameter of the inner semi-circle = 42 m

Hence, radius of the inner semi-circle = $r = 21$ m

Width of the flower bed = 7 m

Diameter of the outer semi-circle = $(42 + 2 \times 7)$ m = 56 m

Hence, radius of the outer semi-circle = $R = 28$ m

Area of the semicircular flower bed = Area of outer semi-circle – area of inner semi-circle

$$\begin{aligned} &= \frac{1}{2} \pi R^2 - \frac{1}{2} \pi r^2 \\ &= \frac{1}{2} \pi (R^2 - r^2) \\ &= \frac{1}{2} \times \frac{22}{7} \times (28^2 - 21^2) \\ &= \frac{1}{2} \times \frac{22}{7} \times (784 - 441) \\ &= \frac{1}{2} \times \frac{22}{7} \times 343 \\ &= 539 \text{ m}^2 \end{aligned}$$

Answer 27.

Radius of innermost circle = $r_1 = 6.3$ cm

Radius of central circle = $r_2 = 8.4$ cm

$$\begin{aligned}\text{Area between two inner circles} &= \pi r_2^2 - \pi r_1^2 \\ &= \pi(8.4)^2 - \pi(6.3)^2 \\ &= 70.56\pi - 39.69\pi \dots\dots\dots(i) \\ &= 221.76 - 124.74 \\ &= 97.02\text{cm}^2\end{aligned}$$

Area between two inner circles = 97.02 cm^2

Let radius of third circle be r

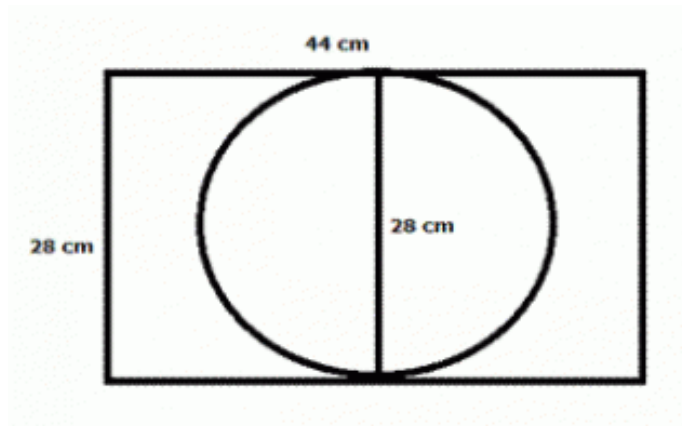
$$\begin{aligned}\text{Area between next two circles} &= \pi r^2 - \pi r_2^2 \\ &= \pi r^2 - \pi(8.4)^2 \\ &= \pi r^2 - 70.56\pi \dots\dots\dots(ii)\end{aligned}$$

Given that (i) and (ii) are equal

$$\begin{aligned}\Rightarrow \pi r^2 - 70.56\pi &= 70.56\pi - 39.69\pi \\ \Rightarrow r^2 - 70.56 &= 70.56 - 39.69 \\ \Rightarrow r^2 &= 70.56 - 39.69 + 70.56 \\ \Rightarrow r^2 &= 101.43 \\ \Rightarrow r &= 10.07\text{cm}\end{aligned}$$

Therefore, radius of third circle is 10.07 cm

Answer 28.



$$\text{Area of piece of paper} = 44 \times 28 = 1232 \text{ cm}^2$$

The biggest circle that can be cut from rectangular piece of paper is of diameter 28 cm (ie. Radius 14 cm).

$$\text{Area of circle} = \pi r^2$$

$$= \frac{22}{7} \times 14 \times 14$$
$$= 616 \text{ cm}^2$$

$$\text{Area of the circle} = 616 \text{ cm}^2$$

$$\text{Area of paper left} = \text{area of paper} - \text{area of circle}$$

$$= (1232 - 616) \text{ cm}^2$$

$$= 616 \text{ cm}^2$$

$$\text{Therefore, area of paper left} = 616 \text{ cm}^2$$

Answer 30.

An equilateral triangle has all angles of 60 degrees

The horse will be able to graze over a sector of a circle of radius 21cm and angle 60, so

$$\text{Area} = \frac{60^\circ}{360^\circ} \pi r^2$$
$$= \frac{60^\circ}{360^\circ} \times \frac{22}{7} \times 21 \times 21$$
$$= 231 \text{ m}^2$$

$$\text{Horse can graze in } 231 \text{ m}^2$$