RACE # 08 MATHEMATICS

TIME : 30 Min. M.M. : 24

READ THE FOLLOWING THEOREMS :

MENSURATION

- For a goemetrical figure, plane or solid :
  Perimeter is the length of its boundary and its unit is the same as that of length. **Area** is the measure of the surface enclosed by its boundary. Its unit is square units.
  Volume of a solid is the measure of the part of space occupied by it. Its unit is cubic units.

(i) Triangles :

- Considering the base as 'b'
  Corresponding altitude as 'h'

$$\text{Area} = \frac{1}{2} \times b \times h$$

$$\text{Longest Altitude} = \frac{2 \times \text{Area}}{\text{Shortest Base}} \quad \text{Shortest Altitude} = \frac{2 \times \text{Area}}{\text{Longest Base}}$$

- **Heron's Formula :**
  If a, b, c are the sides of a triangle

$$\text{Area} = \sqrt{S(S-a)(S-b)(S-c)} \qquad \text{where} \qquad S = \frac{a+b+c}{2}$$

- If 'a' is a side of an equilateral triangle,

$$\text{Area} = \frac{\sqrt{3}a^2}{4} \qquad \text{Altitude} = \frac{\sqrt{3}a}{2}$$

- If 'a' is the measure of the equal sides and 'b' the third side of an isosceles triangle,

$$\text{Area} = \frac{1}{4} b\sqrt{4a^2 - b^2} \qquad \text{Altitude} = \frac{\sqrt{4a^2 - b^2}}{2}$$

Perimeter in all cases is the sum of the three sides

(ii) Quadrilaterals :

Rectangle :

If 'ℓ', 'b', 'd' are the length, breadth and diagonal, then

$\text{Area} = \ell \times b$ $\qquad$ $\text{Perimeter} = 2(\ell + b)$ $\qquad$ $d = \sqrt{\ell^2 + b^2}$

- **Square :**
  If each side is 'a'

$\text{Area} = a^2$ $\qquad$ $\text{Perimeter} = 4a$ $\qquad$ $\text{Diagonal (d)} = \sqrt{2}a$ $\qquad$ $\text{Area} = \frac{d^2}{2}$

- **General Quadrilateral :**

In any general quadrilateral ABCD if diagonal AC = d
perpendiculars from B and D to AC are h_1 and h_2, then

$$\text{Area} = \frac{1}{2} d\left(h_1 + h_2\right)$$

- **Rhombus :**
  If the diagonals are d_1, d_2 and each side 'a', then

$$\text{Area} = \frac{1}{2} d_1 \times d_2 \qquad a^2 = \left(\frac{d_1}{2}\right)^2 + \left(\frac{d_2}{2}\right)^2$$

- **Note :**
  For any quadrilateral whose diagonals d_1 and d_2 are perpendicular to each other,

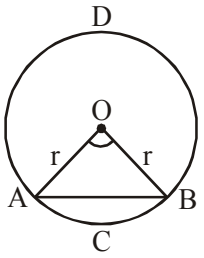
$$\text{Area} = \frac{1}{2} d_1 \times d_2$$

- **Parallelogram :**
  If 'b' any side and 'h' the corresponding altitude
  Area = b × h
- **Trapezium :**
  If the parallel sides are a and b and the distance between them h,

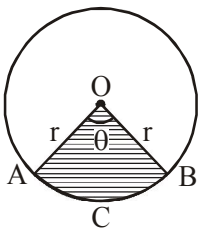
$$\text{Area} = \frac{1}{2}(a + b)h$$

10 CIRCLE, SECTOR AND SEGMENT :

(i) **Let in a circle of centre O**
radius = r AB a chord
∠AOB = θ (the angle subtended by arc ACB at the centre)
OACBO the minor sector,
ACB the minor segment,
BDAB the major segment.



- Circumference of the circle = $2\pi r$
- Area of the circle = πr^2
- Perimeter of semi-circle = $\pi r + 2r$
- Length of arc ACB$\left(\overset{\frown}{ABC}\right) = \ell = r\theta$
  where θ is in radian



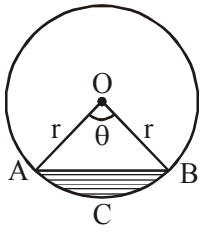
- Area of sector OACBO = $\frac{1}{2} r^2\theta$

[Area of sector OACBO may also be : $\frac{1}{2} r^2\theta = \frac{1}{2} r\theta \,.\, r = \frac{1}{2} \ell.r$]

- Perimeter of sector OACBO = OA = OB + Arc ACB =
  $r + r + r\theta = 2r + r\theta$

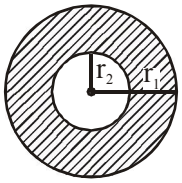
- Area of the minor segment ACBA = Area of sector OACBO – Area of ΔOAB

$$= \left[\frac{1}{2}r^2\theta - \frac{1}{2}r^2\sin\theta\right]$$



- Area of the major segment ABDA = Area of the circle – Area of minor segment ACBA.

(ii) Ring :



Part of the plane between two concentric circles of different radii (r_1 and r_2 where $r_1 > r_2$),

Area of Ring = $\pi r_1^2 - \pi r_2^2 = \pi(r_1 + r_2)(r_1 - r_2)$

(iii) If two circles of radii r_1 and r_2 with $r_1 > r_2$ touch each other

- Externally, the distance between their centres = $(r_1 + r_2)$
- Internally, the distance betweeen their centres = $(r_1 - r_2)$

(iv) In the case of rotating wheels

- Distance moved by a wheel is one rotation is the circumference of the wheel,
- Number of rotation = $\dfrac{\text{Distance Travelled}}{\text{Circumference of the wheel}}$

(v) Rotation of the hands of a clock :

- Angle described by the minute hand of a clock in 1 hour (60 minute) i.e. one rotation = 360°.
- Angle described by the hour hand of a clock in 12 hours (i.e. one rotation) = 360°.

ANSWER THE FOLLOWING QUESTIONS :

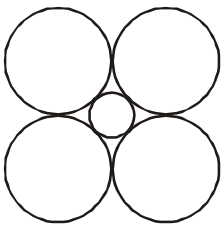
1. The area of a rhombus is 2016 sq cm and its side is 65 cm. The lengths of the diagonals (in cm) are

(A) 125,35 (B) 126,32 (C) 132,26 (D) 135,25

2. A square and an equilateral triangle have the same perimeter. If the diagonal of the square is $12\sqrt{2}$ cm, then the area of the triangle is

(A) $24\sqrt{3}$ cm^2 (B) $24\sqrt{2}$ cm^2 (C) $64\sqrt{3}$ cm^2 (D) $32\sqrt{3}$ cm^2

3. In the figure, when the outer circles all have radii 'r', then the radius of the inner circle will be

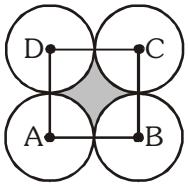


(A) $\sqrt{2}$ r (B) $(\sqrt{2} - 1)$r (C) $\dfrac{1}{\sqrt{2}r}$ (D) $\dfrac{2}{(\sqrt{2}+1)r}$

4. A wire is in the form of a circle of radius 35 cm. If it is bent into the shape of a rhombus, what is the side of the rhombus?
(A) 32 cm (B) 70 cm (C) 55 cm (D) 17 cm

5. There are two concentric circles whose areas are in the ratio of 9 : 16 and the difference between their diameters is 4 cm. What is the area of the outer circle?
(A) 32π cm^2 (B) 64π cm^2 (C) 36π cm^2 (D) 48π cm^2

6. ABCD is a square, four equal circles are just touching each other whose centres are the vertices A, B, C, D of the square. What is the ratio of the shaded to the unshaded area within square?



(A) $\frac{8}{11}$ (B) $\frac{3}{11}$ (C) $\frac{5}{11}$ (D) $\frac{6}{11}$

RACE # 07 **MATHEMATICS**

SECTION-I	Q.	1	2	3	4	5	6
	A.	C	B	B	B	B	A