## Topic
Area of a Circle (by Coiling Method)

Objective
To obtain the formula for area of a circle i.e., πr^2 by coiling method.

Previous Knowledge Required
1. **Definition of the circle:** A circle is the locus of a point in a plane that moves in such a way that its distance from a fixed point remains constant. Fixed point is known as the Centre and the fixed distance is known as the radius of the circle.

fixed
point O
(Centre)

fixed distance
OA(radius)
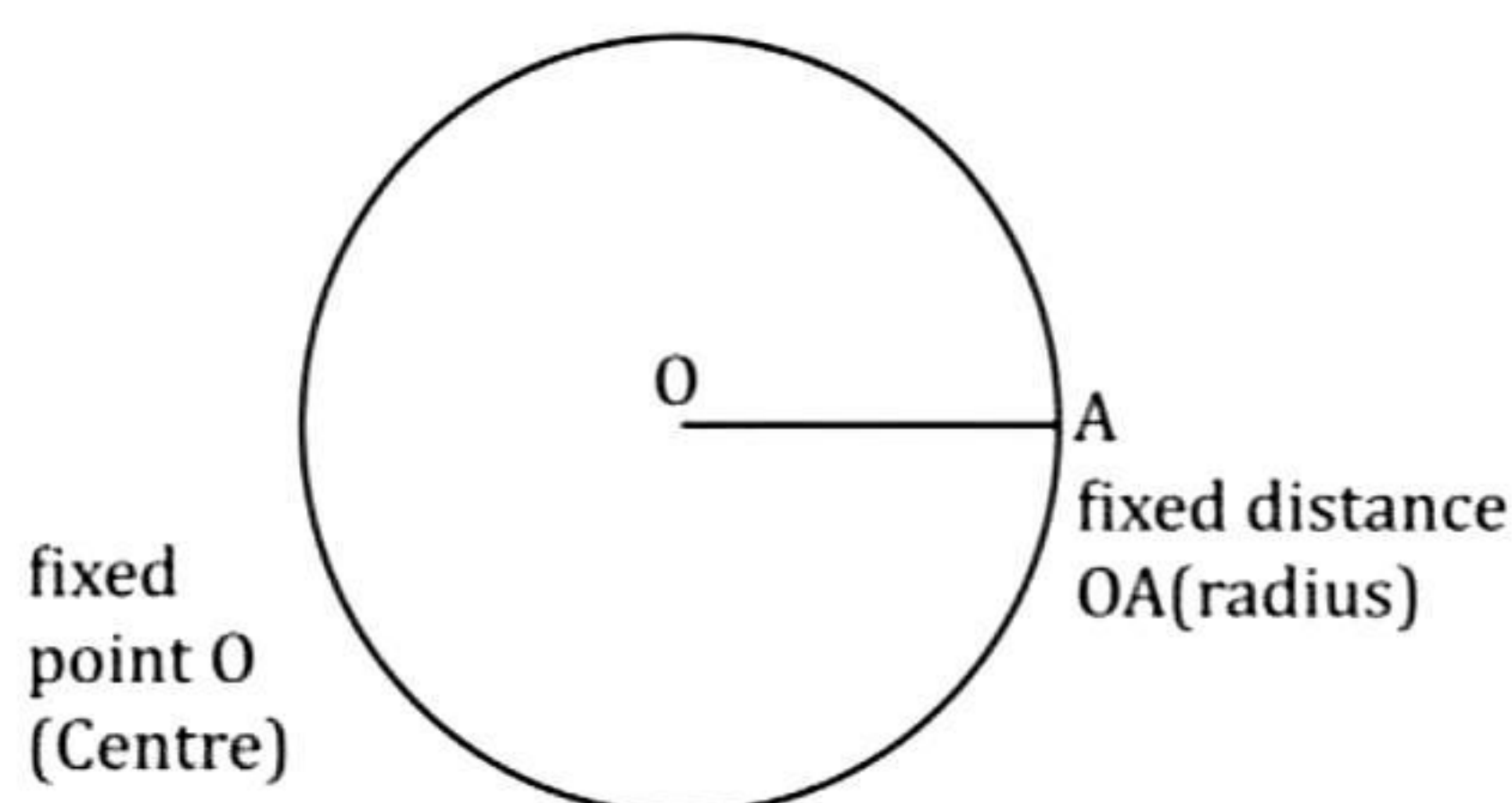
2. **Area of the circle:** It is the measure of the region of a plane enclosed by it.
3. **Circumference of the circle:** Total length of its boundary
   ($C = 2\pi r$, where r is the radius of the circle)
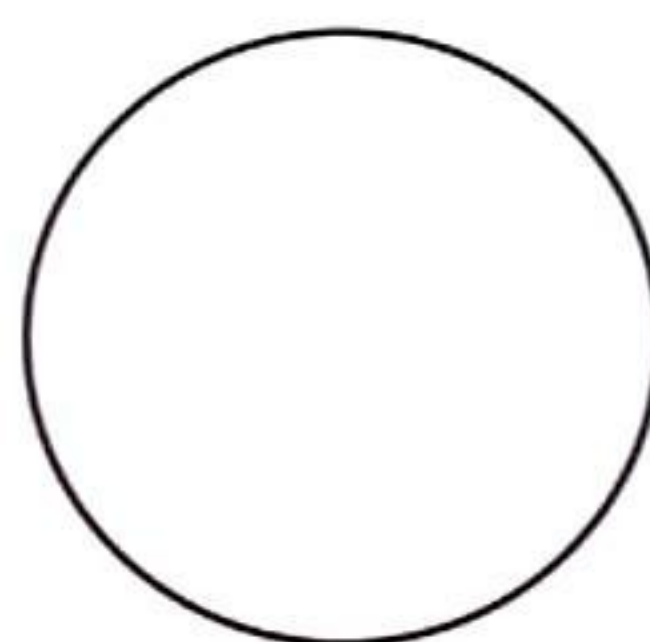
Circumference

4. **Area of a triangle:** $\frac{1}{2} \times$ Base $\times$ Height
5. **Concentric circles:** Circles having the same Centre.

Material Required
Thick string or coloured threads, cutter, a pair of scissors, fevicol, geometry box.

Procedure

1. Construct a circle of radius r, (take r = 3.5 cm) using a compass and draw concentric circles of smaller radius as shown in Fig.(i)
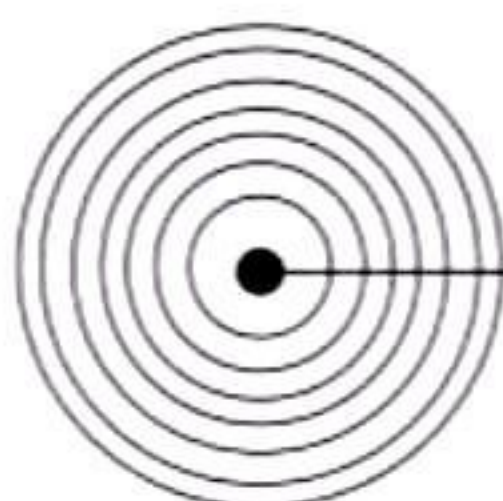

Fig. (i)

2. Fill the area of the drawn circle with concentric circles made of different coloured strings or thread, so that there is no gap between the threads as shown in Fig.(ii).
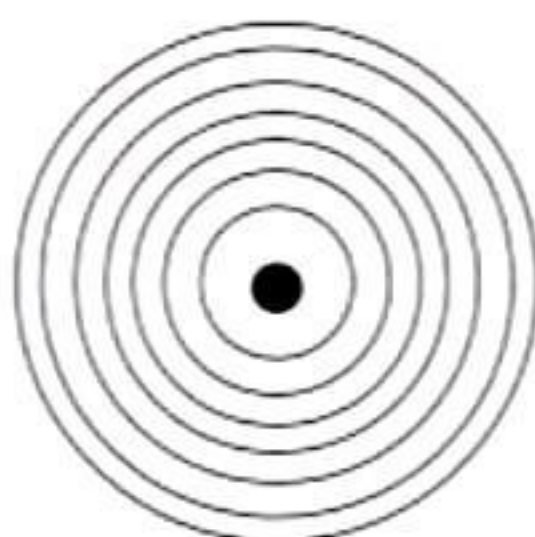

Fig. (ii)

3. Last smallest circle be a point circle.
4. With the help of scissors, cut the coloured circular threads along the radius OA.
5. Open all the threads and arrange each thread as a straight line.
6. Place each thread one over another starting from the thread of the largest circle to the smallest circle in such a way that it forms a triangular shape as shown in Fig.(iii).
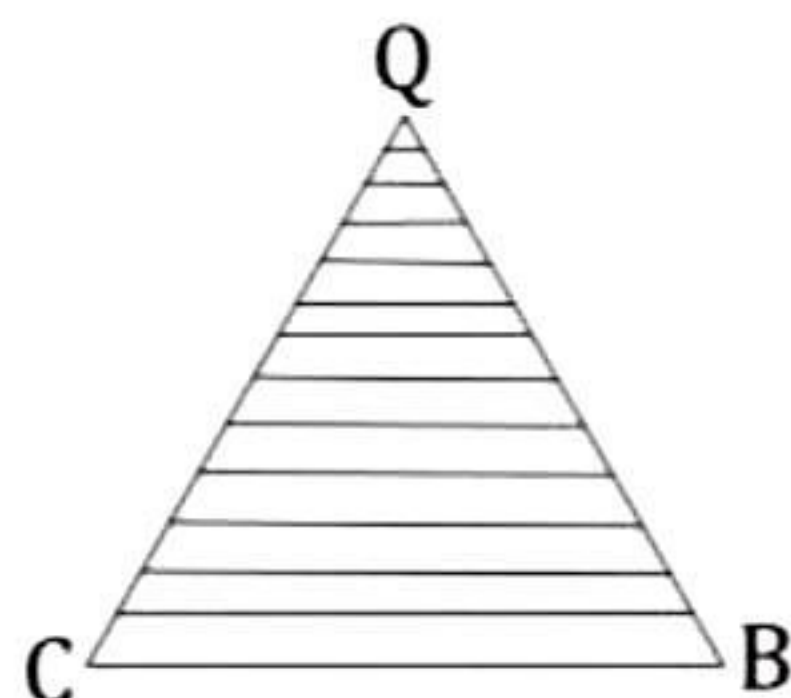

Fig.(iii)

Observation

1. The triangular shape so formed out of the threads; the area of the circle is the same as the area of the triangular shape.
2. Base of the triangle is the circumference of the circle (The largest thread) i.e., Base of $\Delta = 2\pi r$
3. Vertical height of the triangular shape = radius of the circle.
4. Area of $\Delta = \frac{1}{2} \times B \times H = \frac{1}{2} \times 2\pi r \times r = \pi r^2$

   $\therefore$ Area of the circle of radius r $= \pi r^2$ sq. units.

Result

The figure formed in this activity is almost the shape of the triangle, therefore the area of this triangle so formed is equal to the area of the circle i.e., πr^2 sq. units.

Learning Outcome

Students observe that the area of the circle is πr^2 i.e., half the product of its circumference and radius.

Activity Time

1. Using the above activity find the area of the circle taking radius as 4.2 cm.
2. Using the above activity find the area of the circle taking radius as 4.9 cm.

VIVA VOCE

Q 1. What is the area of the rectangle?

Ans. Area of rectangle = length × breadth

Q 2. Mention the area of the circle in terms of diameter.

Ans. Area of circle $= \dfrac{\pi d^2}{4}$, where d is the diameter of the circle.

Q 3. What is the formula to find the area of a sector of a circle of radius r and its central angle θ?

Ans. Area of a sector with central angle $\theta = \dfrac{\pi r^2 \theta}{360°}$.

Q 4. How will you define a circle?

Ans. A circle is the locus of a point in a plane that moves in such a way that its distance from a fixed point remains constant. The fixed point is known as the centre of the circle and the fixed distance is known as the radius of the circle.

MULTIPLE CHOICE QUESTIONS

Q 1. Find the central angle of a circle of radius 21 cm if the length of the arc is 22 cm.

    (a) 30°   (b) 60°   (c) 45°   (d) 100°

Q 2. If the area of a minor segment of a circle is π cm^2 and radius is 7 cm, then what is the area of its major segment?

    (a) 48π cm^2 (b) 49π cm^2 (c) 7π cm^2 (d) None of these

Q 3. Find out the length of a circular arc subtending an angle of 60° at the Centre and radius 14 cm.

    (a) 14 cm   (b) 44 cm   (c) $\dfrac{44}{3}$ cm   (d) None of these

Q 4. If a thread of length is 'a' cm is converted into a circle, then find its area.

    (a) $\dfrac{a}{4\pi}$ (b) $\dfrac{a^2}{4}$ (c) $\dfrac{a^2}{4\pi^2}$ (d) $\dfrac{a^2}{4\pi}$

Q 5. Find the area of a ring shown in the figure if OA = 10 cm and OB = 8 cm.

    (a) 30π cm^2 (b) 36π cm^2 (c) 18π cm^2 (d) None of these

Answer Key

1.(b)	2.(a)	3.(c)	4.(d)	5.(b)