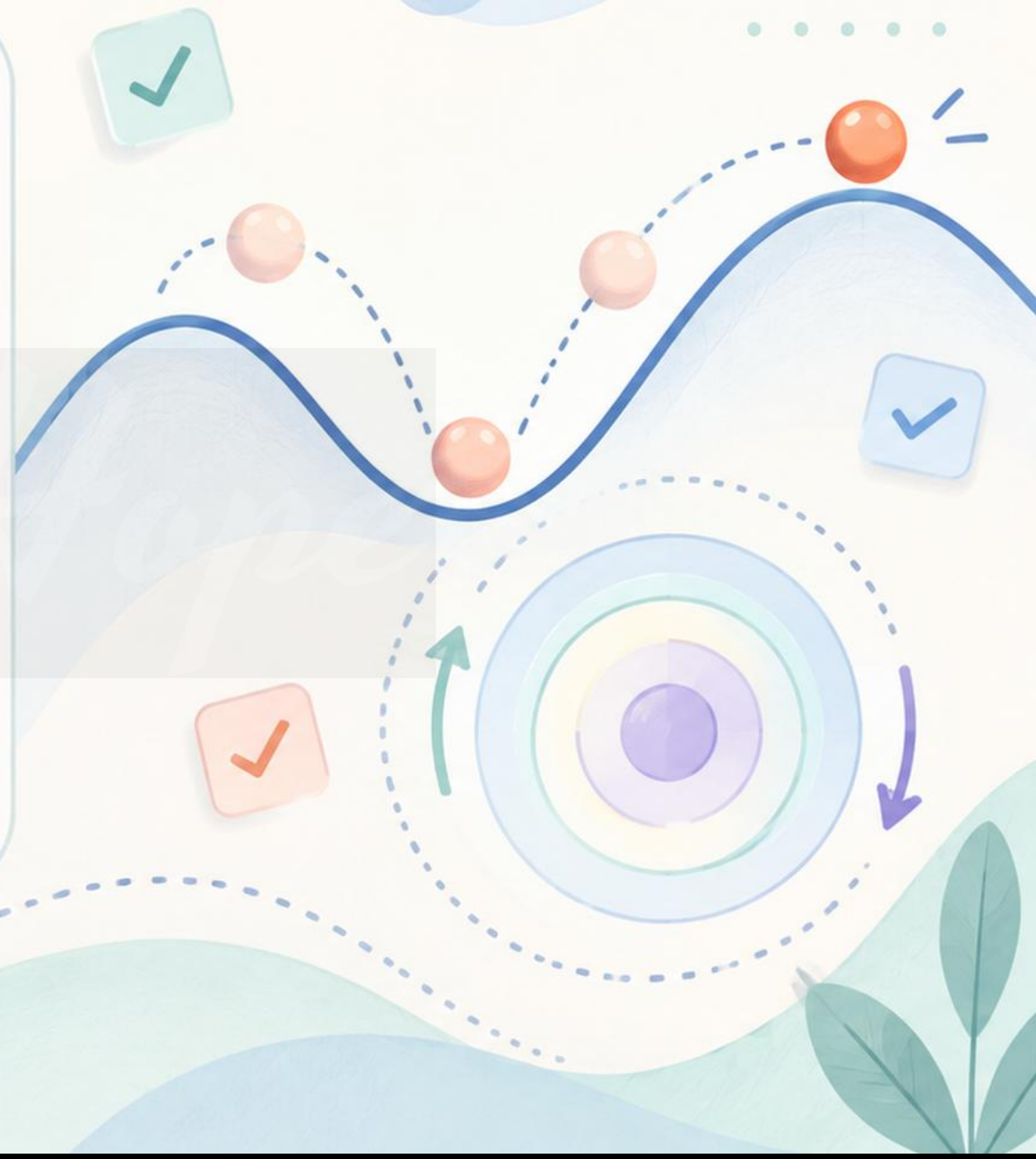


MATHEMATICS • CLASS 9

CHAPTER 5

I'm Up and Down, and Round and Round

NCERT SOLUTIONS



CIRCLES: OPENING ACTIVITIES

① Objects in nature that resemble a circle



full moon



sun



ripples made
by a raindrop



cross-section of
a plant stem

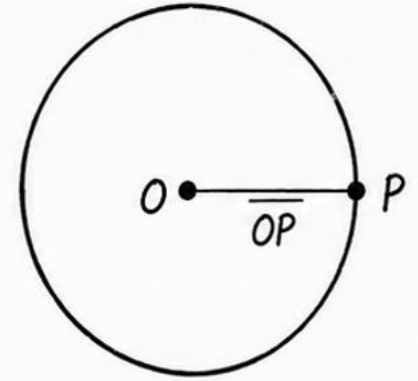


sunflower head

Their boundaries look circular.

② Common property of every circle

- A circle has a fixed centre O .
- Every point P on the circle is at the same distance from O .
- This fixed distance OP is the radius.

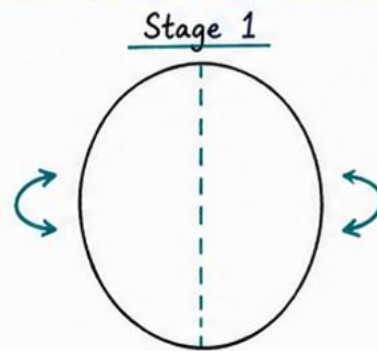


③ Think and Reflect: How can Jamuna locate the centre?

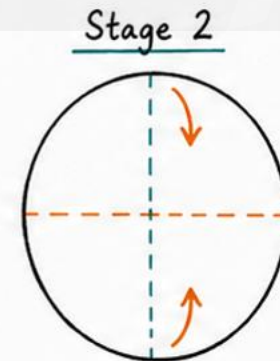
Step 1: Fold the circular paper so that its boundary matches exactly. Open it; the crease is a diameter.

Step 2: Fold it again in a different direction so that the boundary matches. Open it; the second crease is another diameter.

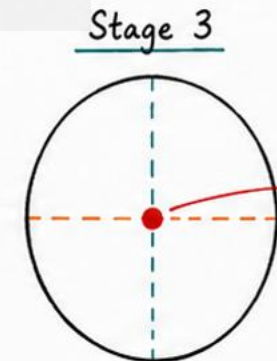
Step 3: The two creases intersect at the centre O .



Fold in half vertically
and open.



Fold in half horizontally
and open.



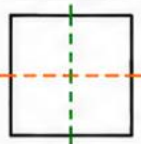
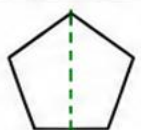
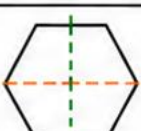
Intersection
point is the
centre O

Answer:

The intersection
of any two
diameter-folds
is the centre.

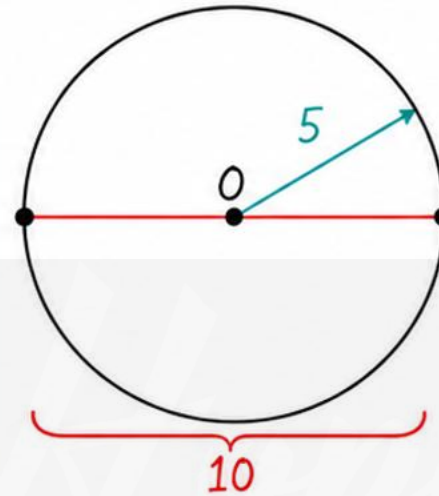
THINK AND REFLECT: SYMMETRY & LOCUS

1. Rotational and reflection symmetries

Figure	Rotational symmetries (angles)	Order of rotation	Number of reflection lines
Square 	at 90° , 180° , 270° , 360°	4	4
Regular pentagon 	through multiples of 72°	5	5
Regular hexagon 	through multiples of 60°	6	6

A complete turn, 360° , is included.

2. Chords in a circle of radius 5 units



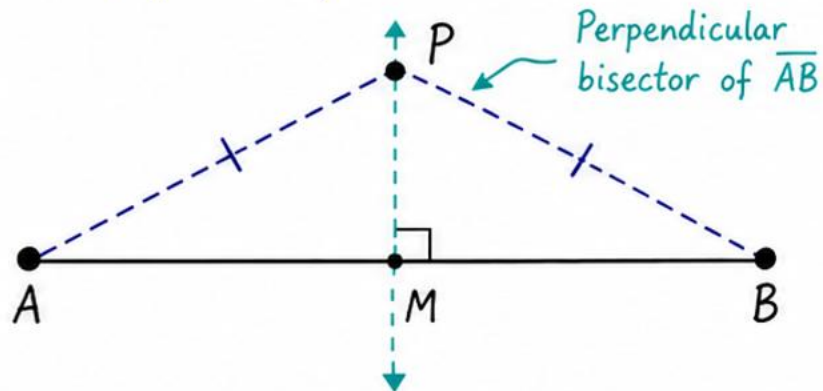
Longest chord = diameter
 $= 2r = 2 \times 5 = 10$ units.

There is no smallest positive chord: endpoints can be taken closer and closer, so chord length approaches 0.

If a degenerate chord is allowed, its limiting length is 0.

Longest = 10 units; no smallest non-zero chord.

3. Locus of points equidistant from A and B

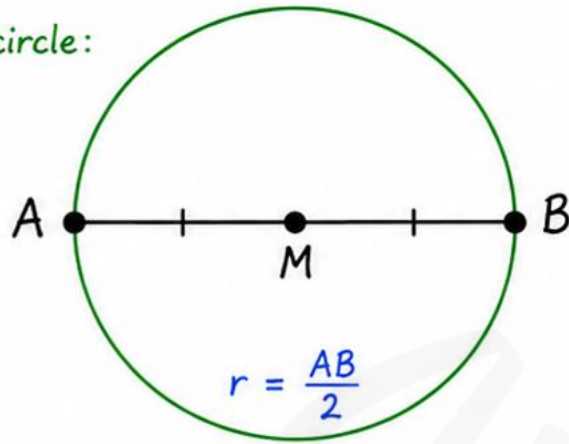


- Every point P on the perpendicular bisector has $PA = PB$.
- Conversely, every point with $PA = PB$ lies on the perpendicular bisector.

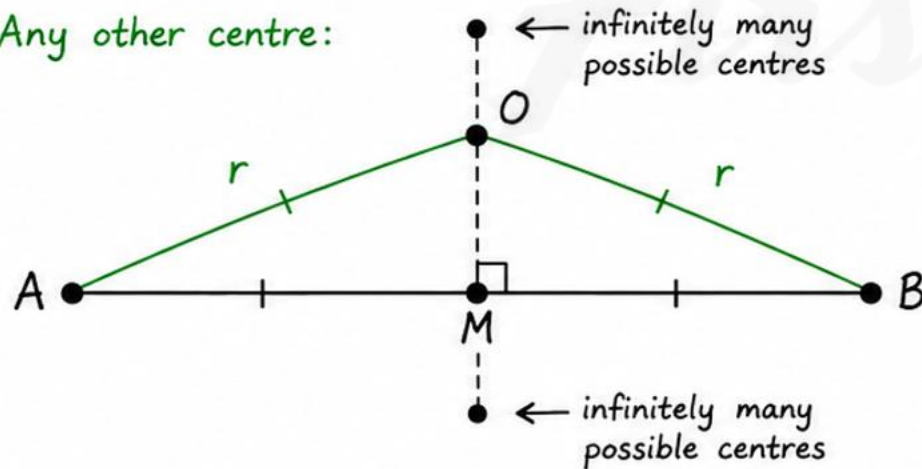
The locus is the perpendicular bisector of $\overline{AB}$.

CIRCLES THROUGH TWO POINTS

Smallest circle:



Any other centre:



Q1. How many circles pass through two distinct points A and B?

Answer: Infinitely many. Every point on the perpendicular bisector of AB can be a centre.

Q2. Are all radii possible?

Let $AB = d$. For a centre O on the perpendicular bisector, radius $r = OA = OB$.

The smallest radius occurs at the midpoint M:

$$r_{\min} = \frac{AB}{2}.$$

No circle through A and B can have radius less than $AB/2$. There is no largest radius; as O moves farther away, r increases without bound.

Possible radii: $r \geq \frac{AB}{2}$.

Q3. As the centre moves away from AB along the perpendicular bisector:

The radius increases.

Q4. How does the circle look?

As the radius increases, the arc through A and B looks less curved (flatter) near the chord.

centre farther from AB



larger radius



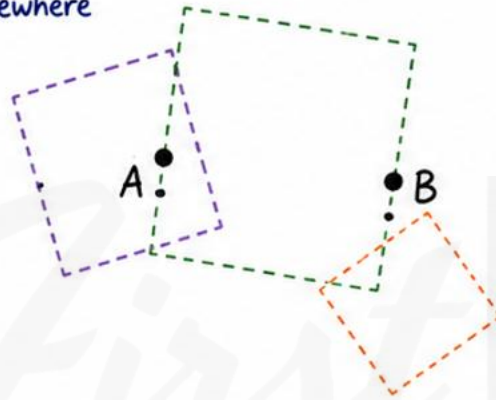
less curvature

SQUARES & THREE COLLINEAR POINTS

Think and Reflect: Squares through A and B

Q5(a) A and B are only required to lie somewhere on the boundary of a square.

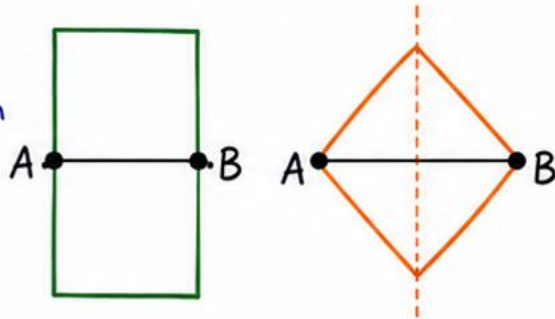
Answer: Infinitely many squares are possible, because the square can change in size and position while keeping A and B on its sides.



Q5(b) A and B are corners (vertices) of the square.

Explain:

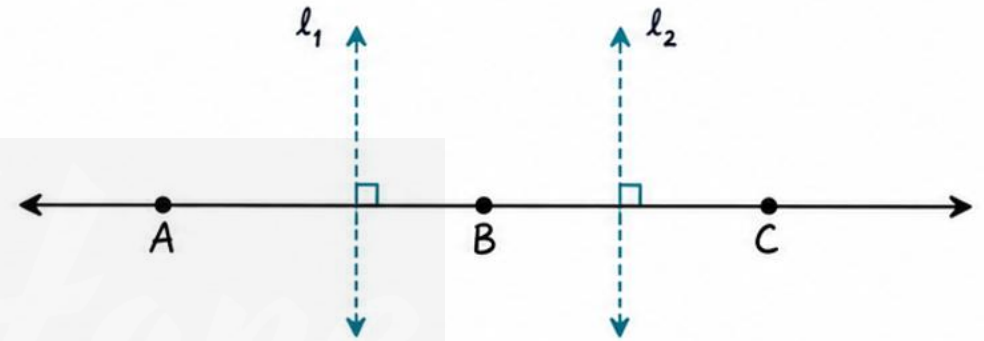
- If $\overline{AB}$ is a **side**, one square can be drawn on each side of $\overline{AB}$: **2 squares**.
- If $\overline{AB}$ is a **diagonal**, its perpendicular bisector fixes one square: **1 square**.



$$\text{Total} = 2 + 1 = 3 \text{ squares.}$$

Think, Draw and Infer: Three collinear points

Let A, B and C be three distinct collinear points.



- The perpendicular bisectors of $\overline{AB}$ and $\overline{BC}$ are both perpendicular to line ABC.
- They are distinct **parallel** lines, so they never meet.
- Therefore, no point P can satisfy $PA = PB = PC$.
- A **circle** cannot pass through three distinct collinear points.
- A **straight line** can cut a circle in at most two distinct points, never three.

No circle passes through three distinct collinear points.

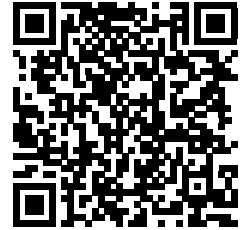


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