**FIRST PRIZE WINNER MR.HARAGOPAL’S SOLUTION**

****

**Given:**

$∠AOC=∠POR,$ **L, M, N, K are midpoints**

**To prove: LM**$ ∥ $**KN**

**Construction:**

**Let** $O^{'}$ **be the center of circle and join it with the points L, M, N, K. Join** $O^{'}O$

**Proof:**

**Let** $∠AOC=∠POR= θ$ **&**

$$∠O^{'}OL= α \& ∠O^{'}OM= β$$

**As** $O^{'}$**is the center and L, M, N, K are midpoints of chords then**

$∠O^{'}LD=∠O^{'}KB=∠O^{'}MQ=∠O^{'}NS=90° $**[from the theorems of circles from class 9th** $⊥ $**bisector of any chord passes through center (or)** $⊥$ **from center to chord bisects it]**

**Now as** $∠O^{'}MO=∠O^{'}NO=90° $ **and as they are same segment angles.**

$⟹∠NOM=∠NO^{'}M= θ$ **[ same segment angles are equal] ---- (1)**

**Similarly as** $=∠O^{'}LO= ∠O^{'}KO=90°$ **and as they are same segment angles.**

$∴O^{'}LKO$ **are cyclic**

$⟹$$∠KOL= ∠KO^{'}L= θ$ **[Same segment angles are equal] --------------- (2)**

**And in quadrilateral** $O^{'}NOK$

**as** $∠N+ ∠K=90°+90°=180°$

$∴$$O^{'}NOK $ **is also cyclic [same segment angles] -------------------------------(3)**

$⟹$$∠KOO^{'}$ **=** $∠KNO^{'}$ **=** $α$ **+**$ θ $

**And in quadrilateral** $O^{'}$**MOL**

**as** $∠M+∠L=90°+90°=180°$

$∴$$O^{'}MOL $**is also cyclic.**

$⟹$$∠LOO^{'}= ∠LMO^{'}$ **[Same segment angles are equal]**

**Let the intersection of lines LM &** $O^{'}N$ **be the point "T"**

**Now in** $∆$$O^{'}MT$**,** $∠O^{'}TL$ **is the exterior angle =** $α$ **+**$ θ $**----------(5) [Exterior angle property of triangle]**

**Now for the lines LM & KN,** $O^{'}N$ **is the transversal and the angles.**

$∠O^{'}TL$ **&** $∠O^{'}NK$ **are corresponding angles as they both are equal to "**$α$ **+**$ θ"$

$∴$ **LM**$ ∥ $**KN**

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\***