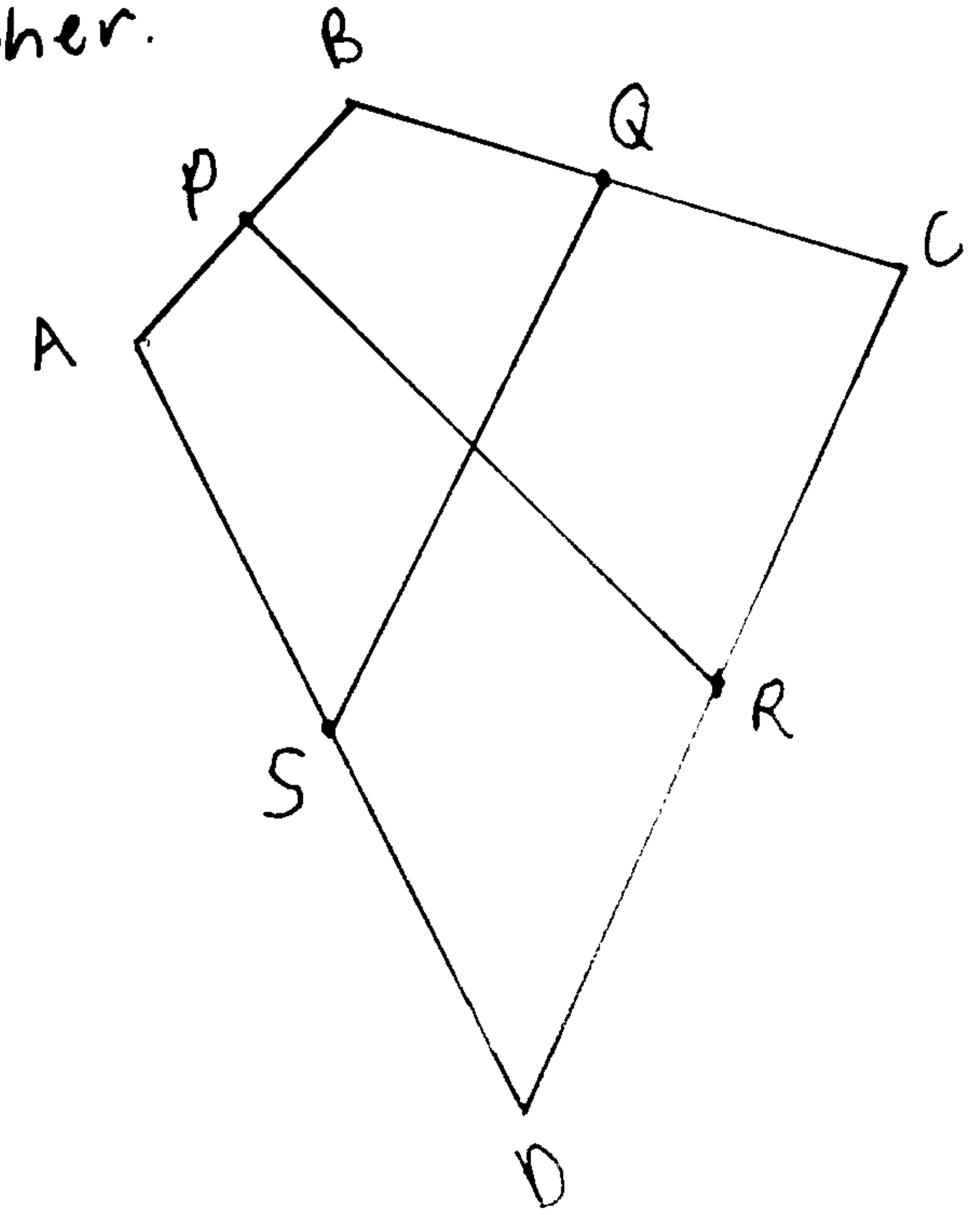
Prove that the line segments joining the midpoints of opposite sides of a Quadrilateral bisect each other.



Need to verify that the midpoint of PR is also the midpoint of SQ

$$\vec{OP} = \vec{OA} + \frac{1}{2}\vec{AB}$$
$$P = A + \frac{1}{2}\vec{AB}$$

$$\vec{OR} = \vec{OA} + \vec{AD} + \frac{1}{2}\vec{DC}$$
$$R = A + \vec{AD} + \frac{1}{2}\vec{DC}$$

$$\vec{OQ} = \vec{OA} + \vec{AB} + \frac{1}{2}\vec{BC}$$
$$Q = A + \vec{AB} + \frac{1}{2}\vec{BC}$$

$$\vec{OS} = \vec{OA} + \frac{1}{2}\vec{AD}$$
$$S = A + \frac{1}{2}\vec{AD}$$

Midpoint of PR

$$= \frac{1}{2}(P + R)$$
$$= \frac{1}{2}\left(A + \frac{1}{2}\vec{AB} + A + \vec{AD} + \frac{1}{2}\vec{DC}\right)$$
$$= \frac{1}{2}\left(A + \frac{1}{2}(B - A) \cancel{+A} + D \cancel{-A} + \frac{1}{2}(C - D)\right)$$
$$= \frac{1}{2}\left(\frac{1}{2}A + \frac{1}{2}B + \frac{1}{2}C + \frac{1}{2}D\right)$$

Midpoint of SQ

$$= \frac{1}{2}(S + Q)$$
$$= \frac{1}{2}\left(A + \frac{1}{2}\vec{AD} + A + \vec{AB} + \frac{1}{2}\vec{BC}\right)$$
$$= \frac{1}{2}\left(A + \frac{1}{2}(D - A) \cancel{+A} + B \cancel{-A} + \frac{1}{2}(C - B)\right)$$
$$= \frac{1}{2}\left(\frac{1}{2}A + \frac{1}{2}B + \frac{1}{2}C + \frac{1}{2}D\right)$$