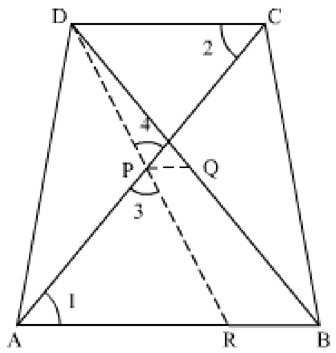
Prove that the line joining the mid points of the diagonals of a trapezium is parallel to the parallel sides and is equal to the half of their difference.



Since, AB || DC and transversal AC cuts then at A and C respectively.

$\therefore \angle 1 = \angle 2$ (Alternate angles)

Now, In ΔAPR and ΔDPC,

$\angle 1 = \angle 2$

AP = CP (P is mid point of AC)

$\angle 3 = \angle 4$ (Vertically opposite angles)

$\therefore \Delta APR \cong \Delta DPC$

$\Rightarrow$ AR = DC and PR = DP

In ΔDRB, P and Q are the mid-points of sides DR and DB respectively.

$\therefore$ PQ || RB

$\Rightarrow$ PQ || AB

$\Rightarrow$ PQ || AB and DC

Again P and Q are the mid-points of sides DR and DB respectively.

$$\therefore PQ = \frac{1}{2}RB$$
$$\Rightarrow PQ = \frac{1}{2}(AB - AR)$$
$$\Rightarrow PQ = \frac{1}{2}(AB - DC)$$