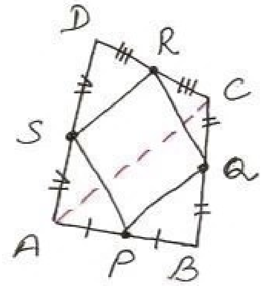
(1)



To show $SR \parallel AC$, $SR = \frac{1}{2}AC$

$PQ = SR$

$PQRS$ is a ||gm

Const - join AC

Proof PQ joins midpts of sides AB and BC resp. of $\triangle ABC$

$PQ \parallel AC$ ... (i)

$PQ = \frac{1}{2}AC$ ... (ii)

[midpoint theorem]

Similarly

$SR \parallel AC$ ... (iii)

$SR = \frac{1}{2}AC$ ... (iv)

From (i) and (iii)

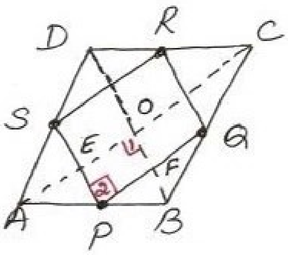
$PQ \parallel SR$

From (ii) and (iv)

$PQ = SR$

□ $PQRS$ is a ||gm $\left[\begin{matrix} PQ \parallel SR \\ PQ = SR \end{matrix}\right]$

(2)



To prove - □ $PQRS$ is a rect.

Proof -

□ $ABCD$ is a ||gm

[Proof same as Q.1]

$PQ \parallel AC$ (proved)

$\Rightarrow PF \parallel EO$

PS joins midpts of sides AB and AD resp. of $\triangle ABD$

$PS \parallel BD$ [Midpoint theorem]

$\Rightarrow PE \parallel FO$

□ $PFOE$ is a ||gm $\left[\begin{matrix} PF \parallel EO \\ PE \parallel FO \end{matrix}\right]$

$\angle 1 = \angle 2$ (opp. angles of a ||gm)

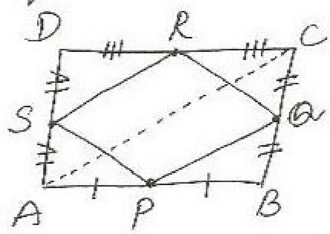
But $\angle 1 = 90^\circ$

[diagonals of a rhombus are $\perp$ to each other]

$\therefore \angle 2 = 90^\circ$

||gm $PQRS$ is a rect.

(3)



To prove - □ $PQRS$ is a rhombus

Proof

□ $PQRS$ is a ||gm. [Same as Q.1]

In $\triangle SAP$ and $\triangle QBP$

$AP = BP$ [$\because P$ is midpt. of AB]

$\angle SAP = \angle QBP = 90^\circ$ [each angle of rect.]

$SA = QB$ [$DA = CB$ opp sides of rect

$\cancel{2}SA = \cancel{2}QB$ $\because S$ is midpt of DA, Q is midpt of BC

$SA = QB$]

$\therefore \triangle SAP \cong \triangle QBP$ by SAS prop.

$SP = QP$ (cpct)

$\therefore$ ||gm $PQRS$ is a rhombus.