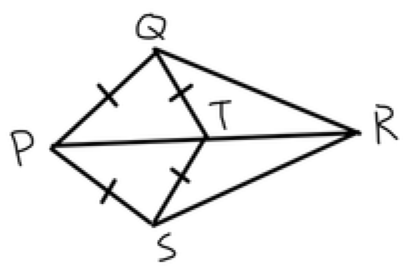
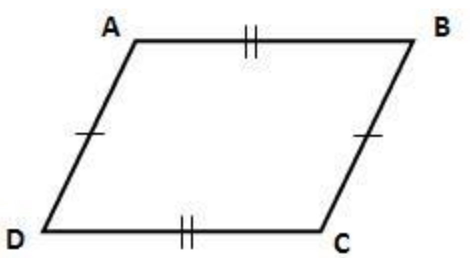
Parallelogram, with Theorems about Opposite Sides and Angles



Statements	Reasons
1.) PQTS is a rhombus with diagonal PR	1.) Given
2.) PT bisects	2.) Rhombus --> each diag. bisects opp. angles
3.) $\angle QPR \cong \angle SPR$	3.) Def. of angle bisector
4.) $PQ \cong PS$	4.) Def. of rhombus
5.) $PR \cong PR$	5.) Reflexive prop.
6.) $\triangle QPR \cong \triangle SPR$	6.) SAS
7.) $RQ \cong RS$	7.) CPCTC

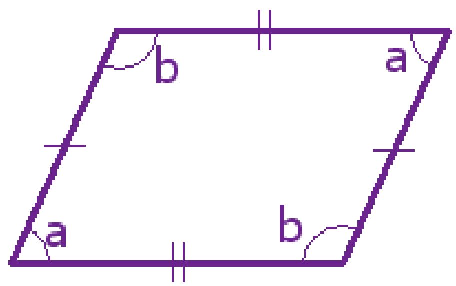
Definition of a Theorem: The opposite sides and angles of a parallelogram are equal to one another, and either of its diameters bisects its area.

Definition of a parallelogram with opposite sides: A 4-sided flat shape with straight sides where opposite sides are parallel.



If $\overline{AD} \cong \overline{BC}$ *and* $\overline{AB} \cong \overline{DC}$,

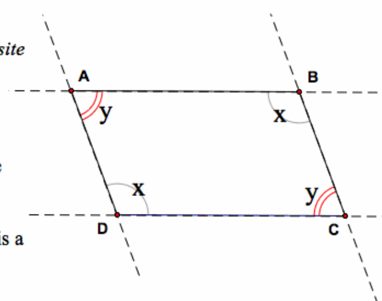
then $ABCD$ *is a Parallelogram*



[Write-up by Brenda King](#)

Theorem 1.27, part 3.

A quadrilateral is a parallelogram if and only if each pair of opposite angles is congruent.



Proof: From 1.26, in a parallelogram, diagonals will form congruent triangles.
By corresponding parts of congruent triangles, the opposite angle will be congruent (see earlier work)

Coversely, given opposite angles are congruent, show the quadrilateral is a parallelogram.

We know the sum of the angles in a 4-gon is $360° = 2x + 2y$ or $180° = x + y$.

By theorem 1.21, *two lines are parallel if and only if a pair of interior angles on the same side of a transveral is supplementary,* so we know $\overline{AB} \| \overline{DC}$ and $\overline{AD} \| \overline{BC}$.

A parallelogram has at least one pair of parallel sides.
Therefore quadrilateral ABCD is a parallelogram.

Real life examples: