Properties of Quadrilaterals

Polygon: a geometric figure formed by three or more coplanar segments called sides. The sides that have a common endpoint are non-collinear. Each side intersects exactly two other sides only at their endpoints called vertices.

Diagonal: a segment that connects any two non-consecutive vertices of a polygon

Quadrilateral: a four-sided polygon

Types of Quadrilaterals

1. Trapezium: a quadrilateral with no pair of parallel sides
2. Trapezoid: a quadrilateral with exactly one pair of parallel sides. If the nonparallel sides are congruent, the trapezoid is isosceles.
3. Parallelogram: a special quadrilateral with both pairs of opposite sides parallel
   a. Rectangle: has four right angles
   b. Rhombus: has four congruent sides
   c. Square: has four congruent angles and four congruent sides

Theorems on Parallelograms

1. Opposite sides of a parallelogram are congruent.
2. Opposite angles of a parallelogram are congruent.
3. Consecutive angles in a parallelogram are supplementary.
4. The diagonals of a parallelogram bisect each other.

Property	Rectangle	Rhombus	Square	All Parallelograms
The Sides				
Opposite sides are parallel.	✓	✓	✓	✓
Opposite sides are congruent.	✓	✓	✓	✓
All sides are congruent.		✓	✓	
The Angles				
Sum of angles is 360°	✓	✓	✓	✓
Opposite angles are ≅.	✓	✓	✓	✓
All four angles are right.	✓		✓	
Consecutive angles are supplementary.	✓	✓	✓	✓
The Diagonals				
Diagonals bisect each other.	✓	✓	✓	✓
Diagonals are congruent.	✓		✓	
Diagonals are perpendicular.		✓	✓	
Diagonals bisect opposite ∠s.		✓	✓	

Practice Exercises

Given: $BLUE$ is a parallelogram.

A. Determine whether each statement is $TRUE$. If the statement is $TRUE$, write the theorem, postulate or definition that justifies the statement.

1. $\overline{BE}||\overline{LU}$
2. R is the midpoint of $\overline{EL}$ and $\overline{BU}$
3. $m\angle B = m\angle U$
4. $m\angle BLU$ and $m\angle LUE$ are supplementary
5. $\angle BLE \cong \angle UEL$
6. $\angle BRE \cong \angle URL$
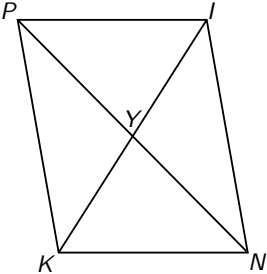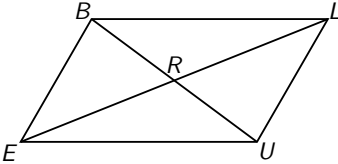7. $\overline{BE} \cong \overline{UL}$
8. $\angle BLU \cong \angle UEB$
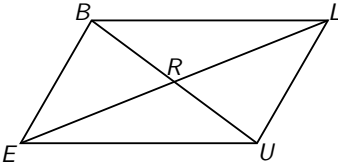
B. Solve each problem completely.

1. If $BL = 3y + 2$, $LU = 5x - 13$, $EU = 2y + 5$, and $EB = 2x - 1$, find the perimeter of $BLUE$.
2. If $BR = x$ and $ER = y$, find $\overline{BU}$ and $\overline{EL}$

Problem Set

$PINK$ is a parallelogram. Determine whether each statement is $TRUE$. If the statement is $TRUE$, write the theorem, postulate or definition that justifies the statement.

1. $\overline{PK}||\overline{IN}$
2. $\angle PIK \cong \angle NKI$
3. $\angle KYN \cong \angle IYP$
4. $\overline{PN} \perp \overline{KI}$
5. $\overline{PI} \cong \overline{NK}$
6. $\triangle PYK \cong \triangle NYI$
7. $\triangle PIN \cong \triangle NKP$
8. $\overline{PN}||\overline{KN}$
9. $\angle KIN \cong \angle PKY$
10. $\overline{KN} \perp \overline{PI}$