

# QUADRILATERALS



## Special Quadrilaterals

Quadrilaterals are polygons with four sides.

Here are the definitions of eight types of quadrilaterals:

- a. Square (SQ): a regular quadrilateral
- b. Rhombus (RH): all sides are equal
- c. Rectangle (RE): all angles are  $90^\circ$
- d. Parallelogram (PA): two pairs of parallel sides
- e. Kite (KI): two distinct pairs of consecutive equal sides, but not all sides equal
- f. Isosceles trapezoid (IT): exactly one pair of parallel sides, one pair of opposite equal sides
- g. General trapezoid (GT): exactly one pair of parallel sides
- h. General quadrilateral (GQ): not one of the above

*You need to know these definitions by heart!*

1. Draw and label two examples of each kind of quadrilaterals, one by finding it on your template and tracing it, the other by creating your own unique example on graph paper. *Make the least special drawing possible for each example!* For example, a square could be used for a, b, c, and d. Only draw a square for a!
2. Some math books define a trapezoid as having *at least* one pair of parallel sides. How does this differ with the definition above?

As we study quadrilaterals, you'll notice that some of the results would be different, depending on which definition of trapezoid one uses. (We'll use the one above, which is the more common one in US schools.)

## Quadrilateral Conjectures

A conjecture is a mathematical statement that someone thinks might be true.

1. Write five conjectures about quadrilaterals, in the form:

*For a quadrilateral, if [statement 1], then [statement 2]*

For each one, also represent it with an if-then diagram.

For the statements, choose among the following (you may use the same statement in more than one conjecture):

- ◇ opposite sides are parallel
- ◇ opposite sides are equal
- ◇ all sides are equal
- ◇ one pair of sides are both parallel and equal
- ◇ two sides are parallel but unequal, and the other two are equal, but not parallel
- ◇ two pairs of consecutive sides are equal
- ◇ opposite angles are equal
- ◇ consecutive angles add up to  $180^\circ$
- ◇ two pairs of consecutive angles are equal
- ◇ all angles are equal
- ◇ the diagonals are equal
- ◇ the diagonals are perpendicular
- ◇ the diagonals bisect each other (meet at each other's middle)

### Example:

*In a quadrilateral, if opposite sides are parallel, then opposite sides are equal.*

[Or: *Opposite sides of a parallelogram are equal, which means exactly the same thing.*]

“If, then” diagram:



2. Write three conjectures that you believe are false. For each one, also represent it with an “if, then” diagram.
3. You have each written eight conjectures. Make a group list, organized as follows:
- a. conjectures that are obviously false
  - b. conjectures that are probably false
  - c. conjectures that are probably true
  - d. conjectures that are obviously true

One of you should e-mail the group list to your teacher.

## Map of Theorems About Quadrilaterals

What conditions make a quadrilateral be a...

Properties of special quadrilaterals:

Kite  
(two pairs of  
consecutive,  
equal sides)

Trapezoid  
(exactly one pair  
of parallel sides)

Isosceles trapezoid  
(trapezoid with  
other pair of  
sides equal)

Parallelogram  
(two pairs of  
parallel sides)

Rectangle  
(all angles equal)

Rhombus  
(all sides equal)

Square  
(all sides equal,  
all angles equal)