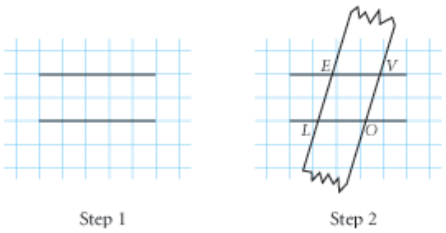
Lesson 5.5: Properties of Parallelograms

In this lesson you will:

- discover how the angles of a parallelogram are related
- discover how the sides of a parallelogram are related
- discover how the diagonals of a parallelogram are related

In this lesson you will discover some special properties of parallelograms. Rhombuses, rectangles, and squares are all specific types of parallelograms. Therefore, any properties that you discover for parallelograms will also apply to these other shapes. However, to be sure that your conjectures will apply to *any* parallelogram, you should investigate parallelograms that don't have any other special properties such as right angles, all congruent angles, or all congruent sides.

Investigation 5.5: "Four Parallelogram Properties"



Step 1 Step 2

A.) Using the lines on a piece of graph paper as a guide, draw a pair of parallel lines that are at least 6 cm apart. Using the parallel edges of your ruler, make a parallelogram. Label your parallelogram *LOVE*.

B.) Let's look at the opposite angles. Measure the angles of your parallelogram *LOVE* using a protractor.

C.) Compare both pairs of opposite angles. Based on your observations, complete the conjecture below, and then add it to your conjecture list.

Parallelogram Opposite Angles Conjecture (C-44)

The opposite angles of a parallelogram are _____.

Two angles that share a common side in a polygon are consecutive angles. In parallelogram *LOVE*, $\angle LOV$ and $\angle EVO$ are a pair of consecutive angles. The consecutive angles of a parallelogram are also related.

D.) What is the sum of the measures of each pair of consecutive angles in parallelogram *LOVE*? _____

E.) Based on your observations, complete the following conjecture. Don't forget to add it to your conjecture list.

Parallelogram Consecutive Angles Conjecture (C-45)

The consecutive angles of a parallelogram are _____.

F.) Describe how to use conjectures C-44 and C-45 to find all the angles of a parallelogram if only one angle measure is given.

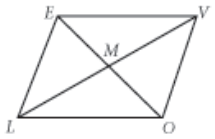
G.) Next let's look at the opposite sides of a parallelogram. With your compass or ruler, compare the lengths of the opposite sides of the parallelogram you made. Based on your observations, complete the conjecture.

Parallelogram Opposite Sides Conjecture (C-46)

The opposite sides of a parallelogram are _____.

H.) Finally, let's consider the diagonals of a parallelogram. On your parallelogram, construct the diagonals $\overline{LV}$ and $\overline{EO}$ as shown below. Label the point where the two diagonals intersect point *M*.

I.) Measure *LM* and *VM*. What can you conclude about point *M?*



J.) Is this conclusion also true for diagonal $\overline{EO}$? _____

K.) Based on your observations, complete the conjecture below.

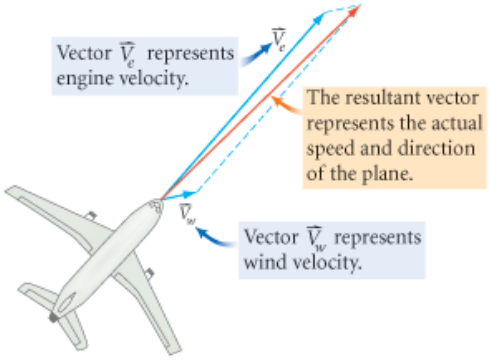
Parallelogram Diagonals Conjecture (C-47)

The diagonals of a parallelogram _____ each other.

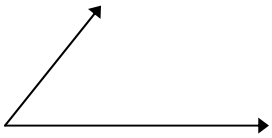
* Add "vector" and "resultant vector" to your vocabulary list.

Parallelograms are used in _____ diagrams. Vectors describe quantities in physics, such as velocity, acceleration, and _____. You can represent a vector by drawing an arrow. The length and direction of the arrow represent the magnitude and direction of the vector.

In many physics problems, you combine vector quantities acting on the same object. For example, the wind current and engine thrust vectors determine the velocity of an airplane, represented in the diagram by a single vector called the resultant vector.

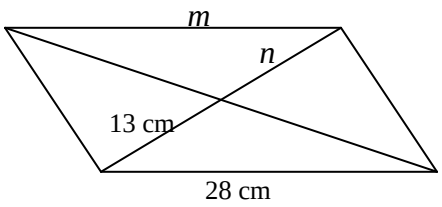


Draw the resultant vector for the vector diagram at right.



•Example 1: In parts a and b, the figures are parallelograms. Find the lettered measures and state which conjectures you used.

a.)



b.)

⇒**ASSIGNMENT**: _____