

CASIO Education Workbook Series

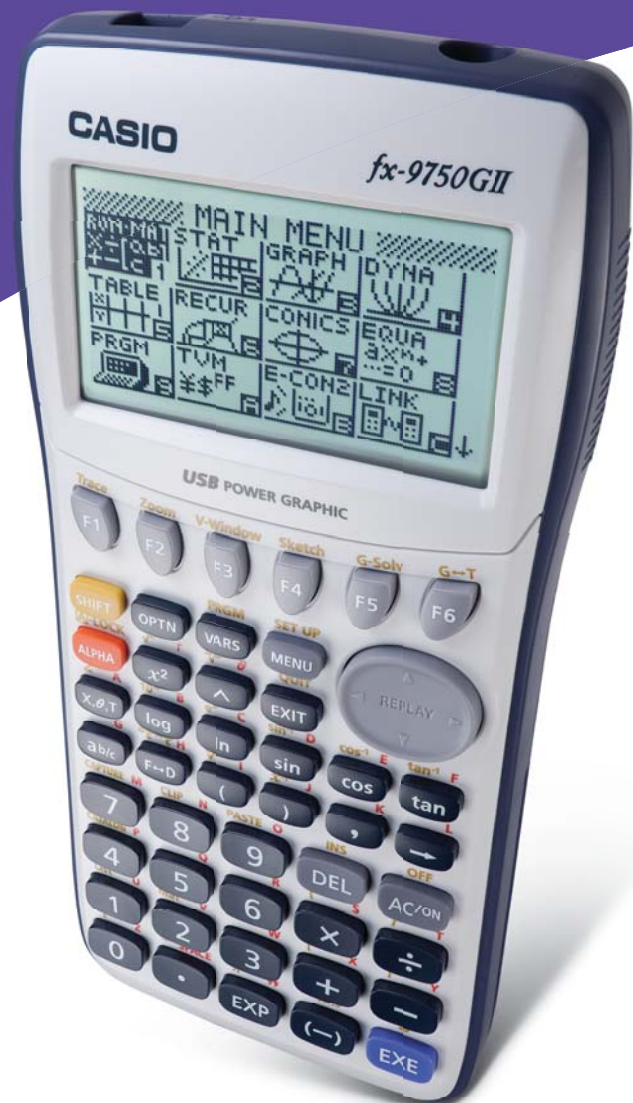
# GEOMETRY

with the

**CASIO *fx-9750GII***

## WHAT'S INSIDE:

- *Distance*
- *Slope*
- *Pythagorean Theorem*
- *Properties of Triangles*
- *Reflections*
- *Rotations*
- *Translations*
- *Properties of Parallelograms*
- *Properties of Special Parallelograms*
- *Area of Regular Polygons*
- *Area & Volume of Rectangular Solids*
- *Arc Length*
- *Area of Sectors*



**Topic Area:** Properties of Parallelograms

## **NCTM Standards:**

- Use geometric ideas to solve problems in, and gain insights into, other disciplines and other areas of interest such as art and architecture.
- Use Cartesian coordinates and other coordinate systems, such as navigational, polar, or spherical systems, to analyze geometric situations.
- Investigate conjectures and solve problems involving two- and three-dimensional objects represented with Cartesian coordinates.

## **Objective**

The student will be able to use algebra and statistics to prove that a quadrilateral is a parallelogram, demonstrate that the opposite sides are equal, demonstrate that the diagonals bisect each other, and prove that the opposite angles are equal.

## **Getting Started**

As a class, review the meaning of slope and the slope-intercept form of an equation; include in the discussion the relationship of the slopes between parallel lines and perpendicular lines. Review methods of proving triangles congruent using the Side-Side-Side method.

### **Prior to using this activity:**

- Students should be able to find the xy-line for a pair of coordinates using a graphing calculator.
- Students should be able to perform calculations involving square roots, ratios, and parentheses using a graphing calculator.
- Students should know the formula for finding the distance between two points.

### **Ways students can provide evidence of learning:**

- The student will be able to write conjectures pertaining to a parallelogram.
- The student will be able apply the properties of a parallelogram to real-life problems.

### **Common mistakes to be on the lookout for:**

- Students may confuse the x and y values in the calculations.
- Students may enter the problem incorrectly into the calculator.

## **Definitions**

- |                 |                |              |
|-----------------|----------------|--------------|
| • Parallelogram | • Diagonal     | • Hypotenuse |
| • Perpendicular | • Intersection | • Leg        |
| • Endpoint      | • Midpoint     |              |
| • Slope         | • Congruent    |              |

# Quite the Quadrilateral

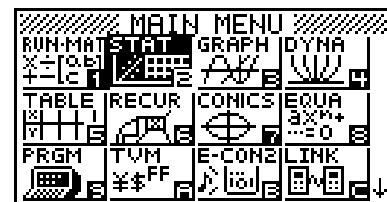
# “How-To”

The following will demonstrate how to enter a set of coordinates into two lists using the Statistics mode of the Casio *fx-9750GII*. After the list is set up, you will find the slope of a line containing the points, save the equation in the Graph mode, and find the intersection of two lines. You will then find the length of a segment.

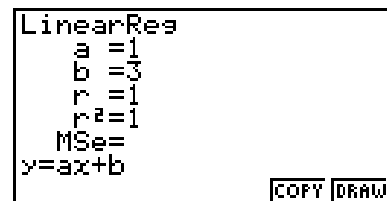
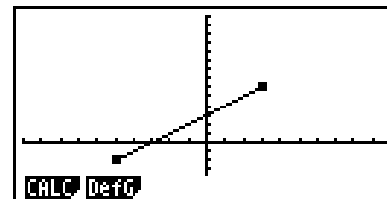
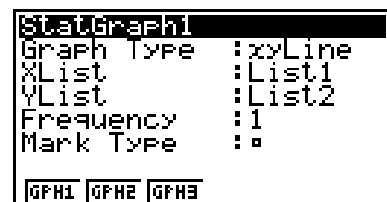
Line segment AB has endpoints at  $(-5, -2)$  and  $(3, 6)$  and segment CD has endpoints at  $(-6, 4)$  and  $(3, -7)$ . Find the slope for each line segment, the coordinates of their intersection, and the length of  $\overline{AB}$ .

To enter values into a list and find the line of best fit:

- From the Main Menu, highlight the Statistics icon and press **EXE** or press **2**.
- To label the first column, highlight the space below List 1 and press **ALPHA** **+** (X) **EXE**.
- To label the second column, highlight the space below List 2 and press **ALPHA** **-** (Y) **EXE**.
- Enter the x-values into List 1 and the y-values into List 2. Be sure to press **EXE** after each value.
- To view the points, press **F1** (GRPH) **F6** (Set) **▼** **F1** (GPH1) **▼** **F2** (XY) **▼** **F1** (List) **1** **▼** **F1** (List) **2** **EXE** **F1** (GPH1).
- Press **EXIT** and **F1** (GPH1) to view the graph.
- Press **F1** (Calc) **F2** (X) **F1** (ax+b) to find the line of best fit.
- Press **F5** (Copy) **EXE** to copy the equation into the graph function.
- Repeat the same steps to find the equation for the second segment.

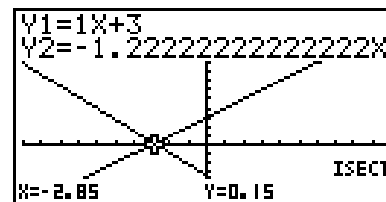
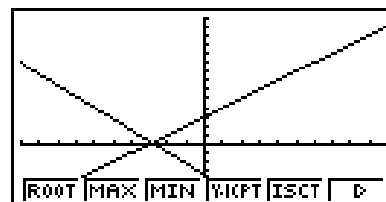
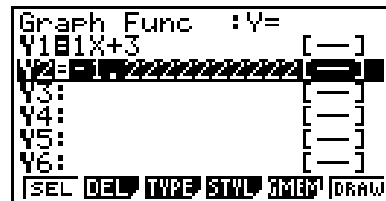
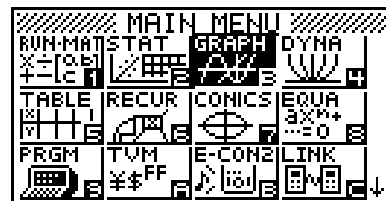


	List 1	List 2	List 3	List 4
SUB	X	Y		
1	-5	-2		
2		6		
3				
4				



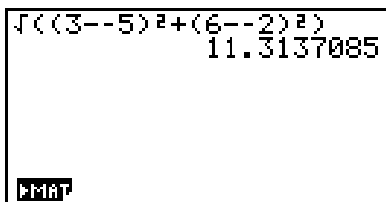
To graph the two equations and find the intersection:

- From the Main Menu, highlight the Graph icon and press **EXE** or press **3**.
- To graph the two equations, highlight each equation and press **F1** (Sel) to turn the function on; when the equal signs are highlighted, you know the equation is selected. Then press **F6** (Draw).
- While viewing the graph, press **F5** (G-Solv) **F5** (ISCT) to find the intersection of the two equations.
- The coordinates are displayed at the bottom of the screen.



To find the length of  $\overline{AB}$ :

- Using the distance formula,  
 $d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$ , press **SHIFT** **x<sup>2</sup>** **(** **(**  
**3** **=** **(-)** **5** **)** **x<sup>2</sup>** **+** **(** **6** **=** **(-)** **2** **)**  
**x<sup>2</sup>** **)** **EXE** to find the length of  $\overline{AB}$ .



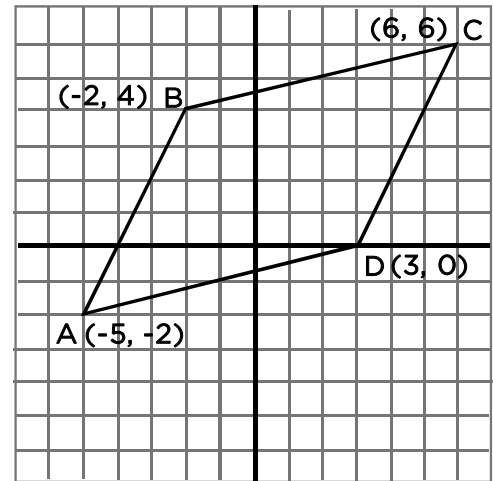
# Quite the Quadrilateral

# Activity

The parallelogram is a special quadrilateral with special properties that is used in a variety of areas, especially in design. In this activity, we will explore the properties and then solve some problems using those properties.

## Questions

The diagram at the right shows Quad ABCD. By definition, a parallelogram is a quadrilateral with both pairs of opposite sides parallel.



1. Find the equation of a line that contains the following points:

a. points B and C

\_\_\_\_\_

b. points A and D

\_\_\_\_\_

2. What is the slope for each line?

\_\_\_\_\_

3. Find the equation of a line that contains the following points:

a. points A and B

\_\_\_\_\_

b. points D and C

\_\_\_\_\_

4. What is the slope for each line?

\_\_\_\_\_

5. Are the opposite sides parallel?

\_\_\_\_\_

Let us see what else we can find out about the sides of a parallelogram.

6. Find the length for the following segments to the nearest tenth.

a.  $\overline{BC}$ : \_\_\_\_\_

b.  $\overline{AD}$ : \_\_\_\_\_

7. Find the length for the following segments to the nearest tenth.
- a.  $\overline{AB}$ : \_\_\_\_\_
- b.  $\overline{DC}$ : \_\_\_\_\_

8. What can you conclude about the opposite of a parallelogram?  
\_\_\_\_\_

Draw the two diagonals for the figure. We are now going to look at their properties in relation to quadrilaterals.

9. Find the equation for the following segments.
- a.  $\overline{AC}$ : \_\_\_\_\_
- b.  $\overline{BD}$ : \_\_\_\_\_

10. Find the coordinates for the intersection of the two diagonals. Draw it on the diagram and label it E.  
\_\_\_\_\_

11. Find the length of the following segments to the nearest tenth.
- a.  $\overline{AE}$ : \_\_\_\_\_
- b.  $\overline{CE}$ : \_\_\_\_\_

12. Find the length of the following segments to the nearest tenth.
- a.  $\overline{BE}$ : \_\_\_\_\_
- b.  $\overline{DE}$ : \_\_\_\_\_

13. What conclusion can be made about the diagonals of a parallelogram?  
\_\_\_\_\_

14. Using the information above, determine the reason why each of the following pairs of triangles are congruent.
- a.  $\triangle ABC \cong \triangle ADC$  by \_\_\_\_\_
- b.  $\triangle ABD \cong \triangle CDB$  by \_\_\_\_\_

15. Since the two pairs of triangles are congruent, then give two pairs of angles that are equal.  
\_\_\_\_\_ and \_\_\_\_\_

16. What conclusion can be made about angles in a parallelogram?

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One method of demonstrating vector addition is by creating a parallelogram. The sum is the coordinates of the fourth vertex of the parallelogram.

17. Given the diagram below and using the properties of parallelograms, find the sum of  $v_1$  and  $v_2$ .

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18. The magnitude of a vector is equal to its length. Find the magnitudes of  $v_1$ ,  $v_2$ , and the resulting vector to the nearest hundredth.

a.  $v_1$

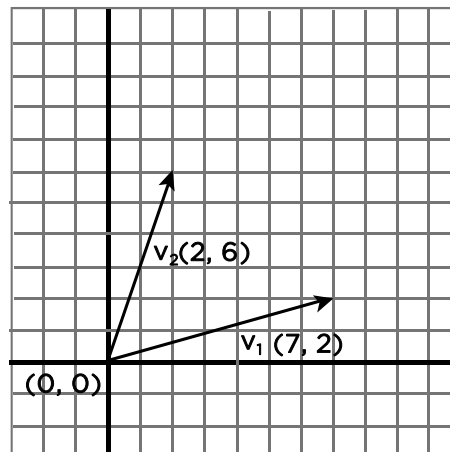
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b.  $v_2$

---

c.  $v_1 + v_2$

---



Solutions:

1. a.  $y = 0.25x + 4.5$

```
LinearReg(ax+b)
a =0.25
b =4.5
r =1
r²=1
MSe=
y=ax+b
COPY DRAW
```

b.  $y = 0.25x - 0.75$

```
LinearReg(ax+b)
a =0.25
b =-0.75
r =1
r²=1
MSe=
y=ax+b
COPY DRAW
```

2. The slope of each line is 0.25.

3. a.  $y = 2x + 8$ ;

```
LinearReg(ax+b)
a =2
b =8
r =1
r²=1
MSe=
y=ax+b
COPY DRAW
```

b.  $y = 2x - 6$

```
LinearReg(ax+b)
a =2
b =-6
r =1
r²=1
MSe=
y=ax+b
COPY DRAW
```

4. The slope of each line is 2.

5. The opposite sides are parallel.

6. a.  $\sqrt{(6 - -2)^2 + (6 - 4)^2} = 8.2$

b.  $\sqrt{(3 - -5)^2 + (0 - -2)^2} = 8.2$

7. a.  $\sqrt{(-2 - -5)^2 + (4 - -2)^2} = 6.7$

b.  $\sqrt{(6 - 3)^2 + (6 - 0)^2} = 6.7$

8. Opposite sides of the parallelogram are equal.



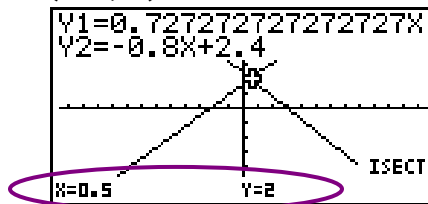
9. a.  $y = 0.36x + 3.81$

```
LinearReg(ax+b)
a =0.36363636
b =3.81818181
r =1
r^2=1
MSe=
y=ax+b
COPY DRAW
```

b.  $y = -0.8x + 2.4$

```
LinearReg(ax+b)
a =-0.8
b =2.4
r =-1
r^2=1
MSe=
y=ax+b
COPY DRAW
```

10. (0.5, 2)



11. a.  $\sqrt{(0.5 - -5)^2 + (2 - -2)^2} = 6.8$

b.  $\sqrt{(0.5 - 6)^2 + (2 - 6)^2} = 6.8$

12. a.  $\sqrt{(0.5 - -2)^2 + (2 - 4)^2} = 3.2$

b.  $\sqrt{(0.5 - -5)^2 + (2 - 4)^2} = 3.2$

13. The diagonals bisect each other.

14. a. SSS Congruency

b. SSS Congruency

15.  $\angle ABC \cong \angle CDA$  &  $\angle BAD \cong \angle DCB$

16. Opposite angles of a parallelogram are equal.

17.  $v_1 + v_2 = \langle 9, 8 \rangle$

18. a.  $v_1 = \sqrt{2^2 + 6^2} = 6.32$  units

b.  $v_2 = \sqrt{7^2 + 2^2} = 7.28$  units

c.  $v_1 + v_2 = \sqrt{9^2 + 8^2} = 12.04$  units

