

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

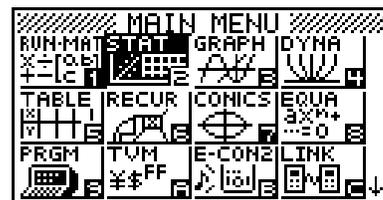
“How-To”

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.

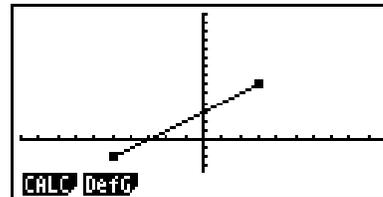
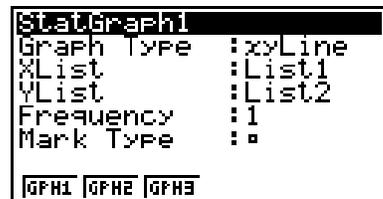
Line segment AB has endpoints at $(-5, -2)$ and $(3, 6)$ and segment CD has endpoints at $(-6, 4)$ and $(3, -7)$. Find the slope for each line segment, the coordinates of their intersection, and the length of \overline{AB} .

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.

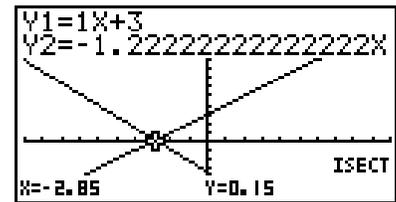
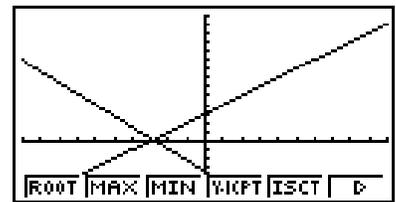
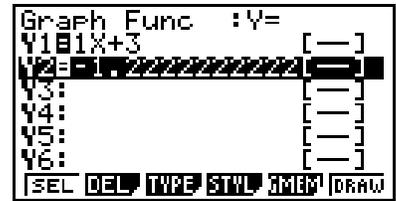
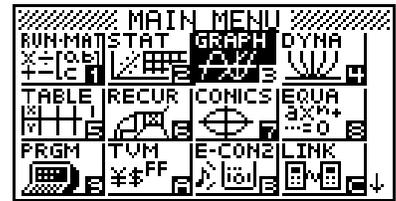


	List 1	List 2	List 3	List 4
SUB	X	Y		
1	-5	-2		
2		6		
3				
4				



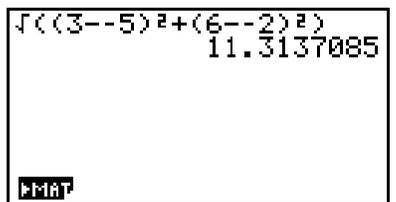
To graph the two equations and find the intersection:

- 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** **x²** **(** **(**
3 **=** **(-)** **5** **)** **x²** **+** **(** **6** **=** **(-)** **2** **)**
x² **)** **EXE** to find the length of \overline{AB} .



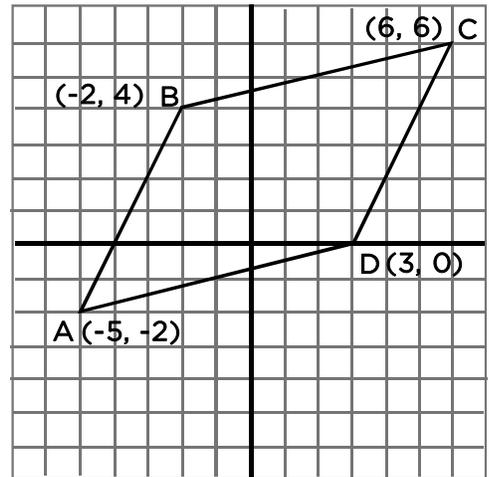
Quite the Quadrilateral

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?

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

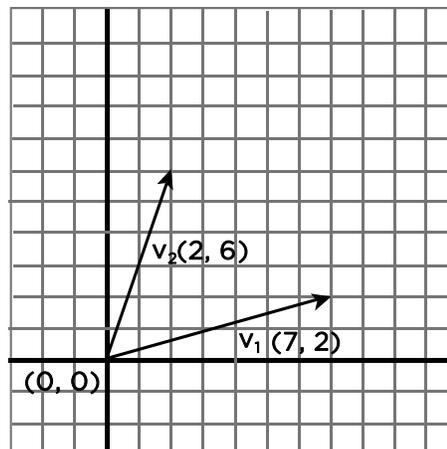
17. Given the diagram below and using the properties of parallelograms, find the sum of v_1 and v_2 .

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

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. $y = 0.36x + 3.81$

```

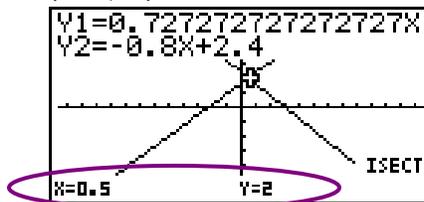
LinearReg(ax+b)
a =0.36363636
b =3.81818181
r =1
r^2=1
MSe=
y=ax+b
COPY DRAW
    
```

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

