

Properties of Trapezoids and Kites

Time required
30 minutes

ID: 9085

Activity Overview

In this activity, students investigate the properties of trapezoids, isosceles trapezoids, and kites by measuring sides and angles in the figures and by constructing and measuring the diagonals of the figures. By dragging vertices of each figure, they can make and test conjectures by seeing which properties hold true regardless of the orientation, shape, or size of the figure.

Topic: Quadrilaterals & General Polygons

- *Prove and apply theorems about the properties of rhombuses, kites and trapezoids.*

Teacher Preparation and Notes

- *This activity is designed to be used in a middle-school or high-school geometry classroom.*
- *For this activity, students should know the definitions of a trapezoid, isosceles trapezoid, and kite. If they do not already know these terms, you can define them as they appear in the lesson, but allow extra time to do so.*
- *Notes for using the TI-Nspire™ Navigator™ System are included throughout the activity. The use of the Navigator System is not necessary for completion of this activity.*
- **To download the student and solution TI-Nspire documents (.tns files) and student worksheet, go to education.ti.com/exchange and enter “9085” in the keyword search box.**

Associated Materials

- *PropTrapsKites_Student.doc*
- *PropTrapsKites.tns*
- *PropTrapsKites_Soln.tns*

Suggested Related Activities

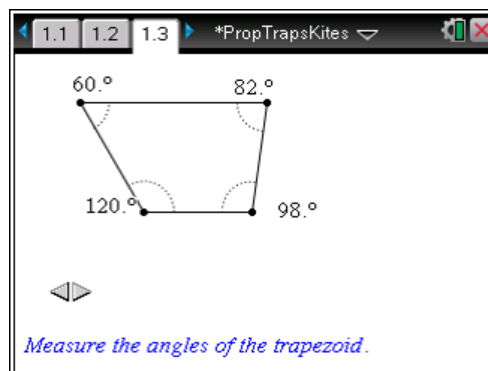
To download any activity listed, go to education.ti.com/exchange and enter the number in the keyword search box.

- *Diagonals of Quadrilaterals (TI-Nspire technology) — 13127*
- *Angles in Polygons (TI-Nspire technology) — 9055*

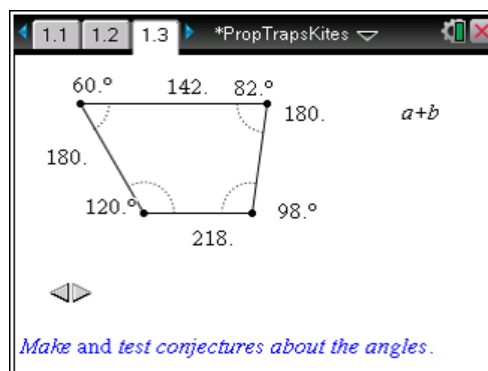
Problem 1 – Investigating trapezoids

On page 1.3, students should move the vertices around to see the different forms for which a trapezoid can take.

They can measure the angles by pressing **MENU > Measurement > Angle** and selecting three points—one on a side of the angle, then the vertex, and then a point on the other side.



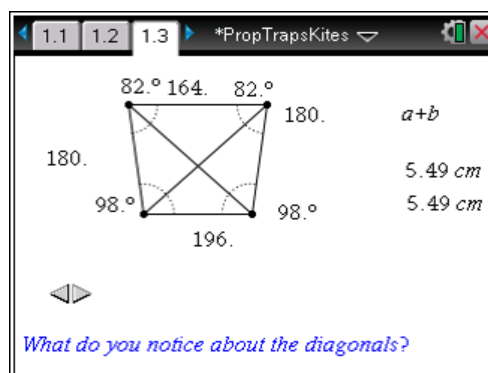
Next, students should drag the vertices to make conjectures about the angles of a trapezoid. If students are stuck, direct students to find the sum of consecutive angles. Students can use the **Text** tool (Actions menu) to display the expression **a+b** (or any other two variables), and then use the **Calculate** tool (also from the Actions menu) to find the sum of two consecutive angles. To use the **Calculate** tool, click on the expression and then on the value to use for each variable as you are prompted. This may be done for all four pairs of consecutive angles as shown.



Instruct students to construct the diagonals of the trapezoid by using the **Segment** tool from the Points & Lines menu. They should then measure the lengths (**MENU > Measurement > Length**) of each diagonal and alter the shape of the trapezoid.

Note: Students need to hover the cursor over the segment measurements and use the **+** and **-** keys to increase the number of displayed digits to 3.

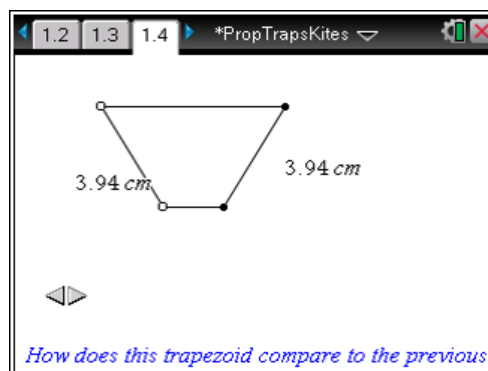
Ask students for any conclusions they can make about the diagonals of a trapezoid.



On page 1.4, students are to drag the vertices of the trapezoid and describe how these trapezoids differ from the ones they formed on page 1.3. (On page 1.4, it appears that the two non-parallel sides are always congruent.)

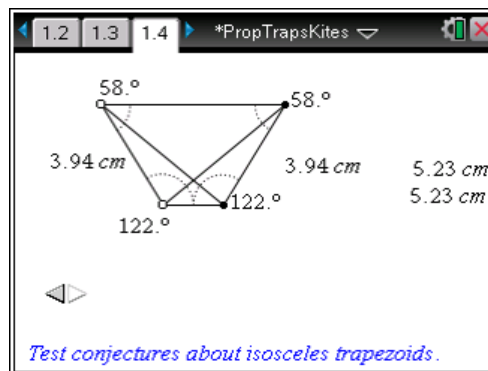
Students should measure the lengths of the sides to confirm that the trapezoids explored on this page are all isosceles trapezoids.

Note: Have students change segment measurements only to display 3 digits.



Since students now know how to construct segments as well as measure sides and angles, students can use the tools to make and test as many conjectures as they can about isosceles trapezoids.

Students should find, along with congruencies discovered for all trapezoids on page 1.3, that the base angles of an isosceles trapezoid are congruent and the diagonals of an isosceles trapezoid are congruent.



TI-Nspire Navigator Opportunity: Quick Poll

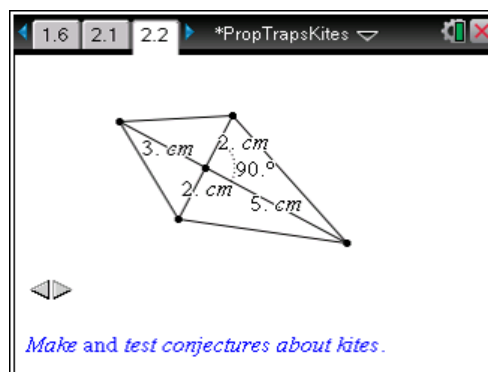
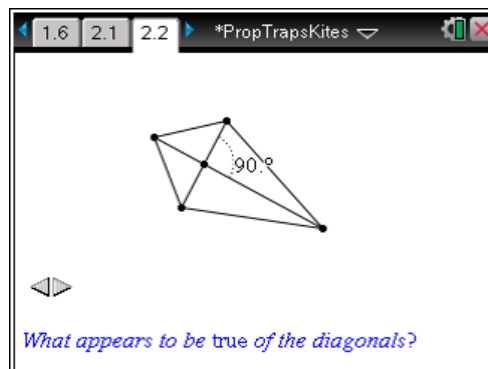
See Note 1 at the end of this lesson.

Problem 2 – Investigating kites

On page 2.2, students will grab and drag vertices to change the shape of the kite. They can measure the sides of the kites to see that two pairs of consecutive sides remain congruent.

After students construct the diagonals of the kite and move it around again, ask them what appears to be true about the diagonals. (They appear to be perpendicular.) Students can measure one of the angles formed by the intersecting diagonals to verify this.

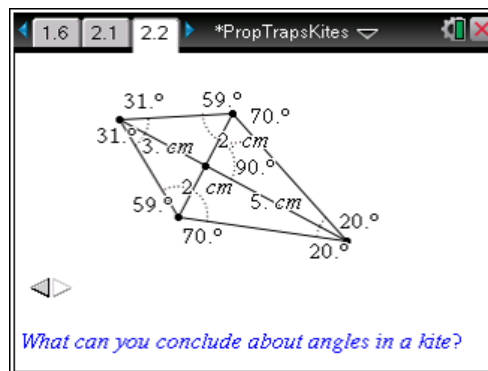
Now, students should look at the lengths of the diagonals and make a conjecture. Let them measure to find that one of the diagonals is bisected by the other. This means that one of the diagonals is a perpendicular bisector of the other.



Last, students need to measure angles in the diagram to make and test as many conjectures as possible about the angles of a kite.

As needed, guide students to draw the following conclusions: the diagonal that is a perpendicular bisector bisects the vertex angles of the kite, these vertex angles are not congruent, and the other two angles, while not bisected, are congruent.

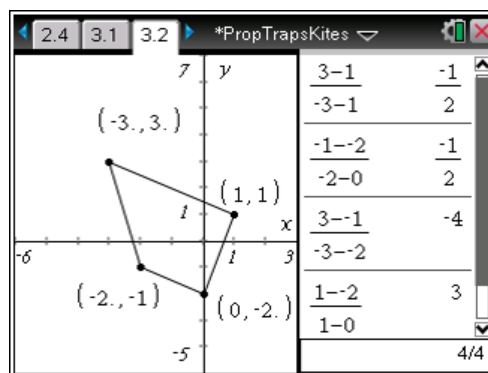
Note: Have students change segment measurements only to display 3 digits.



TI-Nspire Navigator Opportunity: Quick Poll
See Note 2 at the end of this lesson.

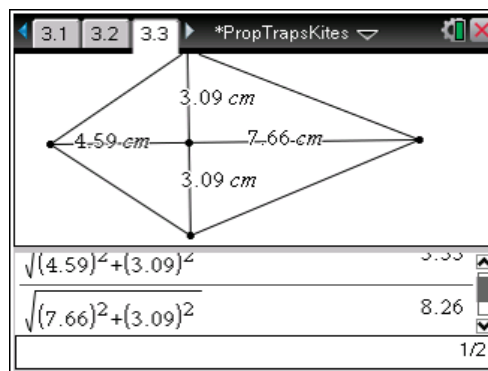
Problem 3 – Extension

A quadrilateral is shown on the left side of page 3.2. Students can find the coordinates of the vertices by selecting **MENU > Actions > Coordinates and Equations**. Then they can use the *Calculator* application on the right side of the page to find the slopes of the sides to show that the quadrilateral is a trapezoid. (Two lines are parallel if and only if they have the same slope.)



On page 3.3, students will need to use the *Calculator* application at the bottom of the page to find the lengths of the sides of the kite.

Although students can use the **Length** tool to find the answers, tell them to use the properties of kites to determine the side lengths first.



TI-Nspire Navigator Opportunities

Note 1

Problem 1, Quick Poll

You may choose to use Quick Poll to assess student understanding. Use the questions from the TI-Nspire document to compare student conjectures and conclusions about trapezoids.

Note 2

Problem 2, Quick Poll

You may choose to use Quick Poll to assess student understanding. Use the questions from the TI-Nspire document to compare student conjectures and conclusions about kites.