



# Midpoint Quadrilaterals

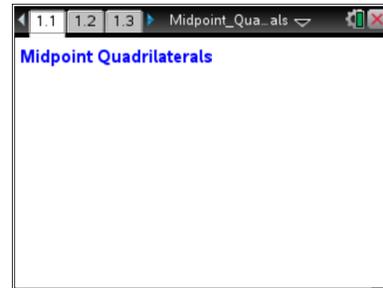
## Student Activity

Name \_\_\_\_\_

Class \_\_\_\_\_

Open or create the TI-Nspire document  
*Midpoint\_Quadrilaterals.tns*.

Students will explore properties of a midpoint quadrilateral.

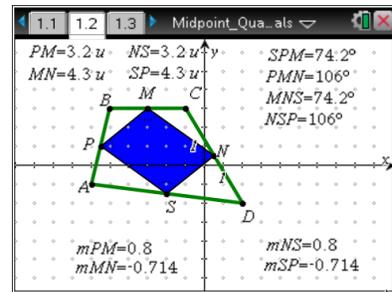


Move to page 1.2.

Press **ctrl** and **ctrl** to navigate through the lesson.

### Part 1 – Exploring the midpoint quadrilateral

On page 1.2, you will see an outer quadrilateral  $ABCD$  with an inner quadrilateral  $PMNS$  constructed using the midpoints of each side of the outer quadrilateral. Angle measurements, side measurements, and slopes of the sides of the inner quadrilateral are given.



Move to any vertex of the outer quadrilateral and drag to explore. Observe the measurements as they change.

1. What type of quadrilateral is the inner quadrilateral? Explain how you know.
2. Drag any of the outer vertices to form non-convex (concave) quadrilaterals. Is the inner quadrilateral still the same type as what you answered in problem 1?
3. Is the inner quadrilateral ever a *special* quadrilateral (rectangle, square, and so on)? Drag the vertices to make the outer quadrilateral into the following shape types and record the type(s) of inner quadrilaterals that result. Make outer quadrilateral measurements if necessary.

Outer Quadrilateral $ABCD$	Inner Quadrilateral $PMNS$
Parallelogram	
Rectangle	
Square	
Rhombus	
Kite	
Trapezoid	
Isosceles Trapezoid	



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Class \_\_\_\_\_

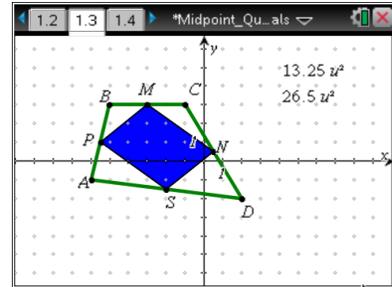
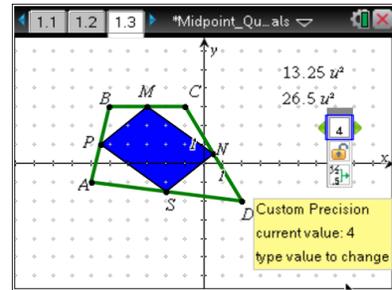
Move to page 1.3.

### Part 2 – Comparing Areas

Press **Menu > Geometry > Measurement > Area**. Move to the inner polygon until the words *polygon MNPS* appear and press . Move the measurement to the upper right part of the screen and press .

Repeat for outer quadrilateral  $ABCD$ . Then press **esc** to exit the **Measurement** tool.

To increase the number of significant digits, hover the cursor above one of the area measures, press **ctrl menu > Attributes > 4 > enter**. Repeat for the other area measure.



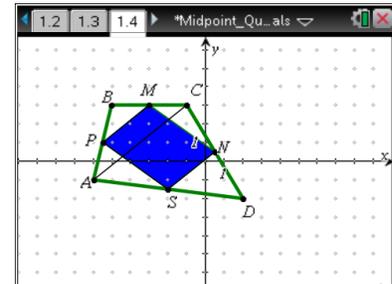
4. What is the relationship between the areas of the inner and outer quadrilaterals?

Move to page 1.4.

### Part 3 – Exploring Proof

Press **Menu > Geometry > Points & Lines > Segment**. Construct diagonal  $AC$  of the outer quadrilateral.

Press **Menu > Geometry > Measurement > Length** to measure the length of the diagonal,  $AC$ , as well as the length of sides  $SN$  and  $MP$ . Press **esc** to exit the **Measurement** tool.



5. What is the relationship between the diagonal length and the inner quadrilateral side length?

Press **Menu > Geometry > Measurement > Slope** to measure the slope of the diagonal,  $AC$ , as well as the slope of sides  $SN$  and  $MP$ . Press **esc** to exit the **Measurement** tool. Drag the vertices of the outer quadrilateral.

6. What is the relationship between the slope of the diagonal and the slope of the midsegment?

7. How could this be used to prove that the inner quadrilateral is a special type of quadrilateral?