Wacky Quadrilaterals

David Martin

What happens when you draw a quadrilateral (a four-sided figure) and connect the midpoints of each side? What if you did this over and over again?

Here is an activity that investigates that!

Activity

Have students draw any quadrilateral that takes up most of the page. They will then measure the interior angles, add them all together and record the measurement. Next, they will measure and record the perimeter. (A recording sheet has been included on pages 43–44.)

Then, have students measure each side and determine the midpoint. They will then connect the midpoints and make a new quadrilateral (iteration 1). They will then measure and record the interior angles and the perimeter of this new quadrilateral. Have them repeat this step for two more iterations.

Ask students what they notice or wonder about. What would be the sum of the interior angles of iteration 10? What about the perimeter? Have students estimate the sum of the interior angles and the perimeter for the 10th iteration. (Do not have them actually create this 10th iteration. Simply have them estimate the measurements based on the pattern.)

Students then colour in the shape to make a creative design.

Figure 1 shows what the final drawing might look like.

Extensions

- Show students the animation on exterior angles of a polygon at www.mathwarehouse.com/animated-gifs/#exterior-angle-polygon. Ask, "What is this visually proving?"
- Show students Paul Lockhart's video "The World of Mathematical Reality" (https://youtu.be/V1gT2f3Fe44).

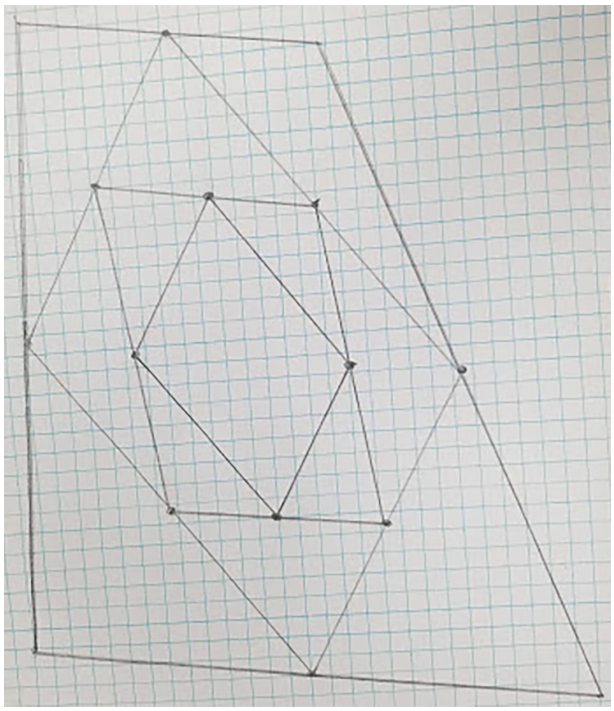

FIGURE 1. *Wacky quadrilaterals drawing.*

David Martin has a master's degree in mathematics, a bachelor's degree in education and, most important, a love of learning. Throughout his career, he has challenged many traditional educational practices, such as homework, tests and even grading. As a division math/science lead teacher, he has the opportunity to learn with teachers and students from pre-K to Grade 12. He is also president of MCATA. You will often find him tinkering with code, playing with mathematics or counting by prime numbers.

Wacky Quadrilaterals Recording Sheet

1. Draw any quadrilateral (a four-sided figure) that takes up most of the page. Measure the interior angles and add them all together and record this sum. Measure and record the perimeter.

2. Measure each side and determine the midpoint. Connect the midpoints and make a new quadrilateral (iteration 1). Measure the interior angles and the perimeter of this new quadrilateral.

3. Repeat step 2 for two more iterations. Record the sum of the interior angles and the perimeter.

4. What do you notice? Wonder about? Estimate what the sum of the angles and the perimeter will be for the 10th iteration. (Do not draw this 10th iteration. Simply estimate based on the pattern.)

5. What do you notice about the sum of the interior angles? Did you notice anything else about the angles?

6. What do you notice about the perimeter of each iteration? Did you notice anything else about the perimeter?

7. Colour in your shape to make a creative design.

Iteration	**Sum of interior angles**	**Perimeter**
0		
Determine the midpoint of each side and connect all four midpoints to make another quadrilateral.		
1		

Iteration	Sum of interior angles	Perimeter
Determine the midpoint of each side and connect all four midpoints to make another quadrilateral.		
2		
Determine the midpoint of each side and connect all four midpoints to make another quadrilateral.		
3		
What if you did this seven more times? Can you guess what the measurements might be?		
10 (estimate the measurements—do not create the quadrilateral)		