Quadrilateral Pretenders: Classifying Quadrilaterals

For GSP5 ACTIVITY NOTES

INTRODUCE

Project the sketch for viewing by the class. Expect to spend about 10 minutes.

1. Open **Quad Pretenders Present.gsp** and go to page "Drag Test." Say, ***Some of these Sketchpad shapes have been constructed to always be squares, and some are just pretending to be.*** Drag vertices *A, B,* and *C* of the purple quadrilateral and see that it is no longer a square. ***What can you say about the shape?*** [It's always a parallelogram] Students may offer, among other ideas, that it is a rectangle, a parallelogram, or a quadrilateral. Suggest that they be as specific as possible and yet still include all possibilities. Help clarify that it's not a rectangle (although it may appear to be in some cases), but it's always a parallelogram.

2. As you drag other parts of the figure, ask, ***Does it stay a parallelogram no matter what I drag?*** [Yes] Students may need to revisit the definition of a parallelogram. ***The drag test showed that the parallelogram shape was pretending to be a square.*** Although the parallelogram initially looked like a square, it was not constructed to have the characteristics required in a square.

3. Review how a quadrilateral is named. ***One name for this parallelogram is parallelogram BCDA. What is another way to name this parallelogram?*** For example, students might say *ABCD, DABC,* or *CDAB.*

4. Refer to the blue quadrilateral. ***This second shape doesn't have its vertices named.*** Show students how to click a vertex with the **Text** tool to show its label. Once all the vertices are labeled, ask students to name the second quadrilateral by its vertices. For example, they might say *JKLI, LIJK,* and so on. ***What shape is IJKL?*** [A general quadrilateral. It has no more specific characteristics.]

5. ***What about shape EFGH? Is it always a square or is it a pretender?*** [It has a right angle.] Drag vertex *E,* and then vertex *F.* ***It still looks like a square. Let's try to drag the other vertices.*** When students see that it is no longer a square, ask them what kind of shape it is. Once they identify it as a trapezoid, ask, ***What else can you say about this trapezoid?*** [It has a right angle.] Encourage many responses. Students might say that it has two parallel sides, thus allowing you to remind them of the definition of a trapezoid. Bring out the fact that this particular trapezoid has a right angle.

6. ***What about shape MNOP? Is it always a square or is it a pretender?*** Drag each vertex in turn until students are satisfied that it will always

remain a square. ***So, shape MNOP is always a square, and the other three shapes were just pretending to be squares.***

7. As students begin work on the activity, let them know that identifying the pretenders is only part of the task; they must also describe as specifically as possible what each pretender really is. Encourage students to ask their classmates for help with Sketchpad, if needed.

8. If you want students to save their work, demonstrate choosing **File | Save As,** and let them know how to name and where to save their files.

DEVELOP

Expect students working at computers to spend about 25 minutes.

9. Assign students to computers and tell them where to locate **Quadrilateral Pretenders.gsp.** Distribute the worksheet. Let pairs work at their own pace. As you circulate, here are some things to notice.

   - For students who may be jumping to conclusions, ask, ***Have you tried to drag each vertex?***
   - If students drag a quadrilateral so that its edges cross, they no longer have a quadrilateral. ***For this activity you will need to limit your dragging to reshaping the quadrilateral without letting sides cross.***
   - Use questions to help students describe the pretenders completely.

     What stays the same as you drag this shape? What changes?

     How are these two opposite sides related?

     What is happening to this angle? To the other angles?
   - Quadrilaterals should be identified as specifically as possible. For example, on the "Trapezoid Pretenders" page, once students have identified trapezoids and pretenders, ask, ***Which quadrilaterals are trapezoids but also have more specific names?***

10. If students will save their work, remind them where to save it now. You might collect students' Explore More work on a flash drive or ask them to save their sketches where they can be displayed later.

SUMMARIZE

Expect to spend at least 10 minutes.

11. Gather the class. Students should have their worksheets with them. You might invite selected pairs to demonstrate their work on pages "Rectangles," "Parallelograms," and "Trapezoids." Ask demonstrators

to explain why they made particular choices. Alternatively, you might lead a class discussion around the solutions provided in **Quad Pretenders Present.gsp.**

12. If you have time, discuss the Explore More. Once students have results that pass the drag test, ask them to share these and the pretenders they made, and tell how they used the properties of the specific quadrilateral to construct the shape in Sketchpad. You might spend another day with students showing their construction work. These constructions could also extend to projects that are presented later.

13. ***What have we learned through this investigation?*** Help students articulate whatever they have learned. Include the objectives of the lesson. Students might offer suggestions like these, or you might want to bring these up.

    - The drag test reveals pretenders—shapes that may *look* like a particular shape, but are not constructed to have the required characteristics.
    - A general quadrilateral can pretend to be any of the more specific quadrilaterals.
    - The square fits within all definitions if your curriculum uses an inclusive definition of trapezoid (a quadrilateral with *at least* one pair of parallel sides). If your curriculum uses an exclusive definition of trapezoid (a quadrilateral with *exactly* one pair of parallel sides), then a square is a rectangle, a rhombus, a parallelogram, a kite, a right quadrilateral, and a quadrilateral.
    - Sometimes definitions of shapes are different (for example, trapezoid). It is important to understand the definitions, particularly when you are building a hierarchy of shapes.
    - A square could be called a right rhombus or an equilateral rectangle.
    - A rhombus is an equilateral parallelogram.
    - A rectangle is a right parallelogram.
    - A kite sometimes looks like a dart. ***What is the difference? Are their mathematical definitions different?*** Let students suggest definitions to distinguish the two shapes. Most likely they will involve an interior angle of more than 180° or use the term *concave.*

14. ***What other questions might you ask about relationships among shapes or definitions of shapes? You may or may not be able to answer them.*** Here are some ideas.

    Are there other kinds of quadrilaterals besides those we've discussed today?

    Is there a right kite? How many right angles would it have? [It could have exactly one right angle or all four right angles (making it a square).]

    Is there a special name for a trapezoid that has three sides the same length? (That is, one base is the same length as the sides.) [No.]

    Is it true that if shape A can pretend to be shape B (but is not actually shape B), then all B shapes are A shapes? [Yes. For example, a rectangle can pretend to be a square, and all squares are rectangles.]

    Can you classify shapes other than quadrilaterals, like triangles? [Yes. For example, equilateral, isosceles, and scalene triangles. Most other polygons are either regular (equilateral and equiangular) or irregular.]

EXTEND

Have students create a tree diagram or Venn diagram showing the relationships among quadrilaterals. For manageability, it's best not to include the right trapezoid or right quadrilateral in all diagrams. Including the kite is also problematic in a Venn diagram that uses inclusive definitions. Creating a visual display of the hierarchy of quadrilaterals could be a homework assignment, or you might create the diagram as a class. You might draw diagrams in Sketchpad like those presented in the last four pages of **Quad Pretenders Present.gsp.**

ANSWERS

1. "Parallelogram Pretenders": *JKLM:* kite; *NOPQ:* parallelogram; *CDEF:* rectangle; *RSTU:* quadrilateral; *VWXY:* trapezoid. *NOPQ* and *CDEF* are parallelograms. A rectangle is also a parallelogram.
2. "Rhombus Pretenders": *ABCD:* trapezoid; *RUST:* rhombus; *EFGH:* rectangle; *VWXY:* parallelogram; *NOPQ:* kite (or dart). *RUST* is a rhombus.
3. "Trapezoid Pretenders": *ABCD:* trapezoid; *JKLM:* quadrilateral; *NOPQ:* rectangle; *EFGH:* isosceles trapezoid. *NOPQ* and *EFGH* are isosceles trapezoids if you are using an inclusive definition of trapezoid.

4. "Square Pretenders": *ABCD:* square; *WXYZ:* rhombus; *KLMN:* parallelogram; *STUV:* rectangle; *CRAB:* quadrilateral; *FISH:* kite (or dart). *ABCD* is a square.
5. "Rectangles": All quadrilaterals can pretend to be rectangles, but only the square and rectangle are truly rectangles. See **Quad Pretenders Present.gsp.**
6. "Parallelograms": All quadrilaterals can pretend to be parallelograms, but the square, rectangle, rhombus, and parallelogram are truly parallelograms. See **Quad Pretenders Present.gsp.**
7. "Trapezoids": All quadrilaterals can pretend to be trapezoids. If you use the inclusive definition of trapezoid (having *at least* one pair of parallel sides), then the square, rectangle, rhombus, parallelogram, isosceles trapezoid, right trapezoid, and trapezoid are all truly trapezoids. If you use the exclusive definition of trapezoid (having *exactly* one pair of parallel sides), then only the last three of these quadrilaterals are trapezoids. See **Quad Pretenders Present.gsp.**
8. "Make Your Own": Constructions will vary. The drag test will indicate whether students have successfully created a specific type of quadrilateral or a pretender.