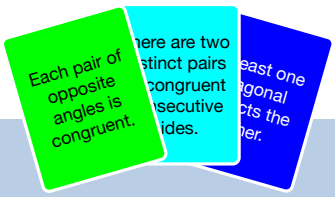
Constructing Quadrilaterals with String



Create quadrilaterals using string and some properties. Challenge yourself to determine which quadrilaterals are possible.

Strands:

Number & Quantity	
Algebra	
Functions	
Geometry	
Statistics & Probability	

Materials Needed:
- *Angles* and *Sides* property cards
- 2 ft of string, one per pair of players (Inside)
- 2 yards of string, one per group of 4 players (Outside)

Where:

Outside	X
Inside	X
On-line	
On-site	

Set-Up:
- Work in pairs.
- Tie the ends of the string together to make a loop.
- Separate and shuffle the *Angles* and *Sides* cards. Place each set of cards face down in its own messy pile.

Object of the Game: Use Angle and Side properties to accurately construct a quadrilateral having those properties.

Pre-Game Play:
- Flip over one card from each pile. Using a string loop, work together to make all the possible quadrilaterals that fit both properties.
- To decide if there are other quadrilaterals that fit both properties, play with the Shape Makers interactive app, https://www.geogebra.org/m/jSuTKW6Z.

Playing the Game:
1. Flip over one *Angles* card and one *Sides* card. All pairs play with these cards.
2. Make as many different types of quadrilaterals as you can that satisfy both properties listed on the *Angles* card and the *Sides* card.
3. In turn, starting with the pair who flipped the cards,
   a. Justify one type of quadrilateral based on the properties listed on the cards. Be specific with your justification. Show how you determined congruence of angles or sides if properties request them.
   b. The other players must agree.
   c. Earn one point for each type of quadrilateral you justify.
   d. In turn, each pair shares one different quadrilateral that satisfies both properties. Continue until all pairs have shared each type of quadrilateral they found to fit the properties.
4. Return the cards to their respective piles and shuffle the piles. Play continues to the left.
5. Repeat Steps 1 through 4 until each pair has completed Step 1 twice.

To Win: The pair with the most points at the end of the game wins.

Think About It:
6. Think about each type of quadrilateral.
   a. How are the sides of the quadrilateral related to each other?
   b. How are the angles of the quadrilateral related to each other?
   c. How do you know?
7. Think about relationships among the quadrilaterals. Consider one card at a time:
   a. Which quadrilaterals have which *Angles* properties?
   b. Which quadrilaterals have which *Sides* properties?
   c. Why do you think so?
8. Are there any property cards that completely determine a quadrilateral without the need of any other properties? Which ones? How do you know?
9. Which quadrilaterals cannot be determined with only one property card? Why do you think so?

Variations:

Take it Outside: Play as above with 4 players per team and longer string. Each player positions one vertex of each quadrilateral.

Diagonals, Too: Include the *Diagonals* property cards. Use a *Diagonals* property card with one other type of property card and replay the game.

Venn Diagram: Use three strings to make a Venn diagram (see figure below). Choose one property card from each pile and place each in its own circle. Write each type of quadrilateral on a separate small sticky note. Playing with others, in turn, place one sticky note while stating why you placed the sticky note as you did. Play until all of the types of quadrilaterals are positioned in the Venn diagram. What properties do different types of quadrilaterals have in common?

Helpful Hints:

- If you are having trouble deciding what a property card says, answer the following questions:
  - Are you adding more restrictions than the card states?
  - Which types of quadrilaterals have the *Angles* property?
  - Which types of quadrilaterals have the *Sides* property?
  - Do any types of quadrilaterals have both properties?
- Play with *Shape Makers* again and answer the **Helpful Hints** questions.