**What is Math?**

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| This is lesson one in a series of six lessons focused around developing a mathematical community at the beginning of the school year. The primary goal of this lesson is for students to begin establishing norms for math class. A secondary goal is to start exploring a non-standard problem that has more than one possible solution. |

**NC Mathematics Standards:**

**Geometry**

**Reason with shapes and their attributes**

**NC.2.G.1** Recognize and draw triangles, quadrilaterals, ~~pentagons, and hexagons~~, having specific attributes; ~~recognize and describe attributes of rectangular prisms and cubes~~.

**Standards for Mathematical Practice:**

1. Make sense of problems and persevere in solving them.

3. Construct viable arguments ~~and critique the reasoning of others~~.

**Student Outcomes:**

* I can think carefully about a problem.
* I can work hard to solve a problem.

**Math Language:**

* math
* triangle
* circle
* rectangle
* square
* side
* side length

**Materials:**

* Access to internet
* [Glencoe Virtual Manipulatives](http://www.glencoe.com/sites/common_assets/mathematics/ebook_assets/vmf/VMF-Interface.html)
* *Chain of Changes* shape sheet from the last page of this file or from <https://nrich.maths.org/221/index>
* Materials for “Math is…” and “There are many ways to solve a problem!” anchor charts

**Advance Preparation**:

* Visit <https://nrich.maths.org/221/index> to read through the problem and the *Teacher Resources* link <https://nrich.maths.org/221/note>
* Decide if you will ask the children to
	+ draw the shapes. If so you will need red, yellow, and blue crayons or markers. or
	+ glue or tape paper shapes onto a sentence strip. If so, you will need sentence strips and glue sticks.
* Print and cut out 1 set of shapes from the *Chain of Changes* shape sheet for each student pair (There are 2 sets on each sheet.)
* Try the link labeled “this interactivity” on the *Teacher Resources* page, to see if the swf-file will work on your computer (an swf-file is a “small web format” file that is an Adobe Flash type file), to move the shapes into a line based on student input. If the applet does not work, use the Glencoe Virtual Manipulatives site and choose the attribute blocks manipulatives to demonstrate.
* Write the [problem](https://docs.google.com/presentation/d/12KTnii3yDiSgWr93PulAGjpN2KymXXvc2D3NPQ7S3UI/edit?usp=sharing) on the board or on paper to project under the document camera.

**Launch:\***

1. Introduce the word ***mathematics***.
* Say: *Learning about mathematics is super important because it is all around us. During our daily math time, we will learn about math in our world, like shapes and numbers. Lots of interesting problems are solved using mathematics and we will use our creativity and good thinking to solve hundreds of problems this year!*
* Give pairs of students the shapes and have them explore with the shapes. Notice what types of “math” they can do using the shapes.
* After the exploration time, say: *You did lots of math. Let’s talk to our partners about the types of math you did with your partner. When we talk to partners, we sit “knees to knees”*. *Then, we decide who shares first. I say something, then my partner says something. We keep taking turns until the teacher gives a signal* (teacher models with a student).
* Partners discuss the math they were able to do during the exploration time. Then, several students share with the whole class. As students share, generate a ***“Math is…”*** chart (see sample chart right). This chart may be displayed and added to throughout the school year.

***Math is…***

Counting

Shapes

Measuring

Sorting

Subtraction

1. Explain today’s task.
	* Say: *Today, we are going to work with shapes. I challenge you to find a solution to this problem.* Have the problem written on the board- “**Place all pieces in a line, starting with the blue triangle. Each time you put the next piece in line it must be either the same shape or the same color. Your last piece must be the red circle.”** *There are incorrect solutions, but there are also many correct solutions.* (NOTE: You can write the problem on a chart for students to reference.)
	* Show a picture of the shape sheet. Explain the challenge. *The challenge for you today involves working with all of these pieces. These pieces are different in their color and in their shape. You’re going to start arranging these pieces in a line beginning with the blue triangle. Each time you place the next piece in line, the next piece must be either the same shape or the same color. AND the last piece in your line must be the red circle. If you play the game Uno, you will notice that the rules for this activity are the same as the rules for Uno.*
	* Use either the swf-file, drawings of shapes on the board, or cut out shapes to use on the document camera, to clarify the task. *Let’s start one line together to make sure the challenge is clear. What shape could come after the blue triangle?* (any blue piece or any triangle) *Why wouldn’t the yellow square come next in line?*

**Explore:**

1. Allow 5-10 minutes for students to find an ordering of the shapes that works. This exploration time is useful for observing and collecting formative data on students’ current level of understanding. If students are productively grappling or if you see a few students showing unproductive frustration, try asking the corresponding questions in the chart below. If the class shows unproductive frustration, pull students back together and complete a sequence of pieces together as a whole group. Then allow students to try again. There are lots of ways of doing this problem! Once students have determined the solution they want to save, have them glue/tape their sequence of shapes onto a sentence strip.

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| **Observation** | **Questions to Ask** |
| Student is struggling and not ordering pieces. | Student may be overwhelmed by the multiple parts of the task. Ask:* If you have to choose the next piece to be the same color, which pieces could be next? (then repeat after the 2nd piece is placed)
* If you have to choose the next piece to be the same shape, which pieces could be next? (then repeat after the 2nd piece is placed)
 |
| Student is working well or quickly and finds a solution. | * Why did you choose this as the next piece?
* Was there another piece you could have chosen for this position?
* (If their neighbor is also finished…) Look at this other sequence. Is this a solution?
* Can you find a different solution?
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As students work, select a few different solutions to share during the “Discuss” section of the lesson and plan what order will bring the most attention to misconceptions and/or to clear understanding.

**Discuss:**

1. Bring students together. *Very often in mathematics, there are many different ways of solving a problem. Let’s see how many different ways our class solved this challenge.*
2. Have pre-selected students share the sequences they created. The teacher will add students’ sentence strips after students have shared to the anchor chart and title it “There are many ways to solve a problem!” Ask students to compare the shared sequence to their own. *Was your sequence of pieces the same? Was it the same for some part of the line?*
3. Say: *Mathematics is everywhere in our world. Today and each day, we will keep talking about math, looking for math in our world, and using math to solve problems. Today you learned that there can be more than one way to solve a problem. We will leave this anchor chart up in our room to remind us of that fact. Today you have done some good thinking about a mathematical challenge!*

**Evaluation of Student Understanding:**

**Informal Evaluation:**

* Students are able to build a sequence of shapes with or without ending on a red circle.
* Students are willing to engage with the problem and try multiple attempts.
* Students worked cooperatively with a partner.

**Meeting the Needs of the Range of Learners:**

**Interventions:**

* Watch [Sesame Street: Tyler Perry and Elmo Eat Math](https://www.youtube.com/watch?v=i9jKFqnd1sE). Have students look for the things Tyler does or says about math during the video. 

**knees to knees**

* If students are struggling to understand the different types of math that they can use during the exploration time, you can watch this video to see a teacher launching a task using a Sesame Street video. This is a video of a teacher modeling “Math is…” with a group of students. <https://www.youtube.com/watch?v=mEj-i1mgCtg&t=7s>
* After the video or exploration time, say: *Tyler did lots of math. Let’s talk to our partners about the things Tyler did. When we talk to partners, we sit “knees to knees”*. *Then, we decide who shares first. I say something, then my partner says something. We keep taking turns until the teacher gives a signal.*
* Partners discuss the math Tyler does in the video. Then, several students share with the whole class. As students share, generate a ***“Math is…”*** chart (see right). This chart may be displayed and added to throughout the school year.

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| * Math is . . .
 |
| * counting
* shapes
* measuring
* sorting
* subtracting
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* The problem can be simplified by not requiring the last piece to be a red circle.

**Extensions:**

* Repeat the start with a blue triangle and end with a red circle requirements, but this time the next piece must be a different color and then the next piece must be a different shape. Continue changing color, then shape to put all the pieces in line.
* Students could use classroom computers to play this game during center time to try to come up with multiple solutions.

**Possible Misconceptions/Suggestions:**

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| **Possible Errors****and Misconceptions** | **Suggestions** |
| Student struggles with the multiple requirements for choosing the next piece.  | Ask the student to choose the next piece to be the same color, then the next piece to be the same shape, so that you isolate the 2 possibilities. After about 3 or 4 pieces, see if the student can make a decision when both options are possible. |
| Student is unwilling to make an attempt. | Work with the student as described above, or ask the student to create a sequence of pieces that they like, then ask the student if their sequence fits these rules.  |

