**Geometry – possible side lengths for a triangle**

\*\*This lesson usually takes 2 full 50 min class period. I think it would be perfect for a 75 – 90 minute block class.

\*\* Tools needed – compass for each student, centimeter ruler for each student, drawing paper, pencils and erasers.

**Focus / Objectives**

* To draw a triangle, to scale, when given the three side lengths
* To be able to explain why a triangle with given side lengths is or is not possible
* To provide the range of values for a missing side length

**Day 1**

**Ignition:** Types of Triangles

 (Instructions on the board as they enter class)

“Get your drawing tools. You need

* a quality compass (test it out! Make sure you like it!)
* a centimeter ruler
* pencil
* plenty of drawing paper

Sketch an acute, obtuse, and a scalene triangle.”

Have them compare their sketches with a neighbor, discuss the meanings of the words acute, obtuse, and scalene.

**Bridge:**

Using your ruler sketch a scalene triangle with side lengths labeled 8 cm, 5 cm, and 7 cm. Discuss the difference between a sketch and an accurate scale drawing.

**Gradual Release**

**I Do:** Model this under the document camera so they can see your hands while you are drawing. Meta-talk through what and why you are doing it.

I will show you how to draw this triangle exactly. Watch me first, then we’ll do it together.

Using your ruler, draw a line 8 cm long. I have found that it is easiest to draw the longest line first, but it really does not matter.

 *Draw an 8 cm line* – remind them that you need to start with the 0 cm mark on the ruler.

Next, I’ll open up my compass to either 5 cm or 7 cm. Which one do you want to do?

 *Get their response and open the compass up the appropriate length. Show them the two points on the ruler.*

Now I’ll draw an arc. Everything on the arc is 5cm (or 7cm) from the end of the segment I just drew.

All I have to do to finish is repeat this using the other endpoint and the other length. X marks the spot for the third vertex. Measure to double check. *Draw the other arc, draw the two sides, label and measure each side as a check.*

**We Do:** REPEAT the same triangle one side at a time with them following your directions. Have them have their neighbor measure their triangle sides and help each other out.

Discuss units –example: If I give you miles, what do you need to do to draw it TO SCALE.

Verbal Confidence check – Do you think you can draw a triangle if I give you ANY three numbers? If they don’t feel confident walk them through another one that works and repeat the question.

**You Do:**

Group the students into random groups of 3-4 people. Three works well but you don’t want too many groups. From here on, the teacher is a facilitator and must be able to question all the groups.

Give them a list of side lengths. I have found 4 sets to work well.

1. 5, 4, 6
2. 3, 5, 7
3. 1, 6, 3 (will not work – you will hear their reaction when they get to it!)
4. 5, 3, 2 (should not work – should end up a line over a line, most likely will make a triangle, we’re human after all)

AS soon as a group hits the third drawing you will hear them start discussing that it doesn’t work. Get over to them and ask them: Why didn’t it work? What’s the problem?

Can they make up another one that won’t work? \*\* With a bigger class you may want to save case 4 until you’re sure all groups have case 3 figured out.

Set up Case 4 as a special case – Should it work? Did yours? What happened? What should have happened?

**Debrief:**

Regroup as a class (without changing seats back) and have them summarize their results. Share some of the drawings of case 4 that actually worked the way it should have (usually one or two people can get it to be a line over a line)

Have the groups to write a rule for how to tell if the three numbers provided can make a triangle.

--- Usually out of time at this point and I have them write their rules down as an exit ticket.

**Day 2**

**Ignition:** Have their tools list and have their rules from yesterday (in their own words) on the board. After they get their tools:

 Review how to draw a triangle given three sides, have them do one that works and one that doesn’t. Compare with and/or help your neighbor.

**Bridge:**

Discuss and evaluate their rules. Come up with one that the class agrees with.

Usually they come up with a version of this:

Add the two small ones and they have to be bigger than the biggest.

**Gradual Release:** This is all small group work with teacher as a facilitator.

 Say: “I know you can tell if a triangle can be drawn or not. BUT, can you give me a range of lengths that could work for a mystery side? Let’s say I give you 3 and 7. What could the 3rd side be? Let’s get into the same groups as yesterday. Find me the range for the 3rd side.”

 Have them group up and start testing theories. Usually the groups will come up with 4 to 11. They will need prompting to get to decimal side lengths and the idea of between 3 and 10. Question them to get them to decimals and the idea of between. Have the groups come up with their own rules for how to find the smallest and largest possible values. Be sure to test their rules.

Also – (This may need individual re-teaching) Make sure they remember how to properly write “between” with symbols 3 < x < 10. NOT 3 – 10.

**Debrief:** Return to regular seats and summarize the rules for finding the range of the third side. Review the rules for determining if the triangle is possible or not, and what it looks like if it does not work.

**Independent practice** from the text – primarily number based, less reliance on the pictures.

**Assessment:** Rely primarily upon discussion and individual conversations. Do their answers show thought? Are they coming up with appropriate conclusions? As you work with the groups, be sure to direct your questions to the members of the group who do not want to volunteer to speak. Have them explain why or why not the triangle works or why they agree with the vocal student taking the leadership role. Also use the independent text work for assessment.