

Lesson Plan Guide

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Class and Grade Taught: 7th grade math
Lesson Date: Tuesday, March 5, 2013

Lesson Logistics and Setting

Unit Topic: Geometry

- **Previous Lesson Topic:** Properties of types of triangles/interior angle sum = 180° for all triangles
- **Current Lesson Topic:** Triangle Inequality
- **Next Lesson Topic:** Finding missing angle in triangles

Lesson Objectives:

(The learner will know/understand/be able to ...)

Goal: Students will be able to determine whether three side lengths construct a triangle or not.

- **Standards Addressed:** 7.G.2 - Draw (freehand, with ruler and protractor, and with technology) geometric shapes with given conditions. Focus on constructing triangles from three measures of angles or sides, noticing when the conditions determine a unique triangle, more than one triangle, or no triangle

- **How will I know students have met the objectives?**

The students will understand that triangles need more requirements (specifically side length requirements) than just having 3 sides.

The students will be able to notice that some side length combinations do not work to create a triangle.

The students will be able to see that the sum of the two shorter sides lengths of a triangle must be greater than the longest side of the triangle.

Materials Needed:

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Straws (3 straws of each of the following lengths: 1 inch, 2 inches, 3 inches, 4 inches, 5 inches, 6 inches, and 7 inches) for each pair of students.

Ruler (one per pair of students)

Triangle worksheet (one per student)

One (uncut) straw per student

Scissors (one per pair)

Introductory Routines (announcements, homework review, etc.)

1-minute timer for students to get their materials and be in their assigned seats.

No homework will be assigned the previous day.

Go over the goal and agenda for the day.

(4 min)

Lesson Activities

(Attach any handouts you will use)

Lesson	Students are working ... <i>(details about how students are configured, what work they are doing and how they are recording their work)</i>	Anticipated Student Thinking/Questions	Teacher Moves
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<p>Launch (10 minutes)</p> <ol style="list-style-type: none"> 1. Pose the questions to be answered in bellwork notebooks: "What are the characteristics of all triangle?" "Can you construct a triangle with the side lengths of 3, 8, 14? Why or why not?", "Can you construct a triangle with the side lengths of 12, 12, 12? Why or why not?", and "Can you construct a triangle with the side lengths of 8, 10, 14? Why or why not?". (4 minutes) 2. Discuss with class what answers to each question/prediction were. (4 minutes) 3. Have 2 students put bellwork away while I have 1 student passing out the handout and another student passing out the straws. (2 minutes) 	<ol style="list-style-type: none"> 1. Students are to be writing down their answers individually in their bellwork notebooks. They will be sitting in their assigned seats which are in groups of 4-6 students. 2. The students will be in their assigned seats with their bellwork journals with their answers open. I will call on a few students for answers. Only the students who I have called on to share their answers should be talking. 3. The students I ask to put bellwork away and pass out materials will be out of their seats walking around the room doing their assigned jobs. All other students will be in their assigned seats. 	<ol style="list-style-type: none"> 1. Students will say that a triangle needs 3 sides. Students will say that a triangle needs 3 angles. Students will say that all the angles in a triangle add up to 180 degrees. Some students may start talking about characteristics of certain types of triangles, such as isosceles triangles. I anticipate most students will think that a triangle can be made from all three examples of side lengths given. 2. I would not be surprised for a student to say that they don't think one of the groups of sides will make a triangle. 	<ol style="list-style-type: none"> 1. I will take attendance as soon as I pose the questions to the students. Once done with attendance, I will walk around the room and monitor students' responses to the their bellwork questions. 2. I will call on students that I have selected to answer each of the following questions. 3. While students are collecting bellwork and passing out materials, I will be making sure all students have a partner. If there are an odd number of students for the day, I will assign a group of 3. I will be making sure all students have a handout and have a partner.
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<p>Explore – Description of Task(s) (24 min)</p> <ol style="list-style-type: none"> 1. I will instruct the students that they are to work with their partner (the student next to them). I will also explain to them what they are to be doing throughout the activity. I will also tell students and give them a key what length each color straw represents, but they will have rulers if they need to measure the straws as well. (2 minutes) 2. Each partner will be constructing 4 triangles and recording information in their tables. (12 minutes) 3. The pair of students will answer the questions on the handout together. (7 minutes) 4. Once students are done answering the questions, They will need to cut a straw in three pieces (each of different lengths) so that they are able to form a triangle out of the three pieces they cut. (3 minutes) 	<ol style="list-style-type: none"> 1. Students will be listening silently to the directions in their seats. They will look over the handout and ask any questions they might have about the activity. 2. While the first partner is constructing the first 4 triangles, his/her partner will be recording the information in the table. Once partner 1 is done constructing the first 4 triangles, partner 2 will record the information for partner 1's triangles. Once all 8 triangles have been recorded, both partners need to make sure they have all 8 triangles' information in both of their tables. 3. Students will work together to answer the questions on the worksheet. Students will hopefully notice that the sum of the two short sides of the triangle must be less than the length of the longest side of the triangle. 4. Students will recognize the triangle inequality (but not know the proper name) and be able to use this to cut a straw in three pieces, each of a different length so that the three pieces can create a triangle. 	<ol style="list-style-type: none"> 1. Students might wonder if just one student can make all the triangles. I will instruct students they are both to make triangles. Students might ask if they can work alone. I will tell students that they are to work in pairs because there is not enough time to get all the data from one person, and it is helpful to talk to another student to share ideas for solutions to the questions. Some students might not realize they have to manipulate sides/straws to make them work to be a triangle, some students might have sides that do form a triangle, but when assembling the triangle, they may not put one of the first sides in the correct spot, see a gap and think it does not make a triangle, I will make sure to tell students at the beginning that they need to make sure to move the straws a few times to make sure one side combination does not work if it doesn't work the first time. Some straws may have been cut a little longer/shorter than the actual length, so some students may get a triangle, that they call yes, when it should be a no. This shouldn't be the case, most error shouldn't be large enough to make a difference, but if this does happen, I will have a smartboard file with lines of lengths 1-6 to be able to show students on there...or can try other straws under the doc cam. 2. Some students might choose the same side lengths for multiple triangles. If a pair of students has many repeats of the same side length combinations, I will encourage them to try different side length combinations. Students might ask if they can just write down four triangles in their table. Students may ask if it matters which side of the triangle they call side 1, 2, or 3. I will tell them it does not matter. They can choose how they want to write the side lengths in the table. Students may not notice the pattern for the sides, so I will make hint cards that could help them get to the correct pattern. If they get stuck and can't find a pattern they can go up to the front of the room and look at the first hint card. If that doesn't help, they can look at the next hint card. There will be at least 3 hints. Some students might put two straws together to make side lengths longer than the possible 7 inches...which is fine, just adds more variety to the triangles that can be created. 3. One student might dominate answering all the questions. I will encourage students at the beginning of the explore task to make sure both partners have a chance to share any thoughts about each question before moving on to the next question. Students might ask if they can just use one hand-out for the pair. I will tell them I want each person to complete a handout, so I can see each person participating as well as so they have the information for their own use. 4. Some students might not notice the pattern for the triangle inequality. If this is the case students might cut their straw incorrectly. Some students might cut their straw before thinking and not be able to make a triangle from the three pieces of their straw. Some students might cut the straw into three equal segments, even though the directions say not to. 	<p><i>Exact question that you will pose to students to begin the exploration.</i></p> <ol style="list-style-type: none"> 1. I will be instructing the students about what will be going on during the activity and what they should be doing. I will ask them "Do you think any 3 side lengths will create a triangle?" 2. I will start monitoring students. I will be listening to student conversations about anything they are noticing, as well as how they are making their triangles and recording their data. I will ask students now "Do you think any 3 side lengths will create a triangle?" I will also ask them if they are noticing any patterns in their tables. 3. I will continue to monitor students. I will be listening to see if one student is dominating answering the questions. If one student is doing all or the majority of answering the questions, I will ask the quieter partner if he or she noticed any patterns. I will also be looking to make sure both students in the pair are writing everything down on their handout. If I notice only one student with writing, I will ask the student with little or no writing a question about what is on the other students' paper, such as, I notice you were talking about this pattern (pointing to the writing on other partner's paper). I will ask what they were talking about so I can see if that student is following along or not. 4. I will still be monitoring, making sure both students in the pairs are cutting their own straws. I will also ask students how they decided to cut the straw in the way that they did.
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<p>Summarize/Share and Discuss (17 min)</p> <ol style="list-style-type: none"> As a class, we will record data for one triangle from each group on the Smartboard. On the board there will be a two column table, one column will be for the yes-a triangle was created, and the other side will be no- a triangle was not able to be constructed from these side lengths.(4 minutes) As a class we will discuss student responses to the questions on the handouts. We will first discuss the patterns students saw in the table. I will be looking for students noticing that the two shorter sides of the triangle are together longer than the longest side of the triangle when the side lengths did make a triangle in the table. I will be calling on students that I previously selected during monitoring before the discussion. (7 min) I will tell students that they found some great observations. And I will share with them that their observation about the sum of the two shorter sides must be larger than the longest side length in order to form a triangle. The math name for this is the triangle inequality. (1 min) I will then ask students if having just 3 sides and an interior angle sum of 180 degrees are the only requirements for building a triangle. I will be looking for, no, and an explanation of the triangle inequality. (2 minutes) I will give students an exit slip with the same 3 sets of triangles' side lengths from the bellwork, to see if all students understand when a triangle will work and when it will not when given side lengths. (2 minutes) Pass out homework. First student done with the exit slip will pass out the homework. (1 minute) 	<p><i>Presentation mode – Sharing solutions, teacher-led discussion, student led discussion, etc.</i></p> <ol style="list-style-type: none"> Students will be sitting in their seats next to their partner. One student from each pair will give the 3 side lengths and yes or no, for whether or not the sides made a triangle, for just one of the triangles they tried to construct during the explore. All students will be sitting quietly and listening, unless they have been called upon to share their data. The students who I have called on to share their findings for the pattern question and the remainder of the questions will come up to the doc cam and show their findings on their hand out. I will also encourage students to show the actual triangles they had made from straws as well so that all students can see the triangles being talked about. Students will be listening to me give the math name, "triangle inequality". They should also be writing the name down on their handout, so they can remember the name. Students will be raising their hand waiting to say that just 3 sides and an interior angle sum of 180 degrees are not the only requirements; the sum of the shorter two sides must be longer than the longest side of the triangle. Students will individually answer whether each set of side lengths will be able to create a triangle. When students are done they will raise their hand and I will come pick it up from them. The students will work on their exit slips, the first person to turn the exit slip into me, will pass out the homework to the clas. 	<ol style="list-style-type: none"> Students may again ask, if order of the side lengths matter, and I will tell them the order doesn't matter. Student may ask if they have to give a "yes" and a "no" or if it matters which they give me. I will tell them to choose whichever one they want, but only one. Students who don't put their side lengths in order from shortest to longest, for example, may have a more difficult time seeing the pattern for the triangle inequality. If this is the case, I will suggest that they write the sides in some order for each triangle. Some students may share that triangles with all the same side lengths will work to create a triangle. Students may ask what "inequality" means. I will explain to them what the inequality sign means and how it follows along with what we just talked about. Students might think the triangle inequality falls under having 3 sides, so I will clarify by asking if a triangle can have ANY three sides. Students might ask if they need to put a reason why, I will say yes, please give your reason why you say it will or will not make a triangle. 	<p><i>What will you say or do to set up the discussion of the big math ideas?</i></p> <ol style="list-style-type: none"> I will be selecting pairs of students to share their data and writing the data on the table. I will be calling on students that I selected while monitoring to share their responses to questions with the class. I will mainly be looking for students who noticed the pattern for the triangle inequality; hopefully a few pairs will have a couple of different ways to explain this finding. I will give the students the formal name to their observations, which will be the triangle inequality. I will then ask them if 3 sides and an interior angle sum of 180 degrees are still the only requirements for building a triangle. I will be passing out the exit slip and collecting them. I will still be collecting exit slips while one student is passing out the homework.
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Summary Statement: Today we discussed what is required to build a triangle. We knew a triangle needed three sides and an interior angle sum of 180 degrees, but we also discovered a triangle doesn't just have any three side lengths. The sum of the two shorter sides must be larger than the longest side of the triangle, which is called the triangle inequality. (1 minute)
(May change based on what actually happens in class)

Homework:

1. Construct two triangles. Label the side lengths. Give a reason, why the given side lengths allow a triangle to be built.
2. Give three sides that will not construct a triangle, explain why they will not.