<table>
<tr><td>Materials: Different right-triangles to hand out to each group, In-class activity papers, rulers, paper, pencil, notes, Rubric for Performance Assessment</td><td>Technology Needed: Computer with PowerPoint and SMART Board</td></tr>
<tr><td>Instructional Strategies:
X Direct instruction
☐ Guided practice
☐ Socratic Seminar
☐ Learning Centers
☐ Lecture
☐ Technology integration
☐ Other (list)
☐ Peer teaching/collaboration/ cooperative learning
☐ Visuals/Graphic organizers
☐ PBL
☐ Discussion/Debate
☐ Modeling</td><td>Guided Practices and Concrete Application:
☐ Large group activity
☐ Independent activity
☐ Pairing/collaboration
☐ Simulations/Scenarios
☐ Other (list)
☐ Hands-on
☐ Technology integration
☐ Imitation/Repeat/Mimic
Explain:</td></tr>
<tr><td>Standard(s)
8.G.6: Explain a proof of the Pythagorean Theorem and its converse.
8.G.7: Apply the Pythagorean Theorem to determine unknown side lengths in right triangles in real-world and mathematical problems in two and three dimensions.
Standard 3: Understand and Apply the Pythagorean Theorem.</td><td rowspan="2">Differentiation
Below Proficiency:
For below proficiency students, there will be a couple of options I can use. The first option is going to be pairing below proficiency students with above proficiency students while doing the group project during class. This way, they will be able to participate in peer to peer learning. Another option will be to have below proficiency students use Khan Academy to watch introductory videos to the Pythagorean Theorem. These videos do a good job at starting at an introductory level and slowly incorporating new ideas.

Above Proficiency: For above proficiency students, I will have them start to learn some more advanced content such as Pythagorean triples, etc. I will also challenge them to do one or two extra examples on the performance assessment that are a little bit more advanced. I would inform them that I would not grade these extra examples, but I will provide feedback on them as to if they are correct or where they can improve. This will help to further their understanding.

Approaching/Emerging Proficiency: For those approaching/emerging proficiency, I would have them continue along with the content as normal. I may have some of these students work with below proficiency students during group work and help bring the below proficiency students to understanding.

Modalities/Learning Preferences: The different learning preferences in this lesson include direct instruction, group work, and an individual project.</td></tr>
<tr><td>Objective(s)
TLW identify different parts of a right-triangle
TLW will apply their newly acquired knowledge to solve real life problems involving the Pythagorean Theorem.
TLW create and solve problems on their performance assessment designed to assess their knowledge of the Pythagorean Theorem.
Bloom’s Taxonomy Cognitive Level:
Knowledge
Apply
Create</td></tr>
<tr><td>Classroom Management- (grouping(s), movement/transitions, etc.)
Groups will be pre-determined by myself based on proficiency levels. Students will be expected to observe the classroom procedure of remaining quiet while getting into groups.
Also, during the transition, I will play a 1-minute song to signal when to start getting into</td><td>Behavior Expectations- (systems, strategies, procedures specific to the lesson, rules and expectations, etc.)
Students will be expected to be respectful and quiet when transitioning to and from group work.
For the performance based assessment, I will set expectations that the pictures and examples used must be school appropriate. If not, we will discuss the consequences.</td></tr>
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groups, and they are expected to be ready to work when the song ends. • When group work is nearing the end, I will play a 2-minute song to signal it is time to go back to their desks. Students will be expected to observe the procedure of being back in their desks and quiet when the song ends.	

Minutes	Procedures
2	**Set-up/Prep:** Bringing up the PowerPoint slide to be used for the instruction. Also, getting supplies and materials ready for the group activity for class. Have the performance assessment explanations ready as well as the rubrics to accompany them.
5	**Engage: (opening activity/ anticipatory Set – access prior learning / stimulate interest /generate questions, etc.)** There will be a bell ringer on the SMART Board. **Make a list of all the different types of triangles that you know about. Please list the characteristics of each triangle (ex: acute angles, obtuse, labels, angle measurements, etc.)** Once the class has finished their bell ringer activity, I will field answers from the class regarding the knowledge they have of triangles. We will briefly discuss these things and then I will present them with the topic of the Pythagorean Theorem. I will have a slide on my PowerPoint that tells where the Pythagorean Theorem can be used in real-life. This will allow the learner to instantly tie what we are going to learn about to real-life. Examples include: baseball diamond, tv/computer screen, distances, etc.)
20	**Explain: (concepts, procedures, vocabulary, etc.)** **1. Vocabulary:** • Right triangle – A triangle that contains a right-angle, or an angle of 90 degrees. • Leg – The two sides of a right-triangle that are not the hypotenuse • Hypotenuse – The side opposite the right-angle in a triangle; also the longest side • Pythagorean Theorem – For any right-triangle, the sum of the squares of the legs equals the square of the hypotenuse ($a^2 + b^2 = c^2$.) • Square root – a number that produces a specific quantity when multiplied with itself (8 is the sq. root of 64) **2.** After covering vocabulary, the students will be presented with the Pythagorean Theorem itself which is $a^2 + b^2 = c^2$. We will look at a proof of the theorem which states that for any right triangle, the sum of the squares of the lengths of the legs equals the square of the length of the hypotenuse. We will then take a look at the converse of the Pythg. Theorem which says that if $a^2 + b^2 = c^2$, then the triangle is a right-triangle. This is the foundation for the lesson, and we will then move on to doing different examples. **3.** First example: The first example will be a right-triangle with side lengths of 5 and 12. We will solve the problem together by working through the following steps to find the hypotenuse: • $a^2 + b^2 = c^2$ • $5^2 + 12^2 = c^2$ • $25 + 144 = c^2$ • $169 = c^2$ • How do we find c at this point? Take the square root. • $\sqrt{169} = \sqrt{c^2}$ • 13 = c or c = 13. Do we need to put a label on here? No. not given one to begin with. **4.** Second example: right-triangle where we are given a leg and the hypotenuse. We will solve the problem together by manipulating the formula to give us the length of the missing leg. One leg is 9 and hypotenuse is 12 • $a^2 + b^2 = c^2$ • $a^2 + 9^2 = 12^2$ • $a^2 + 81 = 144$

	• -81 -81 • $a^2 = 63$ • $\sqrt{a^2} = \sqrt{63}$ • a = 7.93725 • Round to the nearest hundredth – 7.94 Do we need label? No, not given any to begin with. **5.** Now that we have seen how to solve triangles using the Pythagorean Theorem, we will look at real-life scenarios where we can use it. The first situation will involve a baseball field and finding the length from home-plate to 2nd base on a straight line. " Tim is a catcher on his baseball team. He wants to know how far it is to throw from home plate to 2nd base. We know that it is 90 feet between each base. How far is it, to the nearest foot, from home plate to 2nd base? The students will be presented with a picture to represent the information and we will solve from there. • $a^2 + b^2 = c^2$ • $90^2 + 90^2 = c^2$ • $8100 + 8100 = c^2$ • $16200 = c^2$ • How do we find c at this point? Take the square root. • $\sqrt{16200} = \sqrt{c^2}$ • c = 127.2792 ; do we need to round? Yes. To what decimal place? Label? Yes. Feet. • c = 127 feet 6.) Now we will do one last example of a real-life scenario. "Angie is walking home from math club. First, she walks 6 miles due north. Then she proceeds to walk 5 miles due west. How far, to the nearest tenth of a mile, is Angie from where she started walking?" • $a^2 + b^2 = c^2$ • $6^2 + 5^2 = c^2$ • $36 + 25 = c^2$ • $61 = c^2$ • How do we find c at this point? Take the square root. • $\sqrt{61} = \sqrt{c^2}$ • c = 7.8102 ; do we need to round? Yes. To what decimal place? Tenths. Label? Yes. Feet. • c = 7.8 miles Now that we have wrapped up talking about the Pythagorean Theorem, I will have the class break up and do a group activity.
17	**Explore: (independent, concreate practice/application with relevant learning task -connections from content to real-life experiences, reflective questions- probing or clarifying questions)** Students will now participate in a group activity. I will explain to the students that they are going to measure 3 assigned objects around the room. They are going to measure the doorframe, tv screen, and bookshelf. They are to measure the two side lengths (legs) and use these measurements to come up with the length of the diagonal (hypotenuse) for these real-life objects. They are to work together to take the measurements, and then once they have collected all of their data, they are to work as a group on the calculations. Once they have finished their calculations, we will go over the results as a class and see if everyone got to the right answer(s). At this point I will play the music to transition students into their group activity. I will then play music to signal the group activity is coming to a close and students need to be back to their own desks within 2 minutes. Once all the students have returned to their desks, we will go over the results as a class.
6	**Review (wrap up and transition to next activity):** At this point, I will explain to the students that we are going to be doing a performance assessment. As a replacement for a quiz, students will have an opportunity to do a project where they tie their knowledge of the

	Pythagorean Theorem to real life. Students will be asked to take pictures of right-triangles (or other shapes where there is a right triangle present. They will then be asked to put the pictures into a word document, powerpoint, etc. with labels on the pictures for lengths of sides, etc. They will then calculate the missing side on each picture and show all of their work along the way. Students will be shown an example and given a rubric that states the expectations for the performance assessment. Once I have finished covering the performance assessment and handing out the rubric, I will field any questions regarding the project or any questions from class during the day. If there are no questions, students will be dismissed.

Formative Assessment: (linked to objectives) **Progress monitoring throughout lesson- clarifying questions, check-in strategies, etc.** I will monitor progress during the lesson by observing groups during group work. I will check to see if everyone is participating/understanding the material. **Consideration for Back-up Plan:** As a backup plan, I will have a video from Khan Academy on an introduction to the Pythagorean Theorem in case students are having a hard time grasping the concept.	**Summative Assessment (linked back to objectives)** **End of lesson:** The summative assessment for this lesson will be the performance assessment listed above. Students are going to be asked to take pictures of right-triangles in the real-world. They will then be asked to measure the two different sides of the shape so they are able to find the third side using the Pythagorean Theorem. They will then import these pictures into a word document, Powerpoint, etc., and show all of their work that they did to solve the right-triangle. This performance assessment will take the place of a quiz they would normally have on this lesson. **If applicable- overall unit, chapter, concept, etc.:**

Reflection (What went well? What did the students learn? How do you know? What changes would you make?):