Lesson Plan
Template

Instructions: This lesson plan template provides a space for you to plan lessons around the Education Connections model of Sheltered Instruction (SI), which includes four strands—*define, modify, cultivate, apply*. (See page 4 of this document for more information on the four strands). Fill out the information about your lesson plan in the space provided in the left-hand column, *Lesson Information and Activities*. While you plan, list which strand(s) relates to this portion of your planning in the right-hand column, *SI Strand(s)*, along with any notes about how the strand can be implemented effectively in this lesson.

Lesson Information and Activities	SI Strand(s)

Lesson Title: Tackled! Real World Application of the Pythagorean Theorem

Content Area: Math / Geometry   **Grade Level(s): 10**

Unit Description: This resource was developed to assist students who were struggling with the concept of the Pythagorean Theorem. Having previously observed a few lessons taught with straight calculations, which was challenging for ELLs with limited prior education in math, I created this lesson. The focus on vocabulary, the video with a real world application, working through the solution with a partner, and practicing further with interactive practice problems helped students to master this concept.

Length of lesson: 1 block period, 80 minutes.   Number of ELs: 27

Proficiency Levels	1	2	3	4		
ELs (numbers and/or names)	14	13				

Program Model Sheltered English class using SIOP Model strategies.

Other relevant student information: This class has 27 ELLs, in grade 10. Their heritage language is Spanish.

Standards and Objectives

	Language Objectives	English language proficiency standards	
1	SWBAT orally use content-specific vocabulary to communicate steps to solving a mathematics problem.	WIDA: ELD Standard 1: English language learners communicate for Social and Instructional purposes within the school setting ELD CA: 1.A Collaborative: Exchanging information and ideas with others through oral collaborative discussions on a range of social and academic topics	**DEFINE**

	Lesson Information and Activities		SI Strand(s)
2	SWBAT to interpret information from a variety of word problems and write steps to solve them.	WIDA: ELD Standard 3: English language learners **communicate** information, ideas and concepts necessary for academic success in the content area of **Mathematics.** ELD CA 1C: Productive: Writing literary and informational texts to present, describe, and explain ideas and information, using appropriate technology.	
	Content Objectives	Content Standards	
1	SWBAT apply the Pythagorean Theorem to determine unknown side lengths in right triangles in real-world and mathematical problems.	CCSS.MATH.CONTENT.HSG.SRT.C.8 Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems.	

Incorporating all four language domains

Identify how the language demands of the tasks are related to each language domain.

	Written	Oral
Receptive	Reading Students will read and solve word problems, using their notes from previous lessons to follow the steps of the Pythagorean Theorem.	Listening Students will watch and listen to a video to conceptualize a right triangle formation in real life, answer teacher-generated questions, and participate in discussions with peers to complete various tasks.
Productive	Writing Students will write vocabulary words and record every time their peer uses the word in context to solve a problem.	Speaking Students will use target vocabulary along with signal words to explain to a partner the steps to solving a mathematics problem. Students will ask questions for clarification as needed.

DEFINE

Key language for students (words and phrases, grammatical structures, sentence types, structure and amount of speech/text, organization of ideas, genre, etc.)

APPLY

General academic language	Language specific to the content area
Sequencing the steps to a problem: first, next, then, after, finally Distance, length, width, diagonal, shortest, longest, slant, formula, determine	Legs, hypotenuse, right triangle, coordinate plane, plot, squared, square root, Pythagorean Theorem

Key characteristics of teacher talk (ways to make the content comprehensible for all students, ways to model key language, etc.)

- Chunk the lesson into smaller segments and stop frequently so students can process information.
- Review key vocabulary words from previous lessons; stop and discuss their use in context while watching the video and setting up the solution to the problem.
- Play video and post to Google Classroom so students can re-watch it on their Chromebooks.
- Model the process of explaining steps to solving the problem using target vocabulary, from counting units of length, setting up the triangle, and transferring numbers into the formula.

CULTIVATE

How the lesson will incorporate bilingualism/students' native languages as resources

- Peer-to-peer interaction with clarification in native language as needed.
- Students will utilize math specific bilingual dictionaries.

Materials and Texts

Name	Genre (e.g., narrative)	Level	Connection to Students (What will this mean to them? How can you make it even more meaningful?)
Video – INT Champs 99 yards https://www.youtube.com/watch?v=9G9139DXvNY			This video engages students in real-world scenarios where we would use the Pythagorean Theorem to answer a question. Since it is a sports example, the students already have some understanding of running down a field and trying to intercept a football.
Mathematically Speaking task sheet from Understanding Language, ell.stanford.edu (http://ell.stanford.edu/sites/default/files/math_learnmore_files/4.Language%20of%20Math%20Task%20Templates%2010-4-13.pdf)			Students will use this tool to explain the steps to solving a problem while utilizing target vocabulary words in the content area.
Illustrative Math https://www.illustrativemathematics.org/content-standards/tasks/655			The diagram and student task for the football interception scenario can be found on this site. Depending on the level of language proficiency of your students, you can show them more discussion of the task and variations on solutions.

Supplementary Materials and Realia

A soft ball for demonstration purposes

Lesson Information and Activities	SI Strand(s)
Estimated Time: One 80 minute class segment

Language Domains: XReading   XWriting   XListening   XSpeaking

Grouping:

    X Independent Work   **X** Pair   ☐ Small Group   **X** Whole class
Reason for grouping: | **MODIFY** |

☐ First language	**X** English proficiency	☐Reading level	**X** Content understanding	☐ Interest	☐ Other:

| **Preview**: Connections to past learning or the larger unit sequence

    WHOLE CLASS

    1.   Ask students to review previous learning about the Pythagorean Theorem. What is the formula? ($a^2 + b^2 = c^2$). If we start with points and draw a right triangle, which numbers will we have to plug into this equation? Elicit responses from various students. Reinforce use of key vocabulary through choral response.

    2. Explain that many professional athletes (football players, soccer players, and tennis players for example) must develop a very fine sense of geometry in order to know when and where to meet the ball. Demonstrate with a soft football, with one student holding it running in a straight line and another student running from a corner of the room to try to catch him. This is what we will be looking for in the video clip.

    3.   Background info: In this case, Ben Watson of the Patriots is running to catch Champ Bailey of the Broncos and stop him from scoring a touchdown. We will watch the video and then look at how the distance they each ran can be transferred to a triangle.

    4. Play video, straight through first time and then the second time pause to check for comprehension. Then show students the graphic representation of the play and help them draw a triangle and elicit that they will count the hash-marks to find distance. Ask students: *How can you use the diagram and the Pythagorean Theorem to find approximately how many yards Ben Watson ran to track down Champ Bailey?* | **CULTIVATE** |

| **Presentation**: Primary activity steps associated with lesson implementation
Differentiation, scaffolding, modifications, strategies employed, interaction activities, materials integrated that function to shelter language and content for the EL students

    PAIR WORK

    1. Teacher hands out the <u>Mathematically Speaking</u> chart and has students write in their target vocabulary words: length, leg, hypotenuse, right triangle, formula, squared, square root | **APPLY** |

Lesson Information and Activities	SI Strand(s)
2. Teacher invites a student to model the beginning of the process with him/her while the other students observe. (Do not give away answer!) Keep the task sheet projected with a document camera so students can see how tally marks are recorded when target words are used. Write signal words on the board to help students move the conversation along (first, then, next, etc.) 3. Student pairs are formed with intentional grouping, using a stronger student in math as peer assistant to a struggling student. On the Smartboard, the teacher projects this sample problem based on the video: During the 2005 Divisional Playoff game between The Denver Broncos and The New England Patriots, Bronco player Champ Bailey intercepted Tom Brady around the goal line (see the circled B). He ran the ball nearly all the way to the other goal line. Ben Watson of the New England Patriots (see the circled W) chased after Champ and tracked him down just before the other goal line. In the image below, each hash mark is equal to one yard: note too that the field is 53 1/3 yards wide. Use the Pythagorean Theorem to find approximately how many yards Watson ran in this play. 4. One student explains his or her solution to the other student as he or she writes a check on the chart each time a target word is used in the explanation.	**CULTIVATE**

Lesson Information and Activities	SI Strand(s)
5. Students keep talking until all target words have been used. Students can assist each other as needed to use all their words. They then switch roles and the other student communicates his or her solution while the partner tallies the target vocabulary used. 6. Teacher circulates to check each pair's work. NOTE: The range in possible run lengths for each player is similar. Both players ran roughly the same distance, give or take a yard. Depending on how each student measures or estimates the lengths of the triangle, it is possible that they might find that Watson ran a greater distance, that Bailey ran a greater distance or that they ran the same distance. The focus here should be on the process of modeling the problem with right triangles, how we came to the lengths of the right triangles, how we computed the distances as well as communicating and critiquing the reasoning of others. 7. Ask students: Which player ran further during this play? By approximately how many more yards? Discuss how answers may have been slightly different. Independent Practice 1. Students will complete practice problems from JMAP: https://www.jmap.org/Worksheets/G.SRT.C.8.PythagoreanTheorem1a.pdf. Have students record their work in their notebooks. Alternatively, these problems can be put into a Google Form and used as a formative assessment to monitor progress and inform instructional planning. **Assessment**: Activities for formative and summative assessment during and after primary lesson activities. How does assessment account for the language demands embedded in core content for ELs? Students will be assessed through a range of tools including: 1. Frequent checks for understanding – questioning individual students 2. Monitoring conversations of pairs and listening as they discuss the steps for solving a problem. Ask a student to translate another student's response if he/she is having difficulty expressing the solution. 3. Check accuracy of online practice problems.	**APPLY**
How are parents, families, and the community invited into or associated with the content, delivery, or extension of this lesson? This lesson helps students to apply mathematical learning to a concrete application in the real world—in this case, a sports play. The teacher could invite a school football coach into the class to draw a sample play and ask them to solve it for him. Students could also be given a template of a soccer field, since they	**CULTIVATE**

Lesson Information and Activities	SI Strand(s)
may be more familiar with that sport from their home countries, and then ask them to create a scenario for the rest of the class to solve using the Pythagorean Theorem.	

Education Connections' Four Strands of Sheltered Instruction

Sheltered Instruction is an approach that makes academic content, as well as language development, more accessible for EL students. The Education Connections activities are based on *Four Strands* of Sheltered Instruction. They are: Define, Modify, Cultivate, Apply.

Define

- **Develop, define, refine, communicate, and assess *content objectives* for every lesson**
- **Develop, define, refine, communicate, and assess *language objectives* for every lesson**
- **Ensure objectives derive from, and are aligned with, English language proficiency (ELP), as well as content standards**

Modify

- **Differentiate instruction through lesson adaptation and instructional modifications**
- **Scaffold instruction in response to students' individualized language and content learning needs**
- **Identify the language demands and domains embedded in lessons and explicitly address language use and needs for both teaching and learning**

Cultivate

- Explicitly identify and acknowledge the **cultural competence, human capital, knowledge, experiences, and resources students bring to the classroom**
- Invite parental and/or familial involvement in the school and classroom and make connections that extend beyond the core curriculum
- **Support native language** maintenance, additive bilingualism, and biliteracy development

Apply

- **Directly promote language use through interaction with peers, teachers, as well as the core content**
- **Encourage and facilitate language use in both English, as well as students' home languages**
- **Develop and implement activities that require use of all four language domains**