

Stories of Home and Place

Affirming Identity as Students Build Mastery
A High School Geometry Unit: Introduction to Trigonometry

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Introduction

Observe and experience beautiful relationships. Imagine and problem solve. Determine truth from fallacy through reason. My name is Michael Harpst and I teach high school mathematics. I reason we are all naturally inclined to observe, imagine, recognize patterns, problem solve and share our thoughtful experiences with others as a part of what it means to be human.

Mathematics is a source of strength for me to endure mystery, confusion, and chaos. Yes, even chaos submits unwillingly to patterns and earns curiosity for mathematical study. Geometry is broadly an ancient science for human history. All peoples have studied geometry in some form or reason. For what more is Geometry, than “the science that treats of the shape and size of things?” (James 186). High School Geometry is the study of shape and size relationships and how observations may logically draw systematic conclusions. It is a course for students to strengthen their reasoning skills necessary to logically enhance their choices for themselves and those who will depend on them.

When I received a colleague’s invitation to consider applying to the Diné Institute for Navajo Nation Educators, I was hoping that the institute would aid my craft in serving diverse high school geometry students’ experience to become more fulfilling and meaningful. I was concerned, “Are Diné students in my class struggling with their cultural identities due to being in a public high school or struggling to draw connections or meaning between mathematics and themselves due to cultural barriers that I am unaware of? If so, is the struggle preventable? What steps do I take to help?” I wanted my students to experience more joy and success. I wanted to learn more about the Diné and identify possible ways to improve their social experience in the classroom and help all my students experience an inclusive classroom where they can enjoy increased participation in imaginative exploration and problem solving with mathematics.

In this seminar, I studied the creation of reflective communication prompts to guide students to explore their identities. These prompts encourage the students to use their sense of identity to build and sustain communities ripe for shared mathematics enjoyment and collaborative problem solving.

In general, I employ a dual method approach to address student curriculum enjoyment in a diverse culture setting. The first method is to facilitate student growth in isolated personal reflections. The students are guided to draw important connections between their geometric discoveries and valuable sense of cultural identity, home, and values. Students are guided to make beautiful connections between their geometric discoveries and themselves. The second method to encourage identity affirmation is to facilitate collaborative learning activities designed to build positive communication skills, fostering social development while respecting diverse student identities in a multicultural setting. Students may have beautiful connections to offer each other based on their diverse cultural backgrounds. Students have the opportunity to experience revelation, joy, and truth from each other as well as from the default common core state geometry curriculum. This High School Geometry unit honors my students’ unique identities and provides the skills for collaborative problem solving.

Context and Rationale

This curriculum unit is for my Geometry B class at Summit High School (SHS). Summit High School offers an alternative to the traditional model for 9-12 grade students who want to continue their education and experience personal growth within the Flagstaff Unified School District (FUSD):

(SHS) recognizes that there can be challenges in a student's personal environment, peer interactions, or academic performance. Therefore, special attention and assistance are given to facilitate growth and understanding of self and others. Students will be instructed with techniques that allow them to take control of the areas in which they are experiencing difficulty. By utilizing smaller class sizes, a block schedule, and a focus on graduation requirements, Summit can help students recover credits, graduate, and prepare for their future.(Summit High School / Overview)

SHS is bordered on the north by the San Francisco Peaks known as Dook' o'oosliid in Diné, one of the four sacred Mountains. The city of Flagstaff is considered a border town of the Navajo and Hopi Nations. Nevarez and Wyloge reported Arizona state school demographics in 2016 with SHS having approximately 40% Native Americans. It is the largest of the diverse demographics in the school and likely for my courses. Within the population of Native American students at SHS, most identify as Navajo. From this demographic, the diversity of students continues to vary from one 9-week quarter to the next.

SHS has students enroll to attend the Teenage Parent Program (TAPP), an alternative education program supporting pregnant and parenting teens who need to continue their education, while remaining close to their infants. Other students either have been expelled from other traditional schools, personally seek a small personal school environment, or have other specific needs that our school is best suited to meet. SHS students likely have above average Adverse Childhood Experiences (ACE) Scores. ACE scores indicate students endure higher than average traumatic life events. (Felitti) According to the CDC-Kaiser ACE Study, "(ACEs) have a tremendous impact on future violence victimization and perpetration, and lifelong health and opportunity" ("Adverse Childhood Experiences (ACEs)" 2020). School staff participate in numerous trainings so that SHS can be recognized as a trauma informed school, allowing teachers to be of greater positive impact on students who have experienced trauma.

Generally, students have a history of bouncing between living environments. It is not uncommon to hear students share they attended schools and then began living with another family member in Flagstaff. Students tend to relocate homes frequently, moving from one town to the next while still trying to complete their academics with SHS.

This learning community each year is likely to have numerous social and therapeutic needs to be addressed within the education setting beyond mere mastering geometry. These students require education with various supplemental coping skills, career preparation skills, identity formation guidance, communication skills, organization skills, empathy building, self-reflection, improved ability to persevere and a safe environment to practice expressing themselves, to sustain them to the point of improving their generally low math self-efficacy skills. This project is designed to address such needs for not just Diné students, but for all the students in my course. The diverse population of the school's nontraditional students are currently dispersed physically due to the

Covid-19 pandemic, making the likely education experience online during the school 2020-21 school year. This unit is designed to be administered in a variety of educational settings, including, but not limited to, blended, remote, or distance online learning.

Students in my classes generally fell behind in their mathematics in their late elementary and middle school years. It is not uncommon to find students who had no academic mathematics growth for 2 to 4 years prior to enrolling in my course. Their perspective of math is usually something like, “I used to really like math” or “I used to really love math.” They speak in past tense and tend to avoid discussing the gap of time where slower growth or negative experiences occurred. In general, students have this disconnect with recent success in math and inevitably struggle to try in front of each other. They struggle with acceptance and have often confused this with making mistakes in math. It is a challenge to help them understand that making mistakes in math is an expected part of the learning process. Making mistakes in math is opportunity for mathematical and social growth.

I want my students to build an empathetic and supportive community with each other where everyone supports the other in their quest to master the course objectives. In the beginning of the course, students usually require joint activities with a substantial amount of guidance developing affective and mindfulness skills. From there, prerequisite math skills are identified regularly throughout the progression of the unit. This initial unit of the course welcomes depleted students to an environment based on acceptance, fun, and affirmation. Together, we can be ourselves, love mathematics, be accepted, be helpful to one another, and grow mathematically without fear or shame.

Diné Cultural and character educational standards are integrated into the unit to support the Diné population with their identity recognition. The goal is that students learn to respect and value each other as they participate within the unit. Diné Cultural and character educational standards are introduced for as a norm since Diné culture is the most prevalent. Students will use the Diné Cultural and character educational standards as building blocks for customizing their own culture and character standards for themselves. As students progress through the unit, they take time to participate in small activities designed to validate their identities and inclusive interactions. Students assess themselves on their individually determined or adopted cultural and character standards at different points throughout the unit.

Content Objectives

The goals of this unit include:

1. Students master Arizona Common Core Standards-based Geometry objectives,
2. Students participate within an inclusive community of learners,
3. Students familiarize themselves with their classmates' diverse cultures,
4. Students embrace opportunities to foster their identity
5. Students experience the culminating "height activity" of determining the height of a sacred mountain, determining its distance from their place of rest, and then collaborating with their classmates over the results of their methods and calculations. The fun aspect of the "height activity," can be completed with regards to the relatively nearby San Francisco Peaks, or it could be completed by students immersed digitally in the course Minecraft world where students can interact, learn, and build within a plethora of digital biomes. The biomes contain land features like mountains and oceans that students can participate in performing geometric based calculations on for size and shape. The digital world does have its limitations, but the experience students have may still offer plenty of learning opportunities to take place.

In the Stories of Home and Place Seminar, we focused on the themes of identity and belonging. I chose this seminar to better understand how to facilitate student development of their sense of identity and acceptance of others. This is part of my broader personal initiative, fostering community in my classroom. One goal is for students to feel safer expressing their identity with others in the classroom and empathetically respond to each other's shared experiences in constructive ways.

In this unit – which is designed for 9th through 12th graders in a geometry class – students celebrate their uniqueness and identity. The students build homes for themselves as part of a class village within Minecraft Education Edition. Students practice acts of kindness as they collaborate with each other as they build their homes and village. Students who identify with traditional Diné hogans, may build their own hogan. The unit includes a reflection sheet to guide students as they build the different stages of their village. There are four points in the unit where students celebrate their achievement, write a reflection of their math progress, their sense of identity, and progress of a chosen cultural/character-based objective. Students who are Diné are encouraged to choose a Diné Culture or Character standard for their objective.

There are a number of math learning objectives that this unit covers, but I also want students to engage with the themes of identity, belonging, home, and place in this unit. In order to bring these themes into my math classroom, I have designed inquiry-based lessons followed up with reflective prompts to foster student made connections between the math lesson and aspects of student values, home, and attributes they may identify with.

If students struggling with negative past experience in classrooms are integrated in a more supportive community, then they may be more likely to challenge themselves more in mathematics and experience perseverance and success in the course. Focusing my efforts more so on the community in the classroom dually supports the overall mission statement of SHS:

“The mission of Summit High School is to provide a high-quality education that offers a gateway to college, career, citizenship and life readiness. Staff provide for the academic and personal needs of students who had difficulties in traditional school settings.”
 (“About Us / Vision & Mission”)

In the seminar, we read various works emphasizing various ways authors, or characters of their written works, describe their own or other character identities. I found the reading and discussion of works written by the following authors to be enriching: Erik Bitsui, Sandra Cisneros, Danielle Geller, Rex Lee Jim, Robin Kimmerer, Bojan Louis, Irvin Morris, Luci Tapahonso, and Laura Tohe. Our seminar leader demonstrated examples of reflective prompts where we would describe aspects of our own experiences with belonging, place, home, and sense of identity. I found myself encouraged to explore and discover perspectives of identity that I had not considered for myself.

Throughout my participation in the seminar, I developed a list of tips on how to integrate writing responses with my students and how to encourage them to share personal reflections on their experiences or thoughts.

Tip 1: Prompts can have three generic parts.

- 1st Situation or Topic Introduction.
- 2nd Encouragement or Inspiration.
- 3rd Describe Task.

Tip 2: Prompts need not be specific. Allow for open-ended responses. This allows for creative responses and meaningful feedback space. I observed how simple open-ended prompts resulted in some incredibly complex and surprising responses. The seminar leader asked me to simply describe my home. This was a revelation for me where I was originally stressed with how I was to lead students into reflections. Throughout our seminar shares, I began to feel more comfortable with developing simple open-ended prompts that would not have to rely heavily on a vast experience of writing or psychology. The act of sharing about ourselves, is a community builder. The goal, I formulated throughout the seminar, became to create simple open-ended opportunities for student community to take place.

Tip 3: Encourage diverse writing prompts. No one prompt will be sufficient to engage meaningful reflections with all students. Offering diverse types of prompts will increase the probability all students will find a prompt helpful.

Tip 4: Offer choice of prompts for students. Students are more likely to experience ownership and enjoy their prompt if they are able to choose their prompt from a list of different options.

Tip 5: Create reflective prompts based on tangible items. A simple tangible prompt can lead to surprisingly complex and deep responses. So often in stories and through our seminar shares, we found describing tangible experiences to be door openers to home and identity shares. When members of our seminar shared about family meals, there were so many shares that appeared to flood our conversation about identity and home.

Tip 6: I ask students to support their responses with an element of their math lessons. This is meant to strengthen their grasp of the lesson, objective, or skill they reference and to develop an application of logic to support their thought processes.

Tip 7: Though most prompt items are meant to be isolated shares in nature, allowing students the opportunity to extend their thoughts with related collaborations with other students can open the doors to new growth. My seminar leader emphasized at one point the observation of rugged individualism and how it tends to pop up time and time again. This idea that progress is made by making success of her or himself on their own. This might be observed in students as they tend to isolate themselves at their desks or from others during lunch at school. I recall developing that sheer hard work, pulling oneself up by my own bootstraps was the ideal for being successful. During the 2020-21 world pandemic, it was so obvious how some students would tend toward isolation from the class if given the choice. It became apparent to me that I needed to facilitate the development of relationships as a strength that leads to life successes with students. Martin Luther King, Jr. provides words of guidance here, “It’s all right to tell a man to lift himself by his own bootstraps. It is cruel jest to say to a bootless man that he ought to lift himself by his own bootstraps” (King). My students often find themselves in a dependent situation where asking them to pull themselves through is not possible since they have little to pull on due to various hardships. Guiding students to seek help from others, to learn how to spark kindness where they can, and to take chances in being rejected are not words that can necessarily be shared, but actions that they need to experience. No matter what academic unit I teach, facilitating kindness is the best application of knowledge I can think of.

Overall, the seminar was an opportunity for me to become more comfortable with developing prompts, direction and activities that are dedicated to building community with my students.

Example of a Prompt aligned with lessons:

Math Learning Objectives:	Student Reflection Prompt
Inquire and investigate the ratio of measurements comparing the diagonal of the square to the side of the square discovering a decimal ratio to the nearest tenth of a unit.	The $1:\sqrt{2}$, was an unexpected discovery for me relating the side of a square to its diagonal. This is helpful to find a distance between opposite corners of all squares. What is something you found unexpected in geometry this week that turned out to be helpful? How might you discover more unexpected discoveries or helpful applications? Submit a typed-out paragraph consisting of your topic sentence, 1 to 6 supporting
Apply the Pythagorean theorem to determine the exact side measure extended ratio for the 45-45-90 triangle.	
Apply the extended ratio of side measures to determining two side lengths of a 45-45-90 triangle with a single given side length.	
Apply the 45-45-90 side measures extended ratio to solve for distances related to real world scenarios, including baseball, softball,	

rollercoasters, square living area and perimeter, etc.

sentences, and a suggested conclusion sentence.

Teaching Strategies

The unit has been divided into four weeks. Each week has four days of math lessons and one day of class collaboration within Minecraft Education Edition. Throughout the unit, I use two primary teaching strategies.

The first strategy engages the student to learn 4 days of math lessons from interactive lesson guides, interactive and adaptive content deliveries, organized material online, and diverse practice formatted activities. Students are presented with their online day lesson guide, what to choose to do and when. All activities are organized by specific ordered skills. The student is given a list of learning skills necessary to complete the main lesson objective. Students select all the skills they feel they have not mastered. The student essentially creates their own learning path by checking which skills they need to accomplish. The teacher has already ordered the skills so students merely need to minimize ones they know and complete activities with the skills that they have not mastered. Within each skill mapped out online, there are interactive content presentations from sites like Schoolyourself.org, Khan Academy, mathisfun.com, ck12, math antics, GeoGebra, and various other online content organized by the instructor for students to learn and practice the day's skills. The teacher also provides short videos describing the day's activities. Students log in to the course created world to complete a 20-minute task each day. It is in the Minecraft world where students make contributions to each other and collaborate in groups to accomplish tasks. Upon returning from the Minecraft world, students prepare either in small groups or by themselves to complete the daily mastery check.

The second teaching strategy takes place every fifth day of each of the four weeks. The second teaching strategy is a creative design. Students spend almost all class period in Minecraft Education Edition. Students are given a week writing prompt where they reveal their progress through the unit. Students then proceed to participate in designing their own home of their own choosing and composition. The home is meant to reflect how they perceive themselves as individuals and communicate to their classmates' aspects of their culture or value system. The home can also reflect their interests or hobbies. Students spend most of the course immersed in the task building a home that is part of a community. Using Minecraft, students essentially build a village. They are guided with a mindful set of reflections to build basic aspects of a sustainable village. The teacher provides a guide as if the students are to build a Hogan, but students are welcome to branch out creatively from there. The following section describe what students are doing each of these collaborative days in the unit.

Day 5

Students are provided a basic seed world in creative mode where they are directed to choose a plot of land to build their village and agree where each desire to build their hogan or home constructions. Students then begin their constructions. An additional option is to allow students to begin with a premade village and they can get a bit of a head start with some possibilities.

Students provide feedback to their guided reflections either in writing, audio, or video recording. The reflections are provided as they build in the form of audio and written prompts. It is possible for students to merely record their visual displays as they respond and explain their efforts.

Students can use screen recording, screen shots or in game cameras to help express their thoughts and accomplishments.

Options for teacher input:

Provide a Chalkboard in the center of their village and post a link to a math puzzle that indicates what kind of challenge they can expect. For ideas on how to do this, see Geometry Pizazz.

Teacher can create a scavenger hunt for the students to venture off, solving math puzzles, review concepts, and gather useful supplies for their village while in survival mode.

Day 10

Students make enhancements to their homes and village that express personal values and support for each other. This can be done in creative or survival modes depending on the class.

Options for teacher input:

Focus tasks on community building. Provide a checklist of challenges for students to complete with the intention for building community.

Example of Community Building Challenge List

1. Offer to construct a moat, fence, roof, or building add-on for a fellow classmate.
2. Participate building a proportional amount of effort in a village defense construction.
How much should each of your classmates contribute to keep it fair?
 - a. A wall 3 blocks high or a moat around the town.
 - b. Construct a food source that would be enough for everyone to use.
 - c. Build a mine for the village to access equally.
 - d. Build specific tools and distribute them equitably.
 - e. Distribute jobs or tasks for each classmate to focus on for the good of everyone. (farming, fishing, construction, etc.)
3. Ask another classmate for help with a task that would help either you or your village.

Day 15

Students work in survival mode together in their village to overcome a challenge placed upon their village that will take math, creativity, and teamwork to be successful.

Teacher examples:

1. Prior to the start of class, create a natural disaster in the village and provide a timed challenge for the class to work together to recover.
 - a. Earthquake.
 - b. Fire.
 - c. Pollution Clean-up.

- d. Flood.
 - e. Volcanic Eruption.
 - f. Avalanche.
 - g. Zombie Apocalypse.
 - h. Raid.
 - i. Daring Rescue for a stolen beloved livestock.
 - j. Rescue a nearby village from their own disaster.
 - k. Scavenger hunt requiring everyone's participation, math and their resources.
2. Assign a large construction project to be completed in timely manner.
 3. Create proportional model of something fun.

Day 20

Students provide brief presentations of their progress over the course of the unit. Students will emphasize their math growth, how their home reflects who they are as an individual, the value for being a part of a community, and how they feel they have generally developed through the 20-day unit.

Examples:

1. Create Minecraft props for a presentation they can give over zoom for student family night.
 - a. Emphasis on one math skill they learned.
 - b. Emphasis on a character or cultural objective practiced.
 - c. Emphasis on interesting or helpful skills or information they gathered from other classmates.
 - d. Emphasis on a fun activity they enjoyed during the unit.
2. Create a simple presentation using a cue card.
3. Create a presentation demonstrating a work created during the unit.

Classroom Activities

The Introduction to Trigonometry Unit for Geometry B

Pre-Assessment 16 items.

Week 1 Ratios with Radicals

Day 1 Lesson 1 Pythagorean Theorem and Distance Formula

Day 2 Lesson 2 Simplifying Radicals and Rewriting Conditional Statements.

Day 3 Lesson 3 Converse of the Pythagorean Theorem and Pythagorean Inequality Theorem

Day 4 Lesson 4 45-45-90 Triangle Sides Ratio with applications and Rationalizing the Denominator

Day 5 Individual Reflection and Village Collaboration 1 Reflection, Resilience, Communication

Week 2 Ratios to Functions

Day 6 Lesson 5 30-60-90 Triangle Sides Ratio with applications.

Day 7 Lesson 6 Combined Special Right Triangle Side Ratios

Day 8 Lesson 7 Introduction to Trigonometric Ratios

Day 9 Lesson 8 Inverse Trigonometric Functions

Day 10 Reflection 2 Respect, Tolerance, Relationships

Week 3 Model, Describe and Apply Relationships

Day 11 Lesson 9 Sine and Cosine Complimentary Relationship

Day 12 Lesson 10 Multistep Trigonometry Exercises

Day 13 Lesson 11 Applications of Trigonometry

Day 14 Lesson 12 Angles of Elevation and Depression

Day 15 Reflection 3 Cooperation, Collaboration, Gracious Celebration

Week 4 Navigate to Valid Conclusions

Day 16 Lesson 13 SAS Triangle Area Formula

Day 17 Lesson 14 Law of Sines

Day 18 Lesson 15 Law of Cosines

Day 19 Lesson 16 Solving Triangle Measures.

Day 20 Reflection 4 Accomplishment, Self-Evaluation, Communication

Though the course is organized online, not all activities are online. There are as many hands-on activities off the electronic devices as there are online.

Student Materials Required for Unit:

- Students require Microsoft Accounts and Access to Minecraft Education Edition.
- Communication access with instructor. (Zoom, Meets, Teams, etc.)
- Students require Computer Interface Devices that meet the minimum requirements for the above. (Touch screen, tablet, ipad, mouse and pen, keyboard of sorts)
- Students require Wifi access.
- Compass (or String)
- Straight edge
- Tape Measure, Meter Stick, a specified unit for measure.
- Pencils (Mechanical Pencils or Additional Sharpener)
- Blank Paper
- Graph Paper
- Lined Paper
- An area designated for safe learning and interacting with peers online or in person.
- Materials for optional student-built tools like an inclinometer.

The following examples are four lesson plans for the first week of the of the Trigonometry unit. The students are presented with the overall Learning Objective Goal (LOG). The plans allow teachers to supplement whatever activities they feel comfortable providing for students as each student chooses what skills they are unfamiliar or require review. The desirable tactic is that students upon choosing a skill, will then have a variety of activities to choose from to learn the skill. The teacher chooses to limit specific skills to be assigned to the whole class to facilitate collaboration. Each lesson here has a 20-minute activity that takes place in Minecraft Education Edition. For example, one lesson has students calculating the hypotenuses of triangles formed from pairs of perpendicular adjacent squares to lead them into the application of the Pythagorean theorem and distance formula. Another lesson has students measuring the hypotenuses of various isosceles triangles in a variety of shapes and unique locations. Students are paired together in different ways for these activities. Sometimes, one student is assigned different tasks than the other. Other times, they divide and conquer tasks. The groups submit the same results and are awarded challenge points for their cooperative completion. Challenge points earn students the opportunity to retake assessments and earn kudos from the teacher.

Day 0

Welcome Pre-Course Introduction (20 minutes)

Independent Pre-Unit Assessment 16 items. (20 minutes pre-course time)

Day 1

Lesson 1 Pythagorean Theorem and Distance Formula

Course Login and Welcome

Notice and Wonder (5 minutes)

Nautical Navigation

Students are introduced to tracking marine life and how reliant we are on knowing how to find distance between various forms of marine life, let alone with humans, nautical buoys or nautical beacons.

Introduction of Learning Objective Goals.

Students Choose Education Path to **Learning Objective Goals (LOGs)**. (40-60 minutes)

Learning Skill Map to Goals

1. Define Multiplication in terms of addition and visual models.
2. Multiply two numbers.
3. Find the Area of a Square.
4. Raise a number to the second power.
5. Use the Square/Exponent function on a calculator.
6. Describe a square root.
7. Use the Square root function on a calculator.
8. Describe the Pythagorean Theorem.
9. Solve an equation with the square root property of equality.
10. Apply the Pythagorean Theorem to find a hypotenuse.
11. Apply the Pythagorean Theorem to find any side length. (LOG 1)
12. Review how to calculate distance of a line segment on a number line with known endpoints.
13. Derive the Distance Formula in the cartesian coordinate plane.
14. Apply the distance formula to find distance of a line segment in the cartesian coordinate plane.
15. Apply the distance formula in real world context for example, identifying the distance of marine life relative to another location, person or another marine life. (LOG 2)

Performance Check (5 minutes)

Independent Practice (20 minutes)

Introduction Video	Spiral Review Practice	Independent Practice Submission and Reflection
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Day 2

Lesson 2 Simplifying Radicals and Rewriting Conditional Statements.

Course Login and Welcome

Notice and Wonder (5 minutes)

Different radical expressions are presented. Using a calculator match which ones have the same value. Do you observe any indicators of equality without using a calculator?

Introduction of Learning Objective Goals.

Students Choose Education Path to **Learning Objective Goals (LOGs)**. (40-60 minutes)

Learning Skill Map to Goals

1. Define Composite and Prime numbers.
2. Apply divisibility rules as well as a calculator to determine divisibility.
3. Prime factorize any composite number.
4. Identify perfect square factors of numbers.
5. Multiply Radicals with index 2.
6. Distribute the radical over a product.
- 7. Simplify Radicals with index 2 (LOG 1).**
8. Define Theorem.
9. Describe an If-Then statement.
10. Identify the hypothesis and conclusion of a given conditional statement.
11. Write the Pythagorean Theorem as a Conditional Statement.
12. Write the converse for a given conditional statement.
13. Describe a converse.
- 14. Determine the truth value of a conditional statement and its converse (LOG 2).**

Performance Check (5 minutes)

Independent Practice (20 minutes)

Introduction Video	Spiral Review Practice	Independent Practice Submission and Reflection
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Day 3

Lesson 3 Converse of the Pythagorean Theorem and Pythagorean Inequality Theorem

Course Login and Welcome

Notice and Wonder (5 minutes)

Matching Activity regarding matching lengths with side lengths of triangles. After completing the activity, the student prompted to describe how they chose to pair measurements with the side lengths visually confidently.

Introduction of Learning Objective Goals.

Students Choose Education Path to **Learning Objective Goals (LOGs)**. (20-40 minutes)

Learning Skill Map to Goals

1. Write the Converse of the Pythagorean Theorem.
2. State the truth value for the Converse of the Pythagorean Theorem
3. Apply the Converse of the Pythagorean Theorem to Categorize a Triangle as Right or not (LOG 1).
4. Describe an acute triangle.
5. Describe an obtuse triangle.
6. Describe the Triangle Inequality Theorem.
7. Apply the Triangle Inequality Theorem to determine to categorize a triangle as acute, right, or obtuse (LOG 2).

Performance Check (5 minutes)

Independent Practice (20 minutes)

Introduction Video	Spiral Review Practice	Independent Practice Submission and Reflection
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Day Lesson 4

45-45-90 Triangle Sides Ratio with applications and Rationalizing the Denominator

Course Login and Welcome

Notice and Wonder (5 minutes)

Present Similar Isosceles Right Triangles. Students are introduced to a model bridge with Isosceles Right Triangles and then the actual bridge. There is a protractor nearby and measurements are handy for the model bridge. Students write their observations and thoughts pertaining to the information. A prompt question might be, "How large is the bridge?" or "How many cars can fit on the bridge?"

Introduction of Learning Objective Goals.

Students Choose Education Path to **Learning Objective Goals (LOGs)**. (20-40 minutes)

Learning Skill Map to Goals

1. Describe the Isosceles Triangle.
2. Describe the properties of the Isosceles triangle.
3. Describe Angle Bisector.
4. Prove the Isosceles Triangle Theorem
5. Prove the Triangle Sum Theorem
6. Derive the measures of the acute angles for any isosceles right triangle.
7. Determine the scale factor between proportional side lengths of similar shapes.
8. Derive the extended ratio for any isosceles right triangle with the Pythagorean theorem.
9. Apply the isosceles right triangle extended ratio to find the hypotenuse length (LOG 1).
10. Apply the isosceles right triangle extended ratio to find the leg lengths.
11. Apply the isosceles right triangle extended ratio to find the distance of any square's diagonal or side lengths.
12. Divide Radicals with index 2.
13. Rationalize the denominator.
14. Find leg lengths of isosceles right triangles in radical form.
15. Apply find any side length of an isosceles right triangle given one side length for real world scenarios like bridge lengths or the distance a catcher has to throw a ball in softball or baseball (LOG 2).

Performance Check (5 minutes)

Independent Practice (20 minutes)

Introduction Video	Spiral Review Practice	Independent Practice Submission and Reflection
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Student Assessment Plan

Arizona State Geometry Common Core Standard-based math objectives are the only content that is measured and applied to the student grade for the course. Assessments are made up of daily formative mastery checks, unit summative assessment and the Final Exam at the course end. There will be exit ticket assessments that will be created for each lesson of the unit. The teacher is to be the facilitator, the resource provider, and assessor of student progress with regards to Geometry Standard mastery. There will be one culminating project for students to complete in collaborative groups or as individuals. Groups are desirable, but there are always exceptions that may require the teacher to accommodate an option for individual completion.

Students are informally assessed on communication effectiveness skills by their own cognition with guided reflections where students will judge themselves in their learning. This involves their preparations, expression of self, learning from others, and contribution of feedback to others. The motivation for developing these skills will be addressed and consistently encouraged. However, the expectations for student participation will be met through kind requests and an atmosphere of limited assessed expectations beyond math to encourage students' feelings of ease. Feedback will immediately be provided regarding student performance as the teacher observe and note student progress in real time.

By the end of the unit, students have their own unique experience to present of a chosen culture or character standard-based skill or practice. Students share with each other what they thought of their unit experience. On the last day of the unit, the day will mostly be based on a fun and celebratory atmosphere. The last day involves students gathering around food and invited guests. If this is online, then they will be encouraged to meet in the evening during their family meal where their family can ask questions while the students share their experiences over an online link like Zoom, Microsoft Teams, or Google Meet.

Alignment with Standards

The unit covers four foci for curriculum building. The first focus is the development of math learning objectives under the **Arizona High School Geometry Standards**. This unit is aligned with the following standards:

AZ State Common Core High School Geometry Standards

- G.N-Q.A Reason quantitatively and use units to solve problems.
- G.G-SRT.B.4 Prove theorems involving similarity. Prove Pythagorean Theorem using triangle similarity
- G.G-SRT.C Define trigonometric ratios and solve problems involving right triangles.
- G.G-MG.A.1 Use geometric shapes, their measures, and their properties to describe objects utilizing real-world context.
- G.G-MG.A.3 Apply geometric methods to solve design problems utilizing real-world context.
- G.MP.1-8 Make sense of problems and persevere in solving them.
Reason abstractly and quantitatively.
Construct viable arguments and critique the reasoning of others.
Model with mathematics.
Use appropriate tools strategically.
Attend to precision.

The second focus is the inclusive classroom objectives tied closely to the **Diné Character Building Standards**. This second focus has an example objective, Students develop empathy language and active listening. Examples of Inclusive learning goals that may be used during activities and participation guidelines are currently being referenced from Michigan University's LSA web site (Inclusive Teaching). Students will develop inclusive community collaboration skills as defined by the teacher and master state standardized based geometry skills.

The third focus is development of student learning to address their own personal culture. Diné students are prompted in the unit to adopt at least the one Diné Culture standard. Diné principles and cultural standards are important to address to support the identity of the Diné student population. Due to inherent community embracing nature of the Diné culture, the addressing of Diné principles and cultural standards will also benefit the other students in the course. The unit models thinking about cultural value systems of importance to each cultural group participating in the unit. This therefore has relevance to the diverse school student body. Each student's culture will help shape the class collaborations and encourage the development of social relationships amongst the course.

The Diné recognition that adolescents in grades 9-12 are:

1. Beginning to think about all things.
2. Seeking Harmony and balance in their worlds.

3. Becoming independently skilled.
4. Finding value in being a member of their community.

Look for and express regularity in repeated reasoning.

Diné Standards:

Character Building Concepts 1-4:

- I will use my critical thinking to establish relationships with the environment.
- I will maintain the sacredness of self-identity.
- I will have self-respect.
- I will express gratitude in everything.

Culture Concept 1:

- I will recognize and value my thoughts and personality.

The fourth focus on curriculum goals to address is the Mindfulness curriculum our school applies to all our students across curriculum. It is the Mindfulness curriculum that will guide the reflection prompts and teacher feedback upon the completion of unit partitions.

Resources

“About Us / Vision & Mission.” *Flagstaff Unified School District #1 / Summit High School*, www.fusd1.org/Page/12838. Accessed 12 July 2020.

“Adverse Childhood Experiences (ACEs).” Centers for Disease Control and Prevention, Centers for Disease Control and Prevention, 3 Apr. 2020, www.cdc.gov/violenceprevention/childabuseandneglect/acestudy/index.html.

Felitti, Vincent J, et al. “Relationship of Childhood Abuse and Household Dysfunction to Many of the Leading Causes of Death in Adults.” *American Journal of Preventive Medicine*, vol. 14, no. 4, 1998, pp. 245–258., doi:10.1016/s0749-3797(98)00017-8.

Fu, Roger R., et al. “Knowledge of Magnetism in Ancient Mesoamerica: Precision Measurements of the Potbelly Sculptures from Monte Alto, Guatemala.” *Journal of Archaeological Science*, vol. 106, 2019, pp. 29–36., doi:10.1016/j.jas.2019.03.001.

“Inclusive Teaching.” *Inclusive Teaching*, sites.lsa.umich.edu/inclusive-teaching/.
James, Robert C. and Glenn James. "Geometry" *Mathematics Dictionary*, Fifth Edition, Chapman & Hall, 1992, p. 186.

King, Martin Luther. “Martin Luther King Jr. Speaks with NBC News 11 Months before

Assassination.” NBCNews.com, NBCUniversal News Group, 4 Apr. 2018,
www.nbcnews.com/video/martin-luther-king-jr-speaks-with-nbc-news-11-months-before-assassination-1202163779741.

Nevarez, Griselda and Wyloge, Evan. “Arizona school data shows uneven distribution of ethnic groups.” Arizona Center for Investigative Reporting, 12 February 2020,
<https://azcir.org/news/2016/02/12/arizona-school-ethnicity-disparity-charter-district/>.

Wessel, Thomas R. *The Western Historical Quarterly*, vol. 19, no. 4, 1988, pp. 453–454. JSTOR,
www.jstor.org/stable/968327. Accessed 3 July 2020.