Solving Triangles- Trig and Special Right Triangles

Big Ideas

Content

Triangles occur in nature and everyday life.

Inquiry

Not all of the mathematical principles are necessary if we solve problems in alternate ways.

Nature of the Field

Mathematical principles involving triangles are the cornerstone of architectural design.

Enduring Outcomes

(What will students need to recall,know or do to demonstrate understanding of the Big Idea?

Include a connected set of Analytical, Creative & Practical Outcomes for this Big Idea

Students will analyze different triangles and know which principle can be applied. (Memory, analytical)

Imagine places in nature, architecture, and art that you see triangles. (Creative)

Include a connected set of Analytical, Creative & Practical Outcomes for this Big Idea

Students will create 3 different methods for solving a single problem. (Analytical, creative)

Compare and contrast two methods of solving to decide which is best in the situation. (Analytical, practical)

Include a connected set of Analytical, Creative & Practical Outcomes for this Big Idea

Students will know when they could use triangle solving principles in their life. (Practical)

Students will create a situation where they would need to use trigonometry. (Creative)

Students will use triangle principles to complete measurements in architectural design. (analytical)

Evidence of Enduring Outcomes

What **Evidence** will show that each of these outcomes has been achieved and what kinds of **tasks** will be necessary to generate this evidence?

Evidence: Completion of solving for variables in different triangles (right and non-right) using trigonometry, Pythagorean Theorem, and special right triangles

Task: Diagnostic: Pythag. Theorem quiz
Formative: Homework, quizzes
Summative: Test

Evidence: Find triangles in nature, architecture, and art

Task: Create a poster showing at least 2 examples of triangles in each category (nature, architecture, and art) and explain why you would need to know the length of one side or angle in 2 of the 6 pictures.

What **Evidence** will show that each of these outcomes has been achieved and what kinds of **tasks** will be necessary to generate this evidence?

Evidence: Solving a single problem using 3 different methods. Decide which method you prefer.

Task: Solve a problem using 3 different methods. Show each method clearly with all steps and the final solution. Explain the pros and cons of each method. Determine which method you prefer and explain why.

What **Evidence** will show that each of these outcomes has been achieved and what kinds of **tasks** will be necessary to generate this evidence?

Evidence: Explain a situation that might happen in your life where you would need trigonometry

Task: Journal entry- 2 situations

Evidence: Using trigonometry to solve a real world problem

Task: Project: Create a real world problem where you need to use trigonometry. Explain the situation and use trigonometry to solve the problem.

Evidence: using trigonometry to solve for measurements in a bridge

Task: Find all the lengths of sides and angles in a trapezoidal bride using trigonometry and the Pythagorean Theorem. Create a bridge company and make a proposal to build the bridge. Build a scale model of the bridge.

Essential Questions

What Essential Question is arguable - and *important* to argue about?

Is there more than one way to correctly solve a math problem?

What Essential Question lies at the heart of the subject and helps provide purpose for learning?

What situations in life would require the use of trigonometry?

What Essential Question raises more questions – provoking and sustaining engaged inquiry?

What are the strengths and weaknesses of the law of sines and law of cosines?

What Essential Question raises important conceptual or philosophical issues?

Can we design and build architecture without math?

Instructional Blueprint

Lesson Topics	**Content Standards**	**Measurable/Observable Learning Objectives** (What should students know, understand and/or be able to do?)	**Instructional Strategies/Tasks to Support Differentiation (Include a balance of *analytical, creative*, and *practical* activities)**	**Assessments that match objectives**
1 **Preview unit exam/review Pythagorean Theorem**	Geometry 15.0	Students will be able to complete problems involving the Pythagorean Theorem to solve for unknown sides. Students will recognize when they can and cannot used the Pythagorean Theorem.	No instruction. Completion of homework assignment following the test and at home.	Homework assignment Discussion next class on when we can use the Pythagorean Theorem
2 **Sine, Cosine and Tangent**	Geometry 18.0, 19.0	Students will be able to determine which of the trig functions to use on a set of problems. Students will be able to solve problems involving the 3 trig functions to find unknown sides.	(Explore, Extend, Evaluate) 1. Daily Quiz(diagnostic): Solve a Pythagorean Theorem problem. Discuss use of PT 2. Collaborative Learning: Look for relationship in similar triangles between ratios of sides. Discuss as a class 3. Cornell Notes: Vocabulary, Sine, Cosine and Tangent ration based on group work. 4. White board practice of sine, cosine and tangent problems. Using examples during practice, identify misconceptions about non-right triangles Homework: Practice problems	DQ Group results of ratios with discusstion White Board Homework practice problems

3 **Inverse Trigonometry**	Geometry 18.0, 19.0	Students will be able to solve trig problems using the 3 trig functions to find an unknown angle. Students will explain the meaning of an inverse function.	(Engage, Explain, Evaluate) 1. Daily Quiz: solve a sine problem 2. Pair-Share: Discuss with your partner the meaning of inverse and when you need to use it during trig. 3. Inverse match game (in the style of memory, ex- match + with – and tan with $\tan^{-1}$) 4. Cornell notes: Start with a situation where you would need to know an angle. Notes on how to solve for an angle. 5. Pair-Share- Explain to your partner the difference between a regular trig problem and an inverse trig problem. Homework: Practice Problems	DQ Pair-Share Roaming for discussion during the game Homework Practice Problems

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4 **Law of Sines** **Law of Cosines**	Geometry 18.0, 19.0	Students will be able to solve for an unknown variable on a non-right triangle using the law of sines. Students will be able to solve for an unknown variable on a non-right triangle using the	(Engage, Explore, Explain, Evaluate) 1. DQ: Solve an inverse trig problem and a cosine problem 2. Group: Groups will be given a picture of a non right triangle and will need to come up with an explanation (real word example) that explains the	DQ Group Solution In class practice Journal

		law of cosines. Students will be able to determine which method to use based on a given triangle.	picture. Then they will solve for all sides, angles, and anything else that makes sense in their story. 3. Given a triangle and law of sine and law of cosine problems worked out, come up with a formula from the pattern. This will create a shortcut of what you had to do above. 4. Cornell notes: Examples of each law 5. Practice in groups, scaffold questions to start easier and build upon each other. Journal: Self Assessment- Describe what you feel you have learned and are able to do so far this unit. What do you need more help with? How are you going to get that help? Homework: Solve a problem in 3 different ways. Prepare to discuss these differences with your group by listing the pros and cons of each method.	Homework solution
5 **Trig Applications 1**	Geometry 18.0, 19.0	Students will identify triangles and demonstrate a need for trig in real life situations	(Engage, Explore, Explain, Extend, Evaluate) 1. DQ: Solve a law of cosine problem 2. Discussion of pros and cons from homework 3. Journal of your choice of "favorite method" 4. Examples of triangles in art, architecture, and nature. 5. Cornell Notes: Ladder problems 6. Computer lab explorations to search for triangle examples Homework: create a poster showing 2 examples of triangles in each category: architecture, art, nature. Explain why you would need to use trig to solve for	DQ Discussion Journal Poster Homework Practice Problems

			an unknown side in at least 2 of the 6 examples	
6 **Trig Applications 2**	Geometry 18.0, 19.0	Students will create and solve problems involving real-life situations.	(Engage, Explore, Extend, Evaluate) 1. DQ: ladder trig app problem 2. Discuss and Assign bridge project. Due 2 weeks after end of unit. 3. Airborne problems, clinometer 4. Build and use clinometer to find the height of objects around the school Homework: Create a real-life situation when you would need to use trigonometry and solve the problem. You may or may not use your clinometer. Write a journal entry on 2 more situations that you do not need to solve.	DQ Clinometer solutions "Real-life" solutions
7 **Special Right Triangles**	Geometry 20.0	Students will be able to solve special right triangles. Students will explain why they need special triangles vs. using trig.	(Explore, Explain, Extend, Evaluate) 1. Poster Presentations (from 2 lessons ago) 2. Group Discussion: Real life problem 3. Group Activity: Find ratios using Pythagorean Theorem on multiple triangles to discover the pattern. 4. Cornell Notes: Special Right Triangles 5. In class practice problems, scaffold difficulty 6. Journal: What are the reasons for and against using special right triangles? Discuss as a class Homework: Practice problems	Poster presentation of real world triangles Group presentation of real life problem Worksheet Journal and discussion Homework practice problems
8 **The Triangle Problem**	Geometry 15.0, 17.0, 18.0, 19.0, 20.0	Students will solve for all sides, angles, area, and perimeter of a non-right triangle on a coordinate plane.	(Engage, Explore, Explain, Extend, Evaluate) **Group project**: Create a poster showing all of the solutions (sides, angles, area, perimeter) for a triangle with vertices at (-2, 5), (6, 12), and (9, -7). You may use any of the methods that you have learned this unit. Your <u>entire</u> group will **present** the poster. **Journal**: Identify at least 2 places where you could	Group poster of solution Presentation of solution Discussion of differences Journal

			have solved for a part of the triangle in a different way and why your group chose to do it the way you did.	
9 **Unit Exam**	Geometry 15.0, 17.0, 18.0, 19.0, 20.0	N/A	*N/A*	Summative Exam

Attachments

Attachment 1: Context form that addresses the "context" prompts.

Attachment 2: Standards (state and/or national content standards) this unit will address.

Attachment 3: One detailed assessment related to a single lesson selected from the instructional blueprint. This should include any instructions or prompts you will provide to the students. Also include a rubric and/or other applicable evaluation criteria used to assess levels of mastery related to quality, proficiency, performance, and/or understanding.

Attachment 4: A 2 to 3 page, double-spaced reflective analysis that address the "reflective analysis" prompts.