

Title	Land Surveying		
Creator:	Snoberger, Woody wood210@yahoo.com		
Source:	2009-2010 Secondary PBL Project		
Project Idea:	A new wind farm is being put up in Keyser, WV. CME Engineering has asked you to survey the land by traversing the land to ensure that the wind farm is located on the proper plot of land. They believe that there will be some opposition to the project (because many believe the wind mills may be noisy, harm wildlife, and take up their land) so they not only want you to prove that the benefits outweigh the costs involved in the project, but that most of these concerns are unwarranted. Your job is to come up with a way to traverse the land and prove that it works, disprove the concerns, and show that the benefits outweigh the costs.		
Entry Event:	Have a Civil Engineer/land surveyor speak to class on how they work together.		
Content Standards & Objectives:	Objectives Directly Taught or Learned Through Discovery	Identified Learning Target	Evidence of Success in Achieving Identified Learning Target
	M.O.T.3.3 using various methods, basic identities and graphical representation <ul style="list-style-type: none"> • verify trigonometric identities • prove the sum and difference to two angles, double-angles, and half-angle identities 	Know the proper form for an identity proof Know the basic trigonometric identities Know that the sum and difference of angles can be represented on the Unit Circle Derive the sum and difference, double-angle, and half-angle identities Use the sum and difference of two angles to prove the angle reduction formulas	Land Surveying : Proving law of Sines and Cosines and traversing the land. Teacher Made assessment Identity Activity : Using Identities to change the identity of the "person".
	M.O.T.3.4 justify and present the solutions of trigonometric equations that include both infinite and finite (over a restricted domain) solutions.	Know the Unit Circle values Know the basic trigonometric identities Know the domain restrictions of the basic trigonometric functions Know that division by zero and negative radicands generate restrictions Use correct notation to describe infinitely many solution points on the Unit Circle Analyze domain restrictions in the equation Solve equations by factoring Exclude the restricted values from the domain	Land Surveying : Proving law of sines and cosines to traverse the land. Teacher Made assessment: To further assess areas not covered such as the unit circle.

	<p>M.O.T.3.5 find the value of the inverse trigonometric functions using special angle trigonometric function values and technology.</p> <ul style="list-style-type: none"> draw inferences of restricted domain to recognize and produce a graph of the inverse trigonometric functions. prove conjectures made about the solution of the equations such as $x = \sin(\arcsin y)$, $x = \sin(\arcsin y)$ being sure to consider restrictions of the domain. 	<p>Know the Unit Circle values</p> <p>Know the domain that makes the inverse a function</p> <p>Know that the graph of the inverse is a reflection in $y = x$</p> <p>Know that $f(f^{-1}(x)) = x$ and $f^{-1}(f(x)) = x$</p> <p>$\arcsin y$ means the angle whose sine is y</p> <p>Determine if an expression is an angle or a trigonometric value</p> <p>Explain the relationship between a trigonometric function and its inverse</p> <p>Recognize the restricted values of a trigonometric function</p> <p>Determine whether the problem involves inverse trigonometric values or inverse trigonometric functions</p> <p>Graph the inverse trigonometric functions</p> <p>Find inverse trigonometric values using technology</p> <p>Solve equations involving trigonometric inverse functions</p>	<p>Land Surveying: use inverse functions in the proof of law of sines and cosines</p> <p>Teacher Made assessment</p> <p>Identity Activity: Inverse functions to determine the place to live.</p>
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21st Century Skills	Learning Skills & Technology Tools	Teaching Strategies Culminating Activity	Evidence of Success
<p>Information and Communication Skills:</p>	<p>21C.O.9-12.1.TT2 - Student routinely applies keyboarding skills, keyboard shortcut techniques, and mouse skills with facility, speed and accuracy.</p> <p>21C.O.9-12.1.TT7 - Student uses advanced features and utilities of presentation software (e.g., slide transitions, master slides, narrations and timings, creating web-enabled presentations, creating a non-linear presentation) to communicate ideas to multiple audiences.</p>	<p>The teacher will show examples of shortcuts to increase speed.</p> <p>Students will use Presentation software with their presentations. They will show graphs and include web links to communicate their ideas.</p>	<p>Identity Activity: Typing and using presentation software. Evaluated using Identity Activity Rubric</p> <p>Land Surveying: Typing, using math writing software, and using presentation software. Evaluated using Land Surveying Rubric</p>

<p>Thinking and Reasoning Skills:</p>	<p>21C.O.9-12.2.TT2 - Student collaborates with peers, experts and others to contribute to a content-related knowledge base by using technology to compile, synthesize, produce, and disseminate information, models, and other creative works.</p>	<p>Students will work in groups during this project and will have to show good collaboration skills and also show that they have individual accountability to the group.</p>	<p>Identity Activity: Work in groups to help figure out their identity. Individual presentation though. Evaluated using Identity Activity Rubric</p> <p>Land Surveying: Work in groups and work with surveyors/engineers to show how to survey land. Evaluated using Land Surveying Rubric</p>
<p>Personal and Workplace Skills:</p>	<p>21C.O.9-12.3.TT2 - Student works collaboratively to acquire information from electronic resources, conducts online research, and evaluates information as to validity, appropriateness, usefulness, comprehensiveness and bias.</p>	<p>Students will work in groups to find nonbiased information for research.</p>	<p>Land Surveying: Find nonbiased information about surveying. Evaluated using Land Surveying Rubric</p>

<p>Performance Objectives:</p>	<p>Know Proper form for an identity proof Basic trigonometric identities The sum and difference of angles can be represented on the Unit Circle Unit Circle values Basic trigonometric identities Domain restrictions of the basic trigonometric functions Division by zero and negative radicands generate restrictions The domain that makes the inverse a function The graph of the inverse is a reflection in $y = x$ $f(f^{-1}(x)) = x$ and $f^{-1}(f(x)) = x$ $\arcsin y$ means the angle whose sine is y</p> <p>Do Derive the sum and difference, double-angle, and half-angle identities Use the sum and difference of two angles to prove the angle reduction formulas Use correct notation to describe infinitely many solution points on the Unit Circle Analyze domain restrictions in the equation Solve equations by factoring Exclude the restricted values from the domain Determine if an expression is an angle or a trigonometric value Explain the relationship between a trigonometric function and its inverse Recognize the restricted values of a trigonometric function Determine whether the problem involves inverse trigonometric values or inverse trigonometric functions Graph the inverse trigonometric functions Find inverse trigonometric values using technology Solve equations involving trigonometric inverse functions</p>
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<p>Driving Question:</p>	<p>How can Trigonometry be used to survey land?</p>
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<p>Assessment Plan:</p>	<p style="text-align: center;">Identity Activity</p> <p>Description: This product is to get the students to learn trig identities and also the domain and range of inverse trig functions. The rubric will help guide the students.</p> <p>Scenario: You are part of a Trig protective custody program. Your job is to protect a Trig Function that was at the wrong place at the wrong time. You must first change their identity to something no criminal will ever be able to find, and allows them to keep their true identity deep down. You then will have to make a passport with this new</p>
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identity. Then you must use inverse trigonometric functions to place them in a region of the world that will be comfortable for them.

[Land Surveying](#)

Description: In this product students will show how trig is used in land surveying, they will also establish a way to traverse the land by proving law of sines and/or law of cosines using trig identities and do a cost benefit analysis of the wind farm. The [rubric](#) will help guide the students.

Scenario: A new wind farm is being put up in Keyser, WV. CME Engineering has asked you to survey the land by traversing the land to ensure that the wind farm is located on the proper plot of land. They believe that there will be some opposition to the project (because many believe the wind mills may be noisy, harm wildlife, and take up their land) so they not only want you to prove that the benefits outweigh the costs involved in the project, but that most of these concerns are unwarranted. Your job is to come up with a way to traverse the land and prove that it works, disprove the concerns, and show that the benefits outweigh the costs.

Major Group Products	<u>Land Surveying Identity Activity</u> (Identity Part)
Major Individual Projects	Tests Quizzes <u>Identity Activity</u> (Presentation)

Assessment and Reflection:

Rubric(s) I Will Use:	Collaboration <u>Group Performance Rubric</u>	X	Written Communication	
	Critical Thinking & Problem Solving		Content Knowledge <u>Identity Activity</u> and <u>Rubric Land Surveying Activity</u> and <u>Rubric</u>	X
	Oral Communication		Other <u>Vocabulary Rating Scale</u>	X
Other Classroom Assessments For Learning:	Quizzes/Tests		Practice Presentations	
	Self-Evaluation <u>Self Performance Rating Scale</u>	X	Notes <u>Notes for Proving Law of Sines and Cosines</u>	X
	Peer Evaluation <u>Group Performance Rubric</u>		Checklists/Observations <u>Assignment Checklist</u>	X
	Online Tests and Exams		Concept Maps	
Reflections:	Survey		Focus Group	
	Discussion		Task Management Chart <u>Team Contract</u>	X
	Journal Writing/Learning Log <u>Journal Prompts</u>	X	Other <u>Resource Center</u>	

Map The Product:

[Project Map](#)

Product: [Land Surveying](#)

Knowledge and Skills Needed	Already Have Learned	Taught Before the Project	
1. Oral Communication Skills	X		
2. Presentation Software	X		
3. Trig Identities		X	
4. Law of Sines/Cosines			

	5. Triangle Properties	X		
Resources:	<p>School-based Individuals: Teachers, Principals, Board Members</p> <p>Technology: Computer, Projector, Graphing Software, Excel</p> <p>Community: Engineers, Surveyors</p> <p>Materials: Graphing Calculators, Computer</p>			
Manage the Process:	<p>Before Project Launch: Before Project begins students should know the basic triangle properties and also know the basic trigonometric identities. If students are having trouble in these areas I have provided a resource center that students could use in order to practice these concepts or you can teach mini-lessons if you think the majority of the class is having difficulty in these areas.</p> <p>The grouping should be heterogeneous and encompass all types of learning styles. To get an idea of what kind of learners you have you may want to have them talk a Learning Styles Inventory. If computers are available you could have them do an online one at this website: http://www.learning-styles-online.com/inventory/questions.asp?cookieset=y or http://www.engr.ncsu.edu/learningstyles/ilsweb.html</p> <p>1st Phase: The first day or two should be spent on teaching reviewing the basic trigonometric identities. Then introduce the Identity Activity. This project should take anywhere from 1 week to 1 ½ weeks.</p> <p>2nd Phase: Have students work on Identity Activity. The students will make presentations during this week. When finished the students should complete both Self Performance Rating Scale and the Group Performance Rubric and Journal Prompt 1.</p> <p>3rd Phase: Have a guest speaker (ideally a civil engineer and/or a surveyor) come in to speak to students on how they work together. Have students do Journal prompt 2 before starting the Surveying activity. Work on Land Surveying Activity a few days in class so that the teacher can answer questions about project. Do a mini lesson to help students learn to give an oral presentation.</p> <p>4th Phase: Complete surveying activity and then complete both Self Performance Rating Scale and the Group Performance Rubric and do Journal Prompt 3. Students will present their findings in front of local surveyors/ civil engineers if possible.</p>			
Project Evaluation:	Journal Prompts			
Resource Files Uploaded	<p>Resource Files</p> <ul style="list-style-type: none"> ● UP3482WS2.doc (http://wveis.k12.wv.us/Teach21/CSO/Upload/UP3482WS2.doc) ● UP3482WS3.doc (http://wveis.k12.wv.us/Teach21/CSO/Upload/UP3482WS3.doc) ● UP3482WS4.doc (http://wveis.k12.wv.us/Teach21/CSO/Upload/UP3482WS4.doc) ● UP3482WS5.doc (http://wveis.k12.wv.us/Teach21/CSO/Upload/UP3482WS5.doc) ● UP3482WS6.doc (http://wveis.k12.wv.us/Teach21/CSO/Upload/UP3482WS6.doc) ● UP3482WS7.doc 			

(<http://wveis.k12.wv.us/Teach21/CSO/Upload/UP3482WS7.doc>)

- UP3482WS8.doc

(<http://wveis.k12.wv.us/Teach21/CSO/Upload/UP3482WS8.doc>)

- UP3482WS9.doc

(<http://wveis.k12.wv.us/Teach21/CSO/Upload/UP3482WS9.doc>)

- UP3482WS10.xls

(<http://wveis.k12.wv.us/Teach21/CSO/Upload/UP3482WS10.xls>)

- UP3482WS11.doc

(<http://wveis.k12.wv.us/Teach21/CSO/Upload/UP3482WS11.doc>)

- UP3482WS12.doc

(<http://wveis.k12.wv.us/Teach21/CSO/Upload/UP3482WS12.doc>)

- UP3482WS13.doc

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- UP3482WS15.doc

(<http://wveis.k12.wv.us/Teach21/CSO/Upload/UP3482WS15.doc>)

- UP3482WS16.doc

(<http://wveis.k12.wv.us/Teach21/CSO/Upload/UP3482WS16.doc>)