Performance Based Learning and Assessment Task

REALLY Tall!

I. ASSESSSMENT TASK OVERVIEW & PURPOSE:

Students will review concepts for finding missing sides of a triangle using different geometric concepts (Pythagorean Theorem, Trigonometry, and Similar Figures).

II. UNIT AUTHOR:

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III. COURSE:

Geometry

IV. CONTENT STRAND:

Geometry

V. OBJECTIVES:

Students will find the missing side of a given triangle by using Pythagorean Theorem, Trigonometry (tangent, in this problem), and similar figures.

VI. REFERENCE/RESOURCE MATERIALS:

- "Finding REALLY Tall Heights" activity sheet
- Measurements for activity (given by teacher during activity)
- Calculator

VII. PRIMARY ASSESSMENT STRATEGIES:

To assess this project, use the attached rubric. This rubric allows students to self-assess and teachers to assess the final project. Students should complete the assignment, then self-assess. Afterwards, the student should make any correction he/she feels is necessary, then submit to the teacher for assessment.

VIII. EVALUATION CRITERIA:

Students will be assessed using the teacher column in the rubric.

IX. INSTRUCTIONAL TIME:

This activity is a should fit in a 90-minute block, and should be used as a summative assignment, possibly as preparation for the SOL.

REALLY Tall!

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Geometry

Mathematical Objective(s)
Students will:

- Create a drawing which relates a real-world situation to a mathematical construct
- Identify a strategy to solve a right triangle based on given information
- Find a missing side of a right triangle using:
    - Pythagorean Theorem
    - Similar Figures
    - Trigonometry (specifically, tangent)

Related SOL

G.8 The student will solve real-world problems involving right triangles by using Pythagorean Theorem and its converse, properties of special right triangles, and right triangle trigonometry.

NCTM Standards

- use trigonometric relationships to determine lengths and angle measures.
- use geometric ideas to solve problems in, and gain insights into, other disciplines and other areas of interest such as art and architecture

Materials/Resources

- "REALLY Tall" student activity sheet
- Measurements (to be given by teacher)
- Graphing Calculator

Assumption of Prior Knowledge

This activity is a review of several topics that have been taught during the year. Specifically, students must know Pythagorean Theorem, similar figures, and trigonometry. Students should be working on at least level 3 of the Van Hiele scale of triangles. Students should be able to discuss the relationships between physical objects and geometric representations. They may

have some issues with understanding the tools described (range finder, angle finder, etc.) even though they are described in the activity.

Introduction: Setting Up the Mathematical Task

In this activity, the teacher will ask the students to use previously-learned knowledge about right triangles to find a missing side. The activity should take between 60 and 90 minutes.

To introduce the task, the teacher should group students in medium-sized groups (4-6 students) and give them the first page of the activity sheet. The teacher should lead a discussion about each tool, and how each one can be used. The teacher should ask the following question for group discussion: "Why can't we use the rangefinder to directly measure the height of the objects?" The class should be led to see that the rangefinder only works if you have an object to reflect the laser. This should lead the class to discuss that all of the shapes created will be some kind of triangle.

The teacher will then give students the first problem, which will ask them to indirectly find the height of the school's flagpole. Students will be asked to create a strategy that they will implement before being given any measurements. The teacher will have all of the measurements, but will only give each group exactly what measurements they say they can find. Groups will also be asked how they will find these measurements (how tools are used) before any information is given. After they have found the height of the flagpole, students will be asked to write a short letter to the principal explaining the height, along with supporting evidence.

Once students have completed the flagpole activity, students will be given the water tower activity. Repeat the steps above, but emphasize that students must create a different strategy in order to receive full credit. For the last question, have students change groups. This way, they can discuss the third different strategy with others, who may have used a different strategy already.

Place students in large groups (8-12 students) and have them compare strategies and answers with peers. Remind students that rounding can cause slightly different answers. Distribute rubrics, and have students give themselves a grade on the rubric before corrections. Let students make any corrections they choose, then have them submit their final work along with the rubric for assessment.

Since this activity is all about applying previous knowledge to solve a problem, the teacher should only be involved to keep students focused and on task. Students should have all of the knowledge they need to complete this assignment, so the "thinking" portion must not be given to them.

To summarize the activity, students will be asked to write briefly about the following prompt:

"We were able to do use some of the properties of right triangles to solve these problems. Besides finding the height of an object, what other questions could a right triangle be used to solve?"

Student Exploration

During the activity, the students will be using triangles to model real world situations. The students will be working in small and medium groups to share ideas and determine an effective method for solving the issues. Once students have created a strategy and determined how to use the tools at their disposal, the teacher will give the students only the information that the student says they need. The students will use the measurements to determine the height of the object in question.

To expand these concepts, the teacher will use a writing prompt to ask students to find other applications of right triangle properties.

Assessment List and Benchmarks

See attached rubric for assessment. Students will self-assess after completing the activity and discussing results with a medium-sized group (6-8 students). Students will then correct any issues before submitting the activity for teacher assessment.

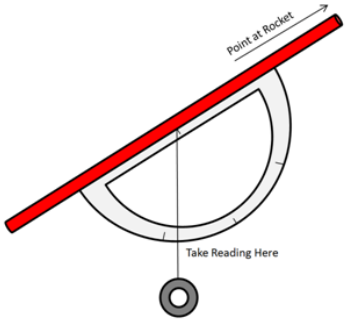
REALLY Tall!

You have been asked to find the heights of three tall structures around your school: a flag pole, a water tower, and a radio tower. You have the following tools at your disposal:

- Rangefinder: This tool looks like a pair of binoculars with a middle section and a button on top. This middle section holds a range-finding laser. When you look through the binoculars, you see crosshairs. When you center your crosshairs on an object and press the button, the laser tells you how far away you are from the object.

- Measuring Tape: This is a long plastic strip with inches and feet marked off. You can use this to measure any linear distance. It has no support, so you cannot hold it up in the air.

- Angle-Finder: This device is created by attaching a string to the middle of a straw. Under the straw, you also attach a piece of paper with a protractor drawn on it. When you look at an object through the straw, you can have a group mate find your angle of elevation by looking at where the string falls on the protractor.



Note: To receive full credit on this activity, each of the problems must be done using a different strategy. Points will be deducted if same strategy is repeated!

I. Flag Pole

Your principal wants to move the flagpole from in front of the school to near the football field. However, school regulations say that no nearby object may be higher than the flagpole. The school recently installed 100-feet-tall lights. Can the principal move the flagpole to the football field?

Once you have determined a strategy and how you will use your tools to find the needed measurements, show your work to your teacher to get your measurements.

Write a short letter to your principal explaining your strategy, your measurements, your results, and your recommendation.

II. Water Tower

Your local water company has a problem: the county has passed a new regulation which will tax any structure taller than 500 feet. They want to know if they will need to pay a tax on the local water tower. You will be paid if you can answer this question.

Once you have determined a strategy and how you will use your tools to find the needed measurements, show your work to your teacher to get your measurements.

Write a short letter to your water company explaining whether or not they will need to pay tax on their water tower. Be sure to include your strategy, measurements, and calculations necessary to support your conclusions.

III. Radio Antenna

A local radio station is offering a $500 prize for high school students. The first student who can accurately determine the height of the station's radio antenna will be the winner. All submissions must come with a written explanation and work.

Once you have determined a strategy and how you will use your tools to find the needed measurements, show your work to your teacher to get your measurements.

Write a submission to the radio station's contest that includes the height of the antenna, along with all strategies, measurements, and calculations.

REALLY Tall – Rubric

Measurements for Flagpole:

Points	Score	Mine	Teacher
3	Student uses unique and correct strategy to find the height, with correct calculations.		
2	Student uses unique and correct strategy to find the height, with incorrect calculations.		
1	Student uses unique strategy to find height, but with errors or misconceptions in the strategy -OR- student reuses previous strategy, completely correct.		
0	Student reuses strategy that give incorrect answer -OR- student does not have strategy to support measurements.		

Letter for Flagpole:

Points	Score	Mine	Teacher
2	Student gives a complete and correct explanation of the strategy used along with solution.		
1	Student gives correct explanation for strategy and solution, but omits important parts in the letter.		
0	Answer given with no explanation		

Measurements for Water Tower:

Points	Score	Mine	Teacher
3	Student uses unique and correct strategy to find the height, with correct calculations.		
2	Student uses unique and correct strategy to find the height, with incorrect calculations.		
1	Student uses unique strategy to find height, but with errors or misconceptions in the strategy -OR- student reuses previous strategy, completely correct.		
0	Student reuses strategy that give incorrect answer -OR- student does not have strategy to support measurements.		

Letter for Water Tower:

Points	Score	Mine	Teacher
2	Student gives a complete and correct explanation of the strategy used along with solution.		
1	Student gives correct explanation for strategy and solution, but omits important parts in the letter.		
0	Answer given with no explanation		

REALLY Tall – Rubric

Measurements for Radio Antenna:

Points	Score	Mine	Teacher
3	Student uses unique and correct strategy to find the height, with correct calculations.		
2	Student uses unique and correct strategy to find the height, with incorrect calculations.		
1	Student uses unique strategy to find height, but with errors or misconceptions in the strategy -OR- student reuses previous strategy, completely correct.		
0	Student reuses strategy that give incorrect answer -OR- student does not have strategy to support measurements.		

Letter for Radio Antenna:

Points	Score	Mine	Teacher
2	Student gives a complete and correct explanation of the strategy used along with solution.		
1	Student gives correct explanation for strategy and solution, but omits important parts in the letter.		
0	Answer given with no explanation		

Final Score before corrections (self-assess) _____/15

Final score after corrections (teacher grade) _____/15