Performance Based Learning and Assessment Task

Fire Truck Presentation

I. ASSESSSMENT TASK OVERVIEW & PURPOSE:
The student will be given a scenario in which they must compare 3 fire trucks to determine if they will be acceptable for use in their community. A letter to the town supervisors will be written giving the students recommendation and reasons for recommendation

II. UNIT AUTHOR:
Scott Stephens, Rappahannock County High School, Rappahannock County Public Schools

III. COURSE:
Geometry

IV. CONTENT STRAND:
Geometry

V. OBJECTIVES:
Determining if 3 given sides will create a right triangle. Analysis of results in order to make a determination about outcomes

VI. REFERENCE/RESOURCE MATERIALS:
Task Sheet (attached), Calculator

VII. PRIMARY ASSESSMENT STRATEGIES:
The student will be assessed using a scoring rubric. (See Attached)

VIII. EVALUATION CRITERIA:
Scoring rubric and benchmark of exemplary work attached

IX. INSTRUCTIONAL TIME:
One 90-minute period

Fire Truck Presentation

Strand
Geometry

Mathematical Objective(s)
Determining whether 3 given sides form a right triangle, Pythagorean Theorem

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

NCTM Standards

- Create and critique inductive and deductive arguments concerning geometric ideas and relationships, such as congruence, similarity, and the Pythagorean relationship.
- Draw geometric objects with specified properties, such as side lengths or angle measures
- Build and draw geometric objects
- Apply and adapt a variety of appropriate strategies to solve problems
- Communicate mathematical thinking coherently and clearly to peers, teachers, and others

Materials/Resources

- Task Worksheet (attached)
- Calculators (if needed for basic calculations)
- Word Processing software

Assumption of Prior Knowledge

- Students should know if 3 given sides form a right triangle
- Students should know how to use the Pythagorean Theorem in order to find a missing side

Introduction: Setting Up the Mathematical Task (Instruction Sheet attached)

- You are given the scenario: Your fire department needs to purchase a new ladder truck. There are 3 such trucks which you are looking at: truck #1 has a ladder that can extend to 75 feet with a cost of $300,000, truck #2 has a ladder that can extend to 120 feet with a cost of $400,000 and truck #3 with a ladder that can extend to 150 feet with a cost of $500,000. Each truck needs to be able to reach the highest building in your community (120 feet is the maximum) with a horizontal distance that ranges between 25 feet and 40 feet. One additional parameter is that each truck is 15 feet tall – this measurement will have to be taken into account when you make your determinations

- You are to create a presentation to your board of supervisors which shows why each truck does or does not meet the needs of your department in order to secure funding for the new truck. The presentation needs to contain drawings and the calculations you used as well as your findings and recommendations.

Student Exploration

Student/Teacher Actions:

- Students will individually analyze and determine how to prove the different scenarios given.
- The teacher should make sure all the students stay on task.
- If any students are struggling, the teacher should ask the students leading questions, such as "Do these sides meet your needs?"

Monitoring Student Responses

- Students will read their presentations to the whole group at the end of the class period.
- Throughout the task the teacher will move through the room to check on accuracy of computations and assist with the final presentation.

Assessment List and Benchmarks

Assessment List

Element	0	1	2
Mathematical calculations are correct. Truck 1	Incorrect Calculations	Minor errors in calculations	Calculations are correct
Mathematical calculations are correct. Truck 2	Incorrect Calculations	Minor errors in calculations	Calculations are correct
Mathematical calculations are correct. Truck 3	Incorrect Calculations	Minor errors in calculations	Calculations are correct
Sketches for each scenario are shown and labeled correctly	Sketches not present	Sketches present but labels are inaccurate	Sketches present and labels are accurate
Determination for choice of truck is shown	No determination made	Determination made but no explanation given	Determination made and explanation given
Presentation is neat and organized.	Lacks neatness and organization	Needs work	Neat and well organized
All required elements for presentation are there with explanations	Incomplete in more than one area	Incomplete in one area	Complete

SOL: G.8

You belong to the local fire squad and you need to purchase a new ladder truck. In order to get the necessary funds for the truck you must go in front of the local supervisors at their monthly meeting. You have three trucks to choose from, one with a ladder that extends to 75 feet that costs $300,000 a second ladder truck that extends to 120 feet which costs $400,000 and the third truck whose ladder extends to 150 feet which costs $500,000. Knowing that the supervisors will okay the purchase of a single ladder truck you must come up with a proposal for a truck that will reach the roof of every building in the community your department services at the lowest price.

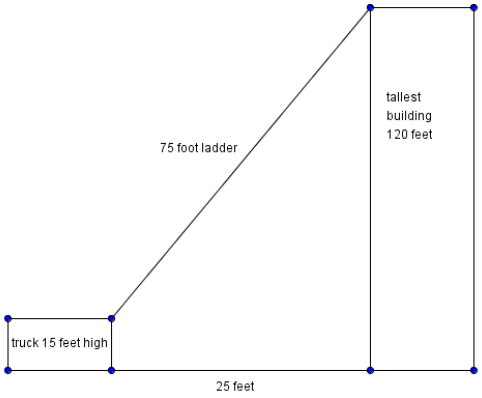
Some parameters to keep in mind:

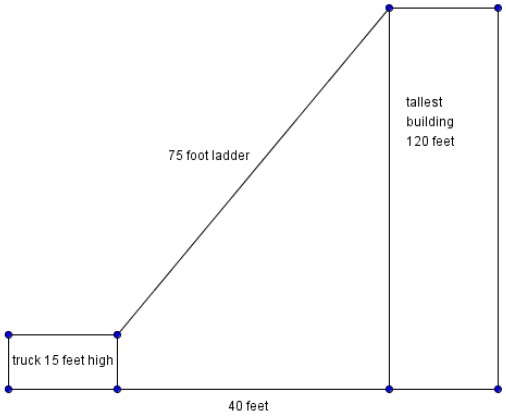
1. The minimum setback for properties in your town (the minimum distance a building needs to be from the street) is 25 feet with a maximum of 40 feet.

2. Town ordnance limits the height of buildings to 120 feet in your community.

3. Every one of the trucks you have to choose from is 15 feet tall (this must be taken in account when figuring how high the ladder will reach)

Truck #1

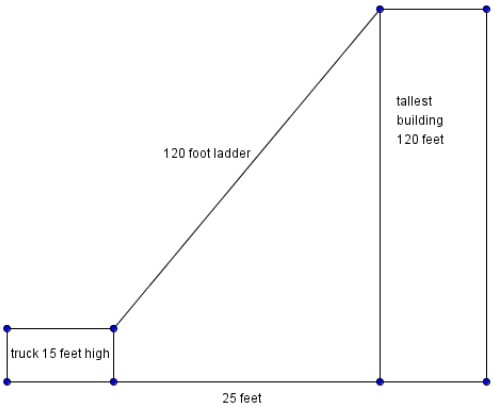


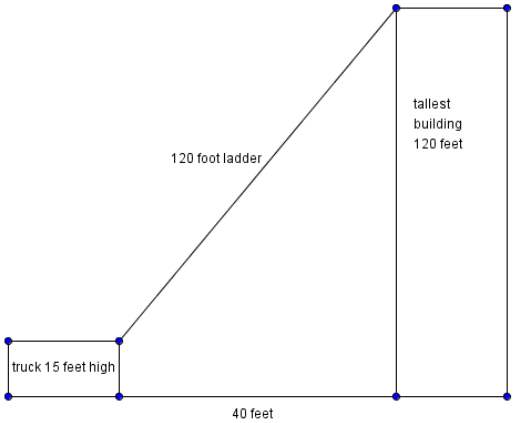


$75^2 < 25^2 + (120-15)^2$ $75^2 < 40^2 + (120-15)^2$

The furthest this ladder will reach with a horizontal distance of 25 feet is 79 feet and with a horizontal distance of 40 feet it will only reach 63 feet. This is not a good choice for us because it will not reach the top of our tallest building.

Truck #2

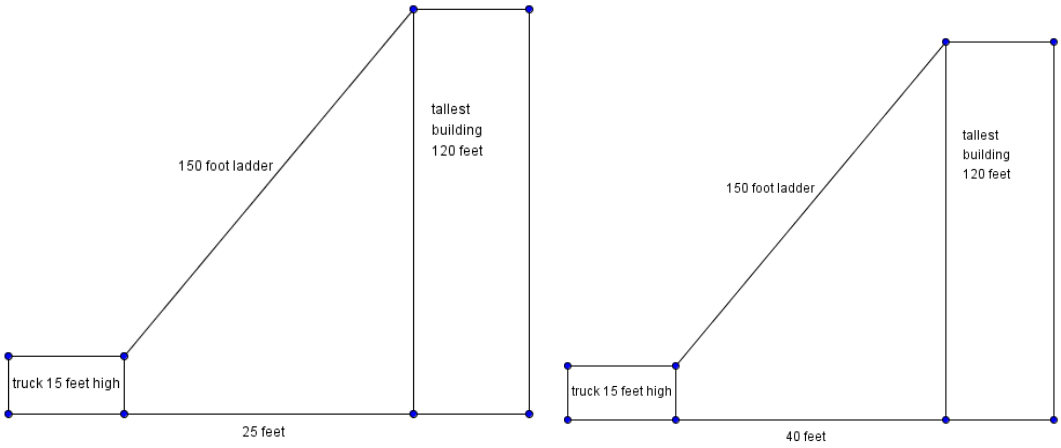




$120^2 > 25^2 + (120-15)^2$ $120^2 > 40^2 + (120-15)^2$

This ladder with a horizontal distance of 25 feet will reach 117 feet and with a horizontal distance of 40 feet it will reach 113 feet. When you factor in the 15 feet for the height of the truck we find that this ladder will reach the top of our tallest building.

Truck #3



$150^2 > 25^2 + (120\text{-}15)^2$ $150^2 > 40^2 + (120\text{-}15)^2$

This ladder with a horizontal distance of 25 feet will reach 147 feet high and with a horizontal distance of 40 feet will reach 145 feet high. This ladder would also fit our community's needs.

Dear Supervisors,

Upon investigating the three choices for our new ladder truck we have come to the conclusion that truck #2 would be a great choice in ladder trucks for our community. Truck #1, with a 75 foot ladder simply will not meet our town's needs because the ladder cannot reach the top floor of our tallest building. Both truck #2 and truck #3 will reach our tallest building but considering our town ordinance which does not allow a building over 120 feet tall and the cost involved we are submitting our recommendation for truck #2 with a cost of $400,000 dollars.

Thank you

Town x Fire Department