Lesson Plan: MEASURING A TOWER

Teacher: Pedro Blaya

Subject: PHYSICS

<table>
<tr><td>Title : Lesson</td><td>Time : 2 class periods (50’ each)</td></tr>
<tr><td colspan="2">Subject : PHYSICS</td></tr>
<tr><td colspan="2">Aim: Demonstrate an understanding of the principles of trigonometry and measurement in physics.</td></tr>
<tr><td colspan="2">Key CS elements: decomposition, pattern recognition, abstraction, algorithm design</td></tr>
<tr><td colspan="2">Age group : 1st -2nd ESO, 13 year olds</td></tr>
<tr><td>Learning situations:
Apply computational thinking skills to design and implement a method for measuring the height of a tower.
Analyze and interpret data collected during the tower measurement process.</td><td>Activity type : Measuring a Tower</td></tr>
<tr><td colspan="2">Resources :
Protractors
Rulers or measuring tapes
Smartphones or digital cameras
Graphing software or spreadsheet program
Computers or tablets with internet access
Printed copies of the worksheet (included in the lesson plan)</td></tr>
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Learning development:

First we identify the problem: we need to measure a high tower, and we cannot do that with a measuring tape, so how can we do it? We expect their answers to end in applying trigonometry to solve the problem.

- Review the basic concepts of trigonometry, focusing on the relationships between angles and sides in right triangles (specifically, sine, cosine, and tangent).
- Provide examples of how trigonometry is used to measure heights or distances.
- Engage students by asking them to imagine a scenario where they need to measure the height of a tall tower without directly accessing it.
- What they need to do that: discuss about the materials they can need to fulfill the task.

1. Decomposition:

Fieldwork and Data Collection (30 minutes):

- Take students outside to a suitable location with a tall structure (such as a flagpole, building, or tree).
- Instruct students to measure the distance between two predetermined observation points using rulers or measuring tapes.
- Ask them to use protractors to measure the angles between their line of sight and the top and bottom of the tower.

2. Pattern recognition:

Data Analysis (25 minutes):

- Guide students in organizing and analyzing the data collected during the fieldwork.

- Instruct them to calculate the tower's height using the trigonometric relationships discussed earlier.
- Introduce the concept of uncertainty and discuss potential sources of error in their measurements.

3. Abstraction:

Graphing and Interpretation (20 minutes):

- Assist students in creating graphs of their data using graphing software or a spreadsheet program.
- Instruct them to interpret their graphs and draw conclusions about the accuracy of their measurements
- Indicate that they use the tangent function to calculate the height. The formula would be: height = distance x tangent(angle)

4. Create the Algorithm

Conclusion (10 minutes):

- Summarize the main takeaways from the lesson, highlighting the integration of computational thinking, trigonometry, and measurement in physics.
- Provide opportunities for further exploration or applications of computational thinking in real-world scenarios.

Assessment: Monitoring the students responses, and try to elicit from them the correct answers.

Expected results: The students have to manage measuring a tower in real life (not from a drawing). They should apply the concepts of trigonometry to solve this problem.

Notes:

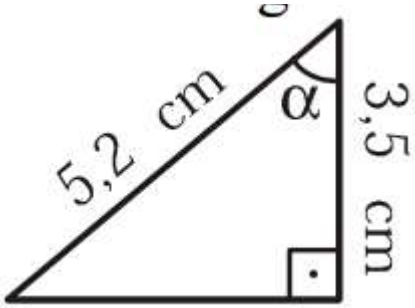
- Discuss the challenges involved in measuring the tower.

WORKSHEET ON MEASURING A TOWER

FIRST WE PRACTICE SOLVING TRIANGLES

1: Resuelve los siguientes triángulos rectángulos, sabiendo:
a) La hipotenusa a = 8 cm y el ángulo C = 47º 16’ 34’’
b) Los catetos b = 9,3 cm y c = 4,1 cm
c) La hipotenusa a = 6,4 cm y el cateto c = 3,8 cm
d) Un cateto b = 10,5 cm y el ángulo B = 60º EJERCICIO

2 : Halla las razones trigonométricas (seno, coseno y tangente) del ángulo α:



EJERCICIO 1 : Desde el lugar donde me encuentro, la visual a la torre de una Iglesia forma un ángulo de 52º con la horizontal. Si me alejo 25 m más de la torre, el ángulo es de 34º. ¿ Cuál es la altura de la torre?

EJERCICIO 2 : Desde el lugar donde me encuentro la visual de una torre forma un ángulo de 32º con la horizontal. Si me acerco 15 m, el ángulo es de 50º. ¿Cuál es la altura de la torre?

IN ENGLISH

3) From a distance of 45 feet from the base of a building, the angle of elevation to the top of the building is 68°. Estimate the height of the building to the nearest foot.
THEY REVISE TRIGONOMETRY:
https://www.transum.org/Maths/Exercise/Trigonometry/

ONLINE PRACTICE
https://www.liveworksheets.com/worksheets/en/Math/Trigonometry

https://math.libretexts.org/Courses/Monroe_Community_College/MTH_165_College_Algebra_MTH_175_Precalculus/05%3A_Trigonometric_Functions_and_Graphs/5.02%3A_Right_Triangle_Trigonometry/5.2e%3A_Exercises_-_Right_Angle_Trigonometry