

Template - Lesson Plan – Backwards by Design

Subject/Grade: Foundations & Pre- Calc 10 Lesson Title: #3: Measuring an Inaccessible Height Teacher(s): Miss Doratti	
Stage 1: Identify Desired Results	
Outcome(s)/Indicator(s): FP10.4 a) Students can develop, explain, and apply relationships and how side and angle sizes compare in similar right triangles b) Students can show how to find the hypotenuse (longest side) of a right triangle and the legs (adj and opp sides) in a right triangle c) Students can solve problems using one or more right triangles by applying ratios or the Pythagorean theorem d) Students can create and solve problems that involve primary trigonometric ratios, Pythagorean theorem, and other measurements	
Key Understandings: ('I Can' statements) <ul style="list-style-type: none"> - I can develop, explain, and apply relationships between the ratios of side lengths and angle sizes in a similar right triangle. - I can show how to find the hypotenuse of a right triangle. - I can solve problems using one right triangle. - I can create and solve problems with right triangle 	Key Questions: n/a as this is more of a hands-on lesson with minimal teaching. I may insert myself into their conversations outdoors when they are making their problems and solving them that will promote deeper thinking.
Prerequisite Learning: <ul style="list-style-type: none"> - SOHCAHTOA – need to understand what this means and how it relates to ratios. - All angles in a triangle add up to 180 degrees. - Basic mathematics to remove denominators when solving for a variable and how it affects the other numbers in an equation. - What the tangent ratio is and how to calculate lengths using it. 	
Stage 2: Determine Evidence for Assessing Learning	
Formative: <ul style="list-style-type: none"> - <u>Daily Problem/Group Work:</u> Groups will have 3 people per group (1 writing on the board, 1 giving instructions to the writer, and one using pen and paper to solve it.) and they will have to work together to solve. I will prompt them to switch, and they can use this method to fix others mistakes until they come to a solution. They will be assessed based on their understanding of the knowledge. I will have a lot of time to do this assessment because I would be assessing them individually as they participated. I will use a checklist to record checkmarks and notes on each students' abilities. *This day the two groups of students that created a problem, will use their problems to run this activity. They will be assessed separately because they will hand in the problem they created and the solution. They must be sent to me via Google Classroom (as a photo) the night before so that I can check its credibility. There will be peer, self, and teacher assessment for the daily problem. - <u>Outdoor-based problem:</u> Students will come up with a problem outdoors and solve it in their group of 2. For example, they may stand at the base of the tree and walk out x number of steps from it. They could use that measurement as the leg of the triangle they had made. They would have to use their clinometer to help them with the angle of inclination. They will have the option to produce this as a TikTok, podcast, vlog, etc. They will be assessing on their structure of their problem and the solution to match. 	
Summative: <ul style="list-style-type: none"> - <u>Exit Slip:</u> Students will have a one question exit slip. This will be used as a checkpoint for that daily teaching. I will be able to re-teach and/or fill gaps in knowledge prior to moving on to the next lesson. This will also make sure that no one gets left behind as I focus on moving forward. We will also go through the solution for the exit slip first thing the next day. I will use a checklist with students' names to record a checkmark and notes. 	

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Stage 3: Build Learning Plan

Set (Engagement):

Length of Time: 5-10 min

Presentations from groups for daily problem (2)

Group activity:

5 Groups of three will be given a triangle with missing lengths or angles. They will do this up on the board. One person will be the board writer, one will be the verbal instruction giver, and the other will be at a desk with paper and pencil working on the solution. Teacher will say switch and they must switch roles. The writer cannot give solutions or help solve the problem at all. As they switch, they may revise the previous work. Go until they believe they have the solution. Groups will stay quiet until all groups have come up with a solution. Repeat with the other 5 groups of 3. Go through the solution that is correct. Discussion after each round is necessary to use this as assessment as learning.

Development:

Length of Time: 10-20 min

Group Activity:

TRY THIS

Work with a partner.

You will need:

- an enlarged copy of a 180° protractor
- scissors
- a measuring tape or 2 metre sticks
- a piece of heavy cardboard big enough for you to attach the paper protractor
- a drinking straw
- glue
- adhesive tape
- a needle and thread
- a small metal washer or weight
- grid paper

A. Make a drinking straw clinometer:

- Glue or tape the paper protractor to the cardboard. Carefully cut it out.
- Use the needle to pull the thread through the cardboard at the centre of baseline of the protractor. Secure the thread to the back of the cardboard with tape. Attach the weight to the other end of the thread.
- Tape the drinking straw along the baseline of the protractor for use as a sighting tube.

B. With your partner, choose a tall object whose height you cannot measure directly; for example, a flagpole, a totem pole, a tree, or a building.

C. One of you stands near the object on level ground. Your partner measures and records your distance from the object.

D. Hold the clinometer as shown, with the weight hanging down.



E. Look at the top of the object through the straw. Your partner records the acute angle indicated by the thread on the protractor.

F. Your partner measures and records how far your eye is above the ground.

G. Sketch a diagram with a vertical line segment representing the object you want to measure. Label:

- your distance from the object
- the vertical distance from the ground to your eyes
- the angle of inclination of the straw

H. Change places with your partner. Repeat Steps B to G.

I. Use your measurements and the tangent ratio to calculate the height of the object.

J. Compare your results with those of your partner. Does the height of your eye affect the measurements? The final result? Explain.

Instructional Strategies:

- Group work activity
- Group discussion
- Google Classroom exit slip
- Outdoors activity – student-created examples based on outdoors (real-life application)
- Guided examples
- Pairs – daily problem (2 groups)

Materials/Resources:

Textbook

Group activity: enlarged copies of protractor, scissors, meter sticks, straws, cardboard, glue, tape, need and thread, washers, graph paper

Google Classroom

Possible Adaptations/

Differentiation:

Universal design will be used so there should not be any adaptations, students will be able to answer using their current knowledge.

Management Strategies:

These will have been in place prior to this lesson. They are working on where to hand things into and where to find missing notes/assessments. Where to put phones for class. Where to find supplies in the classroom.

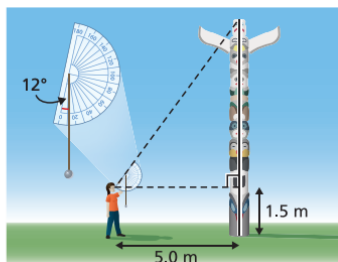
Safety Considerations:

Responsible use of whiteboard markers. Appropriate language use in the group.

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Guided example:

Use the information in the diagram to calculate the height of a totem pole observed with a drinking-straw clinometer. Give the answer to the nearest metre. The diagram is *not* drawn to scale.



Outdoors Group Activity:

Students will come up with a problem outdoors and solve it in their group of 2. For example, they may stand at the base of the tree and walk out x number of steps from it. They could use that measurement as the leg of the triangle they had made. They would have to use their clinometer to help them with the angle of inclination. They will have the option to produce this as a TikTok, podcast, vlog, etc. They will be assessing on their structure of their problem and the solution to match. If they have time, they may take out their phones and start completing this sharing of problem and solution.

Learning Closure:

Length of Time:

Exit slip: This will be posted on the board via Google Classroom.

A hiker saw a hoodoo on a cliff at Willow Creek in Alberta's badlands. The hiker was 9.1 m from the base of the cliff. From that point, the angle between the level ground and the line of sight to the top of the hoodoo was 69° . About how high was the top of the hoodoo above the level ground?



Hand this into your bin. Please ensure your name is on it.

Stage 4: Reflection

(This part of the lesson is completed after the lesson has been delivered; this is where you can record how it went, what you would keep, and what would you change for next time)