Template - Lesson Plan – Backwards by Design

Subject/Grade: Foundations & Pre- Calc 10 **Lesson Title:** #1: The Tangent Ratio **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 hypothenuse (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)

- 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.

Key Questions:

- Why does the value of the tangent ratio of a given angle not depend on the right triangle you use to calculate it?
- How can you use the tangent ratio to determine the measures of the acute angles of a right triangle when you know the lengths of its legs?
- How do the ratios compare to one another?
- What do you think the value of each ratio depends on?

Prerequisite Learning:

- 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.

Stage 2: Determine Evidence for Assessing Learning

Formative:

- Group work on white board/chalkboard: 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.

Summative:

- Exit Slip: 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.

Stage 3: Build Learning Plan

Set (Engagement): **Length of Time:** 5-7 min

I will start the first lesson with a set for the entire unit. I will show a few TikTok videos that involve trigonometry to get students engaged. https://tinyurl.com/yk53exny & https://tinyurl.com/yeosqqtf

Today, we are going to start our journey to solving right triangles using SOH CAH TOA and ratios! The first part of the unit includes learning about the tangent ratio and the angle of inclination.

Instructional Strategies:

- Traditional lecture (very short)
- Pair or individual work to construct a triangle
- Examples on board with student involvement
- Group discussion
- Google Classroom exit slip

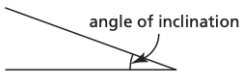
Materials/Resources:

Template - Lesson Plan – Backwards by Design

Development: **Length of Time:** 10-20 min

Definitions for the unit:

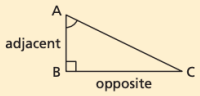
The **angle of inclination** of a line or line segment is the acute angle it makes with the horizontal.



The Tangent Ratio

If $\angle A$ is an acute angle in a right triangle, then

$$\tan A = \frac{\text{length of side opposite } \angle A}{\text{length of side adjacent to } \angle A}$$



Group Activity:

TRY THIS

Work with a partner.

You will need grid paper, a ruler, and a protractor.

A. On grid paper, draw a right $\triangle ABC$ with $\angle B = 90°$.

B. Each of you draws a different right triangle that is similar to $\triangle ABC$.

C. Measure the sides and angles of each triangle. Label your diagrams with the measures.

D. The two shorter sides of a right triangle are its legs. Calculate the ratio of the legs $\frac{CB}{BA}$ as a decimal, then the corresponding ratio for each of the similar triangles.

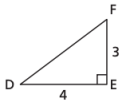
E. How do the ratios compare?

F. What do you think the value of each ratio depends on?

Guided Examples:

Example 1 **Determining the Tangent Ratios for Angles**

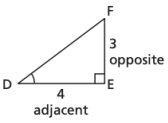
Determine tan D and tan F.



SOLUTION

$$\tan D = \frac{\text{length of side opposite } \angle D}{\text{length of side adjacent to } \angle D}$$

$$\tan D = \frac{EF}{DE}$$ EF is opposite $\angle D$, DE is adjacent to $\angle D$.

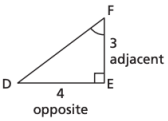


$$\tan D = \frac{3}{4}$$

$$\tan D = 0.75$$

$$\tan F = \frac{\text{length of side opposite } \angle F}{\text{length of side adjacent to } \angle F}$$

$$\tan F = \frac{DE}{EF}$$

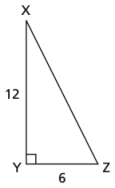


$$\tan F = \frac{4}{3}$$

$$\tan F = 1.\overline{3}$$

CHECK YOUR UNDERSTANDING

1. Determine tan X and tan Z.



[Answer: tan X = 0.5; tan Z = 2]

How are the values of tan D and tan F related? Explain why this relation will always be true for the acute angles in a right triangle.

Textbook
5 whiteboard markers

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.

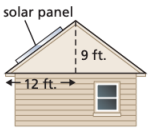
Management Strategies:
These will have been in place prior to this lesson. They are working on where to hand things into and where to find missing notes/assessments.

Safety Considerations:
Responsible use of whiteboard markers.
Appropriate language use in the group.

Template - Lesson Plan – Backwards by Design

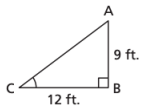
Example 3 Using the Tangent Ratio to Determine an Angle of Inclination

The latitude of Fort Smith, NWT, is approximately 60°. Determine whether this design for a solar panel is the best for Fort Smith. Justify your answer.



SOLUTION

The best angle of inclination for the solar panel is the same as the latitude, 60°. Draw a right triangle to represent the cross-section of the roof and solar panel. ∠C is the angle of inclination. In △ABC:



$$\tan C = \frac{\text{opposite}}{\text{adjacent}}$$

$$\tan C = \frac{AB}{BC}$$ AB is opposite ∠C, BC is adjacent to ∠C.

$$\tan C = \frac{9}{12}$$

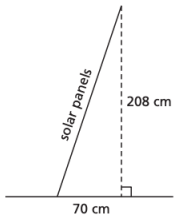
$$\angle C \doteq 37°$$

tan⁻¹(0.75) 36.86989765

The angle of inclination of the solar panel is about 37°, which is not equal to the latitude of Fort Smith. So, this is not the best design.

CHECK YOUR UNDERSTANDING

3. Clyde River on Baffin Island, Nunavut, has a latitude of approximately 70°. The diagram shows the side view of some solar panels. Determine whether this design for solar panels is the best for Clyde River. Justify your answer.



[Answer: The angle of inclination is approximately 71°. So, the design is the best.]

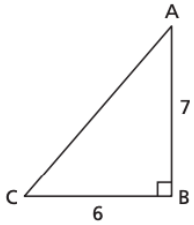
Moment for questions and re-teaching.

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.

Will explain the daily problem assignment and assign groups for this. Each group will present their daily problem once in the unit.

Learning Closure: **Length of Time:**
(Do some form of 'check for understanding' and tell them or have them tell you what they learned today. This can be done using a variety of strategies).

Exit slip: This will be posted on the board via Google Classroom.
Write the tangent ratio for the following acute angle. Show all work.



Hand work into the appropriate bin. Ensure your name is on it.

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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)