Unit 4 - Introduction

Essential Questions

1. How is the tangent ratio connected to the slope of a line?
2. What is the trigonometric ratio of tangent?
3. How can we apply trigonometric ratios to find missing measurements in right triangles?
4. How can we model real world situations with right triangles and use trigonometric ratios to solve problems?
5. How do we recognize and use special right triangles?
6. What are the Law of Sines and the Law of Cosines?

Key Skills

1. Connect side proportions with angle measures in right triangles.
2. Find the tangent, sine, and cosine ratios of various right angles.
3. Rationalize a denominator
4. Find missing sides of triangles using trig ratios and given angles
5. Recognize and use information about the measures in special right triangles

Key Concepts

1. What makes right triangles special when considering angle ratios?
2. What different combinations of angle measures and side lengths prove if two triangles are congruent or not?
3. When should we apply the Law of Sines and the Law of Cosines?

Vocabulary

Alpha

Angle

Clinometer

Conjecture

Hypotenuse

Leg

Slope angle

Slope ratio

Slope triangle

Tangent

Theta

Trigonometry

Change of x

Change of y

Adjacent

Ambiguous

Cosine

Equilateral

Inverse sin, cos, tan

Sine

Pythagorean triple

Law of sines

Law of cosines

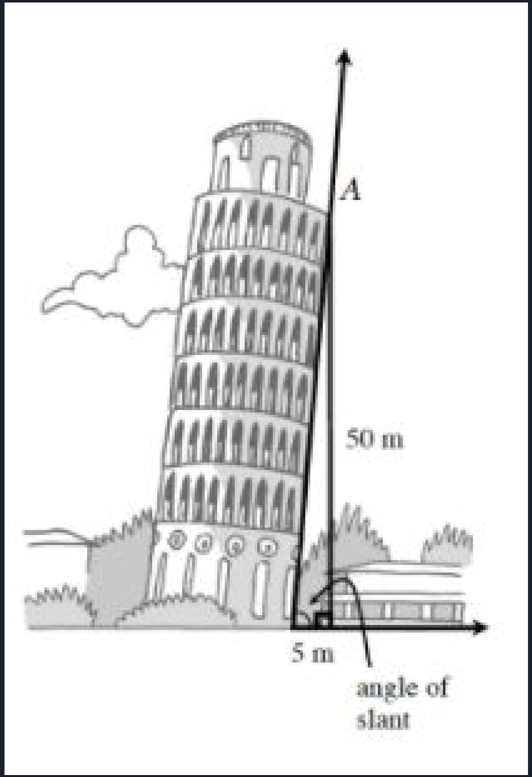
4.1.1 - Constant Ratios in Right Triangles

Aim: What is a slope triangle? How can I use slope triangles to find constant ratios?

The Leaning Tower of Pisa

For centuries, people have marveled at the Leaning Tower of Pisa due to its slant and beauty. Ever since construction of the tower started in the 1100s, the tower has slowly tilted south and has increasingly been at risk of falling over. It is feared that if the angle of slant ever falls below 83°, the tower will collapse.

Engineers closely monitor the angle at which the tower leans. With careful measuring, they know that the point labeled *A* in the diagram at right is now 50 meters off the ground. Also, they determined that when a weight is dropped from point *A*, it lands 5 meters from the base of the tower, as shown in the diagram.



The Leaning Tower of Pisa

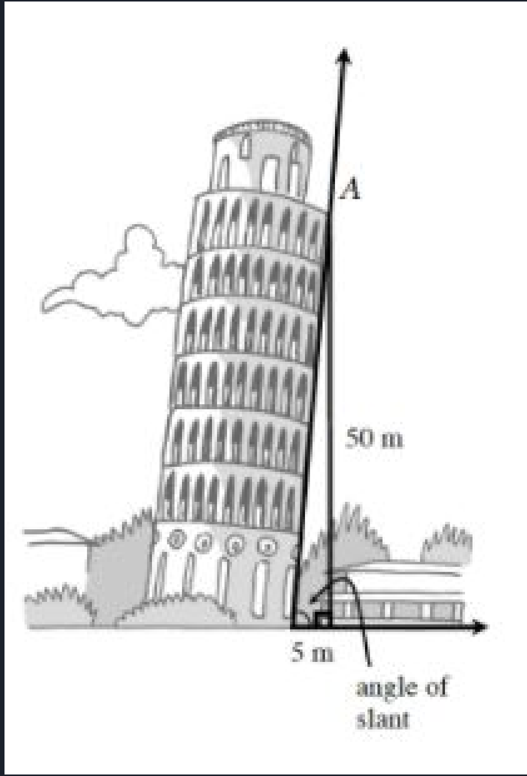
Work independently on the provided worksheet. Make sure to answer all questions thoroughly, as this will be collected for a grade.

1. With the provided measurements, what can you determine about the Leaning Tower of Pisa? What does this value represent?

2. Without using trigonometry, can you determine the angle at which the tower leans? Why or why not?

3. What is another method you can use to describe the Leaning Tower of Pisa? (Hint: think about slope...)

4. Which trigonometric ratio could you use to determine the angle at which the tower is leaning? Explain.



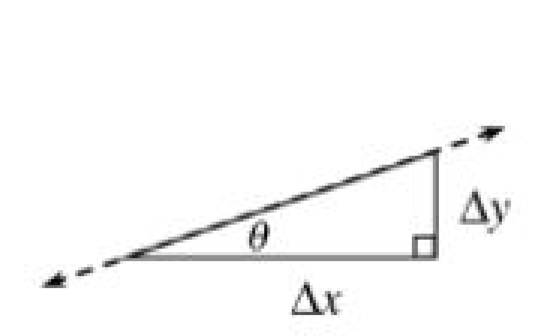
Slope and Angle Notation

Slope: Ratio of the vertical distance to the horizontal distance in a slope triangle formed by two points on a line (rise/run, $\frac{\Delta y}{\Delta x}$)

Indicates how steep a line is, and which direction it's going

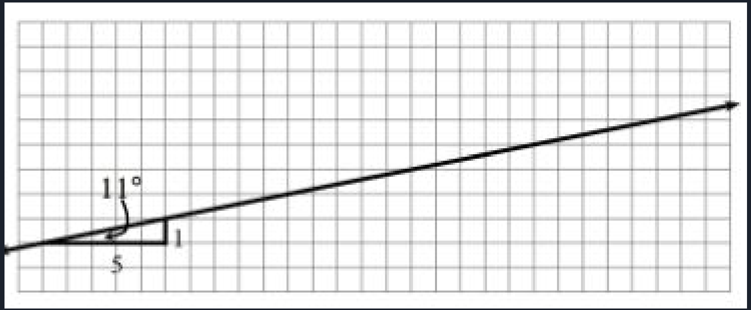
When we create a slope triangle that is oriented like a right triangle, the angle the line makes with the horizontal leg of the triangle is called the **slope angle**.

We represent missing angles using Greek letters - the commonly used letters are Θ (theta) and α (alpha)



Slope Triangles

On your graph paper, draw a coordinate plane and graph the line y = $x/5$. Construct a **slope triangle** like the one to the left.



a. Construct two more slope triangles on your line, each of a different size. Label the lengths of the legs of these triangles

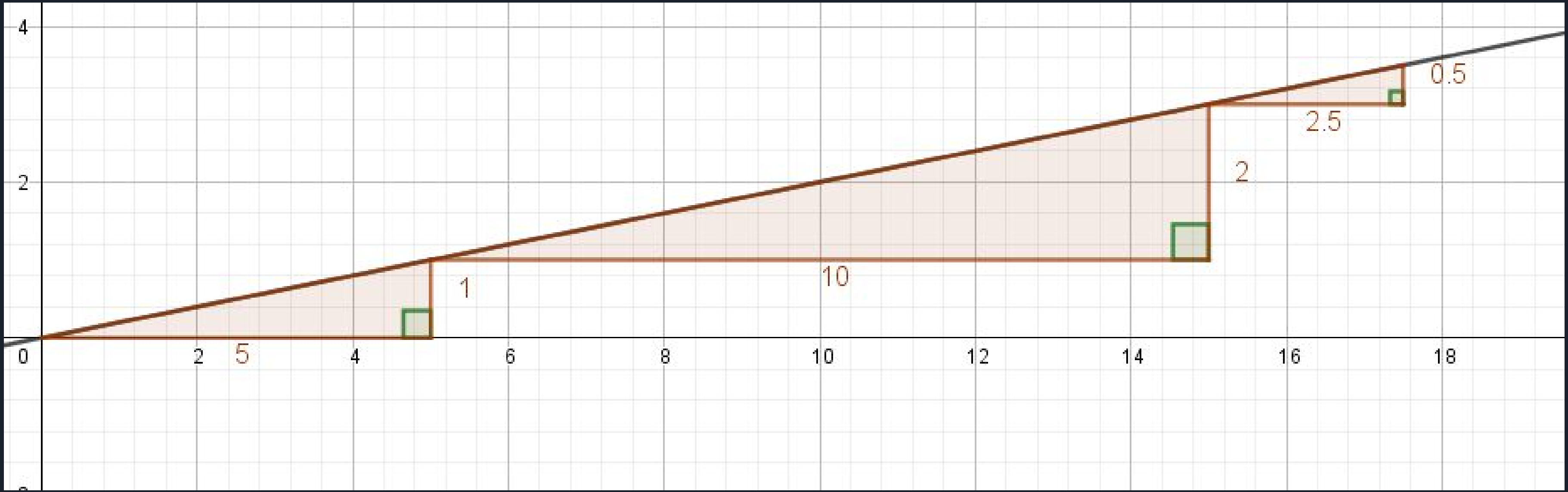
b. Why must all three of these triangles be similar? Which similarity condition can you use?

c. Since the triangles are similar, what does this tell us about slope ratios?

$$\frac{\Delta y}{\Delta x}$$

d. Confirm this by writing the slope ratios as a fraction. Then convert your fractions to decimals and compare.

Slope Triangles



Slope Triangles

Now that we have some knowledge of slope triangles, let's answer a few questions…

1. What if we wanted to draw a slope triangle on our line that had a change in y (Δy) of 6? What would Δx be?

2. What if we had a change in x (Δx) of 40? What would Δy be?

3. What if we were to draw a slope triangle on a different line? Could we use the same slope ratio to find a missing Δx or Δy value?

Slope Triangles

Let's try to confirm our conjecture from the third question…

On your graph paper, create a new coordinate plane and graph the line $y = 2x/5$.

- What is the slope ratio of this line?

- How does the slope angle compare to that of the line $y = x/5$?

- Does this support or contradict your conclusion from question 3 on the previous slide?

Examining Conjectures

Here are some conjectures that are based on what we've covered today. Decide whether you agree or disagree, and be able to explain your reasoning.

- All slope triangles have a ratio of $\frac{1}{5}$
- If the slope ratio is $\frac{1}{5}$, then the slope angle is approximately 11°
- If the line has a slope angle of 11°, then the slope ratio is approximately $\frac{1}{5}$
- Different lines will have different slope angles and different slope ratios

Recap and Homework

What is a slope triangle?

How are slope triangles used to find constant ratios in right triangles?

Get accustomed to seeing the greek letters Θ (theta) and α (alpha) - they'll be used often during this lesson

Homework: On PupilPath