Lab Framework

Text: CORD

Unit number and title: Unit 9 *Using Ratios and Proportions*

Short Description: A hands-on introduction to trigonometry through creating a rudimentary sine table.

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What's Your Sine?

LAB PLAN

TEACHER: Teacher Prep/ Lesson Plan

- **Lab Objective**
  Participants will discover that the sine ratio (opposite/hypotenuse) is constant for angles of the same size; the sine ratio is independent of the size of the triangle in which the angle occurs. Also, as the angle size increases, so does the sine ratio.
  Statement of pre-requisite skills needed (i.e., vocabulary, measurement techniques, formulas, etc.)
  Measuring accurately to the nearest mm with a ruler
  Measuring angles to within 3 degrees with a protractor
  Converting ratios to their decimal equivalents with a calculator
- **Vocabulary**
  Ray
  Vertex
  Altitude
  Right Angle
  Right Triangle
  Opposite side
  Hypotenuse
  Ratio
- **Materials List**
  Protractors
  Centimeter rulers
  Calculators
  Instructions and Recording Sheet (see attached) for collecting data
- **State Standards addressed**
  Math:

G.3.B Determine and prove triangle congruence, triangle similarity, and other properties of triangles
G.3.E Solve problems involving the basic trigonometric ratios of sine,cosine, and tangent.

Reading & Writing:

1.2 Use vocabulary (word meaning) strategies to comprehend text.
1.2.2 Apply strategies to comprehend words and ideas.
1.3 Build vocabulary through wide reading.
2.1 Demonstrate evidence of reading comprehension.
2.1.4 Apply comprehension monitoring strategies for informational and technical materials, complex narratives, and expositions: use prior knowledge.
2.1.5 Apply comprehension-monitoring strategies for informational and technical materials, complex narratives, and expositions; synthesize ideas form selections to make predictions and inferences.

2.1.6 Apply comprehension monitoring strategies for informational and technical materials, complex narratives, and expositions: monitor for meaning, create mental images, and generate and answer questions

- **Leadership Skills**
  1.4 The student will be involved in activities that require applying theory, problem-solving, and using critical and creative thinking skills while understanding outcomes of related decisions
  2.1 The student will communicate, participate, and advocate effectively in pairs, small groups, teams, and large groups in order to reach common goals
  2.2 The student will demonstrate knowledge of conflict resolution and challenge management.
  3.4 The student will understand the organizational skills necessary to be a successful leader and citizen and practices those skills in real-life.
- **SCAN Skills/Workplace Skills**
  Information: Acquires and uses information
  A. *Acquires and Evaluates Information*
  B. *Organizes and Maintains Information*
  C. *Interprets and Communicates Information*
  D. *Uses Computers to Process Information*

Technology: Works with a variety of technologies
A. *Selects Technology*—chooses procedures, tools or equipment including computers and related technologies
B. *Applies Technology to Task*—Understands overall intent and proper procedures for setup and operation of equipment
C. *Maintains and Troubleshoots Equipment*—Prevents, identifies, or solves problems with equipment, including computers and other technologies

- **Set-up information**
  1. Reproduce copies of instructions and recording sheets (back to back)
  2. Provide each student with a protractor and centimeter ruler
  3. Provide each student with at least two pieces of blank paper

- **Lab organization**(-Grouping/leadership opportunities/cooperative learning expectations; -**Timeline required)**
  This is Day 1 of a multi-part lab. The next part of this lab, graphing the results, should take place within two or three weeks. Subsequent labs will be similar, i.e., drawing, measuring, and comparing cosine and tangent ratios.

  Within this particular lab, there are three stages:
  1. Drawing, measuring, dividing (completing recording sheets)
  2. Discussing & articulating findings in groups of 4, then whole-group
  3. Applying findings to real life

- **Teacher Assessment of student learning** (scoring guide, rubric)
  Accurate drawings= 15 points
  Completion of recording sheet = 10 points
  Written statement of findings = 0-5 points (These may be re-written to earn higher points.)

- **Summary of learning** (to be finished after student completes lab)
  -discuss real world application of learning from lab

  As we get to Stage 2 in this lab, we should agree that the sine ratio will be the same for each angle of the same size.

Examples from the real world we could try together:

A grown-up and a kid are out flying a kite. There are 250 feet of string on the spool and all the string is out. The angle of elevation of the is 65 degrees. How high is the kite? Is it higher than the average two-story house?

We know that the Space Needle is 605 feet tall at its highest point. A cable strung from the highest point to a place on the ground was 900 feet long. At what angle does the cable meet the ground? Could a tightrope walker ascend at this angle or would it be too steep?

What's Your Sine?
A Lab in Measuring Angles and Sides With a Partner

What YOU do:

1. Using a protractor, create an angle. (Check the Recording Sheet to decide what size angle you're creating.) Write its size right next to the vertex. Check to see that your partner was able to do this.
2. Extend the rays to any length you choose.
3. Create a right triangle by dropping an altitude (a "plumb line") from the end of one of the rays so that it intersects with the other. See if your partner needs any help with this.
4. Pass your triangle to your partner.

What YOU do next:

1. Identify which side of the triangle is opposite the measured angle. Check to see if you agree with your partner.
2. Measure it to the nearest millimeter and write it on the recording sheet.
3. Identify which side of the triangle is the hypotenuse (opposite the right angle, the longest of the three sides in the triangle.)
4. Measure the hypotenuse to the nearest millimeter and enter it on the recording sheet.
5. Create the SINE RATIO: the length of the side opposite/ the length of the hypotenuse.
6. Divide to find the decimal equivalent of this ratio. Show your partner how to do this if she needs help.
7. Enter this value on the recording sheet.

FINALLY:

1. Compare your sine ratio to the one your partner found for the same angle.
2. What do you notice? Patterns? Trends? Surprises? Shape?

You have completed the measuring portion of this lab when:

1. You and your partner have completed *both* recording sheets. Yes, you are measuring their angles, and they are measuring yours. There should be two (2) sets of measurements for each angle.

You have completed the thinking and writing portion of this lab when:

2. You have written at least two sentences describing what you noticed and at least one sentence describing what you wonder about after having finished this particular activity.

Please turn in your labeled drawings of triangles and your recording sheet. Make certain your name and your partner's name are on both.

What's Your Sine? Recording Sheet

Angle Size	Length of Opposite Side (the Altitude)	Length of Hypotenuse	Sine Ratio: $\frac{\text{Length of opposite side}}{\text{Length of hypotenuse}}$	Decimal Equivalent of Sine Ratio
10º				
15º				
25º				
35º				
45º				
55º				
65º				
75º				
85º				

What did you notice? (Patterns? Trends? Surprises? Shape?)

What do you wonder about now?

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