

Lesson Plan Title: Similar Triangles

Local School District: Adams County/Ohio Valley School District

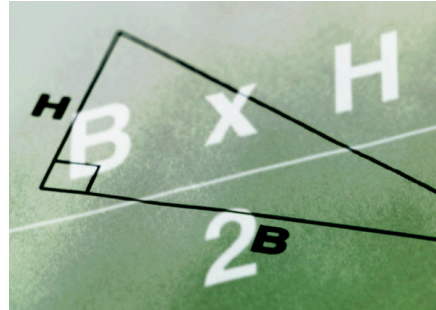
Grade Level: 9th Grade

Teacher Name: Julie Roush

Estimated Total Time: 450 minutes

Daily Time Allocation: 90 minutes

Number of Days: 5 days



Goal: The overall goal is for my students to find the height of different objects such as a tree or the flagpole in the front of the school.

Students will be able to do the following:

1. Organize information given to solve a problem.
2. Calculate the length of a missing side using properties of similar triangles.
3. Solve proportions.
4. Explain the theorem or postulate that allows the triangles in a problem to be similar: Angle-Angle (AA similar), Side-Angle-Side (SAS similar), Side-Side-Side (SSS similar).

National Standards:

NCTM: (National Council of Teachers of Mathematics)
(<http://standards.nctm.org/document/chapter7/index.htm>)

Mathematics Benchmarks and Indicators by Grade Level
(http://www.ode.state.oh.us/academic_content_standards/word/Math_Benchmarks_and_Indicators_by_Grade_Level.doc)

Ohio Standards Connections:

Ohio Standards, Benchmarks, and Indicators (<http://www.genevaschools.org/standards/#math>)
Mathematics Academic Content Standards

- **Key Standard(s), Benchmarks, and Grade Band(s):**
Standard:
Measurement and Geometry and Spatial Sense

Benchmarks and Grade Bands:

8–10 Measurement

- D. Use proportional reasoning and apply indirect measurement techniques, including right triangle trigonometry and properties of similar triangles, to solve problems involving measurements and rates.

8-10 Measurement

- E. Estimate and compute various attributes including length, angle measure, area, surface area, and volume, to a specific level of precision.

8-10 Geometry

- B. Describe and apply properties of similar and congruent figures, and justify conjectures involving similarity and congruence.

- **Grade Level Indicator(s):
Standard**

Grade 8 Measurement

- #3. Use appropriate levels of precision when calculating with measurements.

Grade 8 Measurement

- #7. Apply proportional reasoning to solve problems involving indirect measurements or rates.

Grade 8 Geometry

- #3. Use proportions in several forms to solve problems involving similar figures (part to part, part to wholes, corresponding sides between figures).

Grade 9 Geometry

- #2. Apply proportions and right triangle trigonometry ratios to solve problems involving missing lengths and angle measures in similar figures.

- **Mathematical/Scientific Processes:**

Grade(s) 8-10

- A. Formulate a problem or mathematical model in response to a specific need or situation; determine information required to solving that problem and choose a method for obtaining this information, and set limits for acceptable solution.
- F. Use a variety of mathematical representations flexibly and appropriately to organize, record, and communicate mathematical ideas.
- G. Write clearly and coherently about mathematical thinking and ideas.
- H. Locate and interpret mathematical information accurately, and communicate ideas, processes, and solutions in a complete and easily understood manner.

Preassessment:

Describe how you will know what knowledge, understanding, or skills students already have related to the concepts being taught in this lesson.

- Students will solve equations using inverse operations.
- Students will solve proportions.

Write the following on board:

1. $6x=24$ 2. $3x=72$ 3. $2/5=6/x$ 4. $10/12=x/8$

• Scoring Criteria:

Teacher observation—checks students answers. Class will work problems, and then individual students will go to the board to explain how their answer was calculated (showing all work).

Postassessment:

Describe how you will determine the level of student understanding of the concepts in the lesson.

Students will calculate the height of the school’s flagpole using similar triangles. The students will choose to do an oral presentation or written report explaining mathematical processes and properties used to find the height of the flagpole.

• Scoring Criteria**Extended Response:**

Robert and Susan both drew a right triangle. The legs of the triangle Robert drew are 3 inches and 4 inches. The legs of the triangle Susan drew are 8 inches and 6 inches. Do you think the triangles are similar? Why or why not?

Interdisciplinary Connections:

Language Arts – Written/Oral Presentation

Materials and Resources Needed:

Products that need to be copied, collected, or created. Use box to indicate status.

- Activities and/or worksheet on similar triangle applications
- Tape measure
- String (optional)
- Calculator (optional)

Procedures:

Describe step-by-step instructions for the illustrative activities and specific methods for developing the lesson.

Day 1:

1. Students will complete preassessment—review will be done if teacher deems necessary.
2. Teacher will give similarity property definitions, postulates, and theorems. (AA, SAS, SSS similarity.)
Example problems will be completed on board.
3. Teacher will ask for any questions and have a class discussion on how similar triangles can be used to find lengths of objects not easily measured.
4. Drill and practice worksheet with 5 problems with triangles drawn and labeled and 5 word problems. Students must draw, label, and solve for missing side length from word problem.

Day 2 and Day 3:

5. Students will be placed in groups of two for the following project:
On a sunny day, students locate a tree to calculate height and complete the following:
 1. Measure the height of one student (use string).
 2. Measure the length of student's shadow (use string).
 3. Measure the length of tree's shadow (use string).
 4. Use pencil and paper to set up proportion and solve for the height of the tree (draw picture).
 5. Switch jobs and repeat using another tree.
 6. Return to classroom and work in groups to complete the group's choice of oral presentation or written report.

Day 4 and Day 5:

1. Give oral presentations.

Differentiated Instruction Strategies (http://www.teach-nology.com/tutorials/teaching/differentiate/bottom_line/)

Describe changes that may be needed in depth, breadth, and pace of the lesson to accommodate unique learner needs.

- **Intervention:**
Instead of five problems each on worksheet—only two problems on each.
Students may use resource room, may use calculator, placed in mixed-ability group of students.
- **Enrichment:**
Have students write five word problems using similar triangles to find indirect measures of real-world applications (other than height of trees).

Extension:

Describe how newly gained knowledge, understanding, or skill can be extended through context or application.

Students will use similar triangles to solve for missing lengths in real world applications. Then the students will complete a proof on similar triangles, similar right triangles. The students will use trigonometric ratios of sine, cosine, and tangent to find missing side lengths and angle measures.

Homework Options and Home Connections:

1. Drill and practice worksheet on similar triangles (5 drawn problems that need proportions set up and 5 word problems that students must draw, label, and solve similar triangles).
2. Worksheet on trigonometric ratios.

Key Vocabulary:

- Similarity
- Corresponding sides
- Congruent angles
- Theorem
- Postulates (SAS, AA, SSS, right triangle similarity)
- Indirect measurement
- Ratio
- Proportions

Technology Tips:

Use Web site: “Similar Triangles and Right Triangle Trigonometry”
(<http://homepages.ius.edu/DTRAUGHB/trig.htm>)

General Tips:

Teacher picks group.
Use rope or string (not yarn).
Review reading a ruler before group work starts.
Move from this lesson to trigonometric ratio lesson.

Research Connections:

Find vocations that use similar figures on the job. Make a connection with scale drawings.

Sutton, J., & Krueger, A. (2002). *EDThoughts: What we know about mathematics teaching and learning*. Aurora, CO: McREL.

- “What role does active hands-on learning play in mathematics instruction?” (pp. 90–91.)

Other Web Resources:

http://www.gcseguide.co.uk/similar_triangles.htm

<http://www.projectgcse.co.uk/maths/similar.htm>

<http://mathworld.wolfram.com/SimilarTriangles.html>

<http://regentsprep.org/Regents/math/similar/Lsimilar.htm>

<http://colbycc.edu/www/math/trig/rt-tri2.htm>

Teacher Reflections and Notes:

Worksheet for Procedure 4:

Solve for x.

1. $x/12=8/16$
2. $6/x=9/6$
3. $2/3=12/x$
4. $5/10=x/16-x$
5. $5/4=x+5/x$

Answer the following. Solve by writing and solving a proportion.

1. A man 6 feet tall casts a shadow that is 11 feet long. A building casts a shadow of 139 feet long. What is the height of the building?
2. A person 5 feet tall casts a shadow that is 10 feet long. A tree casts a shadow that is 116 feet long. How tall is the tree?
3. A sign is 8 feet high and casts a 5-foot shadow while a nearby flagpole casts a 20-foot shadow. How high is the flagpole?
4. The shadow of a 4-foot pole is 6 feet long at the same time the shadow of a tower is 52.5 feet long. How tall is the tower?
5. Ryan is 5 feet tall. His shadow is 9 feet long and the shadow of a building is 36 feet long. How tall is the building?