Similar triangles

from the Esri GeoInquiries™ collection for Mathematics

Target audience – Geometry learners	Time required – 15 minutes

Activity	By creating similar triangles, it is possible to find the distance across a river using indirect measurements.
Math Standards	**CCSS: MATH.HSG-SRT.B.4.** Prove theorems involving similarity. **CCSS: MATH.CONTENT.HSG.SRT.B.5.** Use similarity criteria to solve problems. **CCSS: MATH.CONTENT.HSG.SRT.A.2.** Explain similarity for triangles.
Learning Outcomes	• Students will construct a pair of similar triangles. • Students will use similar triangles to find missing side lengths.

Map URL: http://esriurl.com/mathGeoInquiry12

⚙ Engage

What is the difference between direct and indirect measurement?

? What is the difference between direct and indirect measurement? *[Direct measurement measures exactly the thing that needs to be measured, while indirect measurement measures something by measuring something else.]*

? What is an example of each? *[Direct measurement may include your height with a tape measure; indirect measurement would be measuring the speed of your car by observing how your speedometer moves.]*

➜ Click the map URL above to launch the map.

🔍 Explore

How could you use indirect measurements to find the distance across the Mississippi River?

➜ Click the button, Bookmarks. Select Overview.

➜ Read aloud: "You want to know how far it is to the other side of the river—taking measurements on your side of the river only (the east side)."

➜ Click each side of the triangle on your side of the river to show the lengths that you were able to measure directly.

💬 Explain

How can you use similar triangles to find the distance across the river?

? What does it mean for two triangles to be similar? *[Corresponding angles are congruent and corresponding sides are proportional.]*

➜ Read aloud: "The angles at point B and point E are both right angles and are congruent."

? Why are angles DCE and ACB congruent? *[They are vertical angles.]*

? Why are triangles ABC and DEC similar? *[Angle-Angle (AA) Similarity Postulate – if two angles of one triangle are congruent to two angles of another, then the triangles must be similar.]*

– Because these two triangles are similar, the ratios of corresponding side lengths are equal.

➜ Write and solve a proportion to find the distance across the Mississippi River at this location: BC/EC = AB/DE ► 258/768 = 500/X ► X = 1,488 feet (approximately calculated using indirect measurements).

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Elaborate

When does this work?

? What other situations allow you to use similar triangles to find distances indirectly? *[Putting a mirror between you and an object to calculate its height or using shadow lengths to calculate the heights of tall objects, and so on.]*

Evaluate

How could you use the Measurement tool to check your work?

→ Click Measure, select the Distance tool, and choose Feet (US).
→ Measure the distance across the Mississippi River at the end of the Davis Street Ferry Road in East Carondelet, Illinois.
? How accurate was your indirect measurement? *[Answers will vary.]*
→ Calculate the percent error between the distance calculated and the distance measured. *[% Error = (Measured – Calculated) / Measured X 100 = (1500 –1488)/1500 X 100 = 1% error]*

USE THE MEASURE TOOL

- Click Measure, select the Distance button, and from the drop-down list, choose a unit of measurement.
- On the map, click once to start the measurement, click again to change direction, and double-click to stop measuring.
- Hint: Position the area of interest on the map so that it is not obscured by the Measure window.

ADD MAP NOTES

- Click Add and from the drop-down list, choose Add Map Note.
- Type a name, select a template from the drop-down list, and click Create.
- In the Add Features pane, choose a symbol and click in the map to place it.
- In the pop-up window, add your desired information.

Next Steps

DID YOU KNOW? ArcGIS Online is a mapping platform freely available to public, private, and home schools. A school subscription provides additional security, privacy, and content features. Learn more about ArcGIS Online and how to get a school subscription at http://www.esri.com/schools.

THEN TRY THIS...
• For a related instructional activity, see the Area of Complex Figures math GeoInquiry at http://esriurl.com/mathGeoInquiry.
• Explore cartographic projections for your consideration of the impact on this and related activities at http://esriurl.com/Geo41801.

TEXT REFERENCES

This GIS map has been cross-referenced to material in sections of chapters from these high school texts.

- *Holt Geometry by Holt, Rinehart & Winston — Chapter 7*
- *Geometry by Moise & Downs — Chapter 12*
- *Geometry by Houghton Mifflin — Chapter 7*

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