



# 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).

more ►

## 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 Houghton Mifflin — Chapter 7*
- *Geometry by Moise & Downs — Chapter 12*