Rates & proportions: A lost beach

from the Esri GeoInquiries™ collection for Mathematics

MATH

Target audience – Algebra learners **Time required – 15 minutes**

Activity	Determine the rate of coastal erosion by estimating changes in historical aerial photos.
Standards	**CCSS: Math.Content.HSF.LE.A.1.b**. Recognize situations in which one quantity changes at a constant rate per unit interval relative to another. **CCSS: Math.Content.8.F.B.4**. Use functions to model relationships. **CCSS: Math.Content.8.EE.B.5**. Understand the connections between proportional relationships, lines, and linear equations.
Learning Outcomes	• Students will graphically model a proportional relationship, extending the graph to predict a future outcome.

Map URL: http://esriurl.com/mathGeoInquiry1

Engage

How is Timbalier Island changing?

- Read aloud: "Louisiana is washing away. Every hour, a football-sized area of land is being washed out to sea. Measuring the rate of coastal erosion is important to fishermen, oil and gas companies, and environmentalists. In this activity, we will, measure the erosion rate of Timbalier Island, a small island on Louisiana's coast."
- Click the link above to launch the map.
- With the Details button depressed, click the button (Show) Contents.
- Turn on each imagery layer, starting with 1991 and proceeding to 2015.
- ? How does the island appear to be changing? *[The island is eroding at both ends and curling up a bit on the east end.]*

Explore

Can you measure how much it is eroding?

- Turn off all layers except for the 1991 Imagery layer.
- Turn on the three layers, 1991 Markers, 2006 Imagery, and 2006 Markers.
- Click the button Measure. Choose the Distance tool and set it to Meters.
- On the island's right side, measure the distance between the two markers. *[See info box:* Measure Tool.*]*
- ? What is the right erosion distance? *[~ 1275 meters]*
- Repeat the measurement process for the left side of the island.
- ? What is the left erosion distance? *[~ 512 meters]*
- ? What is the annual erosion rate for each side of the island? *[1275m/15yr = 85m/yr]*
- ? Which side is eroding faster? Why do you think that is? *[The island's right side as calculated rate shows.]*

Explain

Where was the island in 2015?

- Using the rates just calculated, estimate how far each end will be eroded between 2006 and 2015 (9 years). *[Right: 85 m/yr * 9 yrs=765 m; Left: 305 m]*
- Turn on the two layers, 2015 Imagery and 2015 Markers.
- On the right side of the island, measure the distance between the 2006 and 2015 markers.
- ? What is the measured erosion distance? *[~825 m]*
- ? How does it compare to the calculated distance? *[Measured distance is 60 m.]*
- On the left side of the island, measure the distance between the 2006 and 20015 markers.
- ? What is the measured erosion distance on the left side of the island? *[~293 m]*
- ? How does it compare to the calculated distance? *[The measured distance is 13m smaller.]*

more ▶

Elaborate

When will Timbalier Island be washed away?

- → Click the button Measure. Choose the Area tool and set it to Square Meters.
- → Turn off all imagery layers except the 1995 Imagery layer.
- → Carefully, pan and zoom to the island such that it is entirely visible on screen.
- → Starting on the left side of the island, click all around the edge of the island until you get back to where you started; double-click to finish.
- ? What is the measured area of the 1995 island? *[~6.1 millioin square meters]*
- ? Repeat for the 2015 island. What is the area in square meters? [~4.75 million square meters]
- → Read aloud: "Subtract the two areas and divide by the number of years between 1995 and 2015."
- ? What is the rate of erosion? [~67,000 square meters annually]
- ? Using this rate of erosion, when do you estimate that Timbalier Island will be completely washed away? *[~71 years or in the year 2085]*

Evaluate

Is this method of calculating rates of erosion consistent?

- ? Are these measures of rates of erosion consistent enough to predict how much erosion takes place from year to year? *[There is a lot of variability, but it is better than guessing.]*
- → Use the results of the first two measurement activities and what you know about the variability of the data to predict the erosion that took place between 1995 and 2015.
- → Use the same measurement techniques from the Explore and Explain sections to check your prediction for the 1995 to 2015 timespan.

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.

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...

• Take a look at coastal erosion in Trinidad with this story map: http://esriurl.com/Geo41803.

TEXT REFERENCES

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

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

Version Q1 2018. Send feedback: http://esriurl.com/GeoInquiryFeedback

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