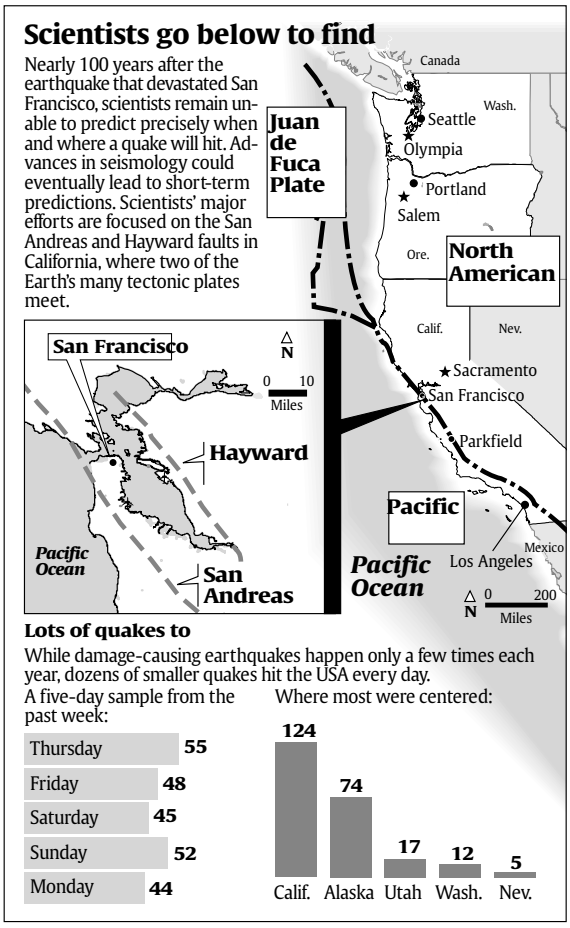
THE NATION'S NEWSPAPER

Math Challenge®
Student Edition

USA TODAY
NO. 1 IN THE USA

Scientists go below to find



Activity Overview:

In this activity, using the USA TODAY Infograph, "Scientists go below to find," you will be introduced to coordinate graphing by using latitude and longitude coordinates to find distances between cities. You will compute the vertical and horizontal distances between the two locations using the longitude and latitude readings, respectively. You will also use the Pythagorean Theorem to determine the distance between cities. Finally you will convert the distance measured in degrees to miles.

Focus Questions:

Q. Using the longitude and latitude lines, determine the distance (measured in degrees) from Los Angeles to Seattle traveling through Parkfield and San Francisco.

Q. What is the shortest distance (measured in degrees) if you were traveling along the fault between Parkfield and San Francisco?

Q. What is the shortest distance (measured in miles) to travel from Los Angeles to Seattle?

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This activity was created for use with Texas Instruments handheld technology.

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Activity Overview:

You will find the distance (measured in degrees) between cities by subtracting their respective latitude and longitude coordinates. This first activity can also serve as a real-life application of the Pythagorean Theorem.

Procedure:

Activity 1: Using the USA TODAY Infograph, "Scientists go below to find," you will explore the relationship between the measures of the sides of a triangle and the angles. Complete Activity 1 before answering the Focus Questions.

Cabri Jr. Directions
- Press ❶, select Cabri Jr. and press ⊆.
- Press ⊥ (π), select Open..., and press ⊆. Highlight PYTHAG and press ⊆.

Q. Complete the table below by using the hand cursor to change the length of FE and ED. Choose three angles less than 90° and three greater than 90°

m∠ E	F E	ED	FD	SUM $FE^2+ ED^2$	FD^2

Summarize the relationship between the last two columns for each angle.

_____

_____

Q. Use the hand cursor to grab F. Move F until the measure of ∠E is 90° and complete the table. Grab D and/or F and change the measure of the sides FE and ED. The measure of m∠E will remain 90°.

m∠ E	FE	ED	FD	SUM $FE^2+ ED^2$	FD^2
90					
90					
90					
90					
90					
90					

(Continued on page 3)

Data Source:

U.S. Geological Survey and USA TODAY Research

Materials:

- TI-83 Plus family or TI-84 Plus family
- Graph paper
- Small straightedge

Additional Information:

- Distance calculation link http://www.meridianworlddata.com/
- Latitude and longitude information http://www.mapsofworld.com/utilities/world-latitude-longitude.htm

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Procedure:

Summarize the relationship between the last two columns for each angle.

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This relationship is known as the Pythagorean Theorem and states that in a right triangle the square of the hypotenuse is equal to the sum of the squares of the lengths of the legs. Explain how you would determine the measure of the hypotenuse if you were given the lengths of the two legs.

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Activity 2: Use the information from Activity 1 and the USA TODAY infograph "Scientists go below to find" to answer the focus questions.

Q. Using the longitude and latitude lines, determine the distance (measured in degrees) from Los Angeles to Seattle traveling through Parkfield and San Francisco.

Step 1. Draw the diagram representing the region formed by Los Angeles to Seattle traveling through Parkfield and San Francisco on graph paper. To assist in the drawing, use the following information about the longitude and latitude for the following cities

	Longitude	Latitude
Olympia, WA:	122.53W	47.03N
Seattle, WA:	122.25W	47.68N
Portland, OR:	122.37W	45.32N
Salem, OR:	123.20W	44.56N
Sacramento, CA:	121.56W	38.30N
San Francisco, CA	122.38W	37.62N
Parkfield, CA	120.26W	35.54N
Los Angeles, CA	118.15W	34.04N

Note: Latitude is measured North or South of the Equator. Any point on the globe below the equator has a negative value for latitude, while points above the equator have positive latitude. Longitude is measured East or West of Greenwich, and in this activity West is negative and East is positive.

Step 2. Label your diagram and explain how you found the total distance traveled. What is the distance traveled from Los Angeles to Seattle?

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Procedure:

Q. What is the shortest distance (measured in degrees) if you were traveling along the fault between Parkfield and San Francisco?

- Let us apply the Pythagorean Theorem to this problem. Certainly, the earth is round and the distances computed in this activity will not be as exact as if we were considering the curvature of the earth. Since the coordinates of latitude and longitude define a specific location, we will use this opportunity to compute the distance between two locations. Draw a diagram of the region between Parkfield and San Francisco using the information found in Step 1 of Activity 2.

Q. What is the shortest distance between Parkfield and San Francisco?

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Q. What is the shortest distance (measured in miles) to travel from Los Angeles to Seattle?

- The following approximate distance calculations are relatively simple, but can produce distance errors. These approximate calculations are performed using latitude and longitude values in degrees. The approximation formula to convert degrees to miles will be used to answer the question above.

Approximate distance in miles: $\sqrt{x^2 + y^2}$

where x = 69.1 * (lat2 - lat1) and y = 53.0 * (long2 - long1)