THE NATION'S NEWSPAPER

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Teacher Edition

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Scientists go below to find

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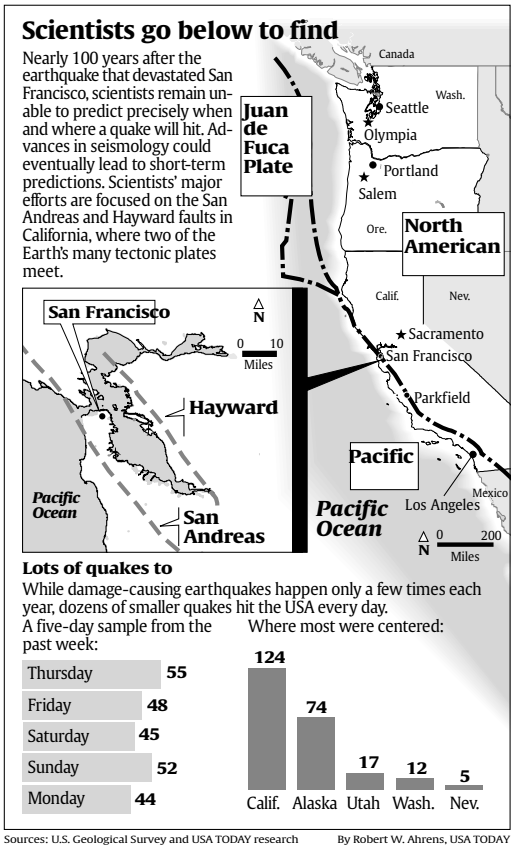

Activity Overview:

In this activity, using the USA TODAY Infograph "Scientists go below to find," students will graph a city's location by using latitude and longitude coordinates. Students will determine the distance to travel between cities using a vertical and horizontal movement. To determine the shortest distance between two cities, students will use the Pythagorean Theorem. Applying the relationships to a real-world problem will help students understand how geometry is used to solve problems.

Activity at a Glance:

- Grade level: 9-12
- Subject: Geometry
- Estimated time required: 30 minutes

Materials:

- TI-83 Plus family or TI-84 Plus family
- Overhead view screen calculator for instruction/demonstration
- Student handout
- Transparency
- USA TODAY newspapers (recommended)
- Cabri® Jr. Application

Prerequisites:

Students should:

- know how to use Cabri Jr.

These activities work with TI navigator A Classroom Learning System

Scientists go below to find

Concepts:

- Horizontal and vertical distance in the coordinate plane
- Pythagorean Theorem

Objectives:

Students will:

- determine the total distance using a horizontal and vertical path.
- use longitude and latitude to graph the location of a particular city.
- determine the shortest distance between two points.

Background:

The purpose of this lesson is to help students to develop a better understanding of distance between points. Students will apply the Pythagorean Theorem to determine the shortest distance between points in the coordinate plane. Solutions to problems will be shown using longitude and latitude and then students will compare this distance to the distance found using the Pythagorean Theorem. Additionally students will convert a distance in degrees to a distance in miles.

Preparation:

- Provide one graphing calculator for each student.
- Each student should have a copy of the corresponding student activity sheet.
- Provide each student with the following AppVar PYTHAG.

Classroom Management Tips:

- Have the students link the AppVars as part of the class period on the previous day or during the beginning of the class period when you are going to use this activity.
- Review opening an AppVars using Cabri Jr. with your class before starting the activity.
- Students can work individually or in groups to assist each other during the activity.
- Have students discuss their discoveries while they work to better understand the relationships.
- Before starting the AppVars, remind students to carefully read the opening screen and the activity pages. Students should take time to identify and discuss what the numbers represent.
- Before starting the activity, discuss using longitude (horizontal) and latitude (vertical) movement to find the distance traveled between two points. Remind students that these components represent the two legs of the right triangle formed.

Data Source:

U.S. Geological Survey and USA TODAY research

National Council of Teachers of Mathematics (NCTM) Standards:

Geometry Standard

- Use visualization, spatial reasoning, and geometric modeling to solve problems.

Problem Solving Standard

- Solve problems that arise in mathematics and in other contexts.

Connections Standard

- Recognize and apply mathematics in contexts outside of mathematics.

Document Links:

Student Handout

Transparency

TI Technology Guide, for information on the following:

- TI-83 Plus family or TI-84 Plus family
- Cabri Jr.

Scientists go below to find

Activity Extension:

- Challenge the students to find and bring in other examples of this type of graph from USA TODAY. Use these as additional problems for students to continue working on this topic or use as a review for an exam.
- Additional information about longitude and latitude can be found at http://www.mapsofworld.com/utilities/world-latitude-longitude.htm. Encourage students to find additional information and write a one-page summary.
- Encourage students to explore the distance calculation link found at http://www.meridianworlddata.com/.

Curriculum Connection:

- Geography
- Physics
- Chemistry

Assessment and Evaluation:

Activity 1: Using the USA TODAY Infograph "Scientists go below to find," you will explore the geometric relationships with triangles using perpendicular bisectors of the sides, bisectors of the angles and medians of the triangle. Complete Activity 1 before answering the Focus Questions.

Q. Complete the table below by using the hand cursor to change the measure of m∠E. Choose three angles less than 90° and three greater than 90°. The following are possible answers.

m∠E	FE	ED	FD	SUM FE^2+ED^2	FD^2

(Answer on page 4.)

Teacher Notes:

Scientists go below to find

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

m∠E	FE	ED	FD	SUM FE^2+ED^2	FD^2
85	3.2	5.6	6.2	41.7	38.4
55	3.9	5.6	4.7	46.4	22.1
25	5.4	5.6	2.4	60.7	5.8
100	3.4	5.6	7.0	42.6	49
115	3.5	5.6	7.8	43.8	60.8
144	3.6	5.6	8.8	44.2	77.4

When the angle is less than 90° the last column is less than the SUM and when the angle is greater than 90° the last column is greater than the SUM. The values in the table are possible answers and the answers students give may be different but the relationship between the last two columns will be the same.

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 to 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					

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

m∠E	FE	ED	FD	SUM FE^2+ED^2	FD^2
90	2.8	4.3	5.1	26.3	26.3
90	3.4	4.3	5.5	30.0	30.0
90	3.0	2.1	3.7	13.4	13.4
90	3.0	4.6	5.5	30.2	30.2
90	3.0	5.6	6.4	40.4	40.4
90	4.8	5.6	7.4	54.4	54.4

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

When the m∠E is 90° the values in the last two columns are equal even when the sides of the triangle are changing.

Teacher Notes:

Scientists go below to find

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.

Find the square root of the sum of the squares of the legs. This value will represent the measure of the hypotenuse.

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. Label your diagram and explain how you found the total distance traveled. What is the distance traveled?

A. The horizontal and vertical distances (measured in degrees) were found for each path from Los Angeles to Parkfield, Parkfield to San Francisco, and San Francisco to Seattle. Adding these together would represent the total distance which is 18 degrees. Check the students graph of this problem situation for any misunderstandings.

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

A. Using the Pythagorean Theorem the shortest distance is the measure of the hypotenuse. This values is 2.970 degrees.

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

A. Using the formula to determine the approximate distance in miles, the shortest distance from Los Angeles to Seattle is approximately 967.250 miles.

Teacher Notes:

These activities work with TI navigator A Classroom Learning System

If you are using the TI-Navigator Classroom Learning System, send the provided LearningCheck assessment to your class to gauge student understanding of the concepts presented in the activity. See the TI-Navigator Basic Skills Guide for addtiional information on how this classroom learning system may be integrated into the activity.