The FUTURES Channel®

MOVIE GUIDE

MOVIE NUMBER 3003

Undersea Treasure

The Movie:

A probability map, constructed by a mathematician, locates a sunken U.S. ship with the largest sunken gold treasure in U.S. history, and reveals even greater wonders. Featured: Larry Stone, Mathematician: Barry Schatz, Project Director, S.S. Central America Project. *(Movie length: 5:38.)*

Background:

In 1857 the *S.S. Central America,* en route from San Francisco to New York with some 600 passengers and crew and thousands of pounds of gold, sank off the coast of North Carolina. In addition to the immediate tragedy of 500 lost lives, the loss of the ship touched off the financial "Panic of 1857". But after awhile, the event—and the ship—were largely forgotten.

Exactly 131 years later, the discovery of the *S.S. Central America* was confirmed through the videocameras of the deep sea tele-operated robot Nemo. The story of the finding of the ship is almost as dramatic as the story of its loss.

Curriculum Connections:

Ratios — 1

Water pressure increases with depth. At the surface of the water the pressure is equal to 1 atmosphere; for every 100 feet of depth the pressure increases by 3 atmospheres. What is the pressure, in atmospheres, at 8,500 feet of depth (the depth of the *S.S. Central America*)?

Percent, Measurement (weight) — 2

One of the gold ingots found at the *S.S. Central America* weighed 63 pounds. If it were 77% gold, and gold is valued at $260 an ounce, what would it be worth?

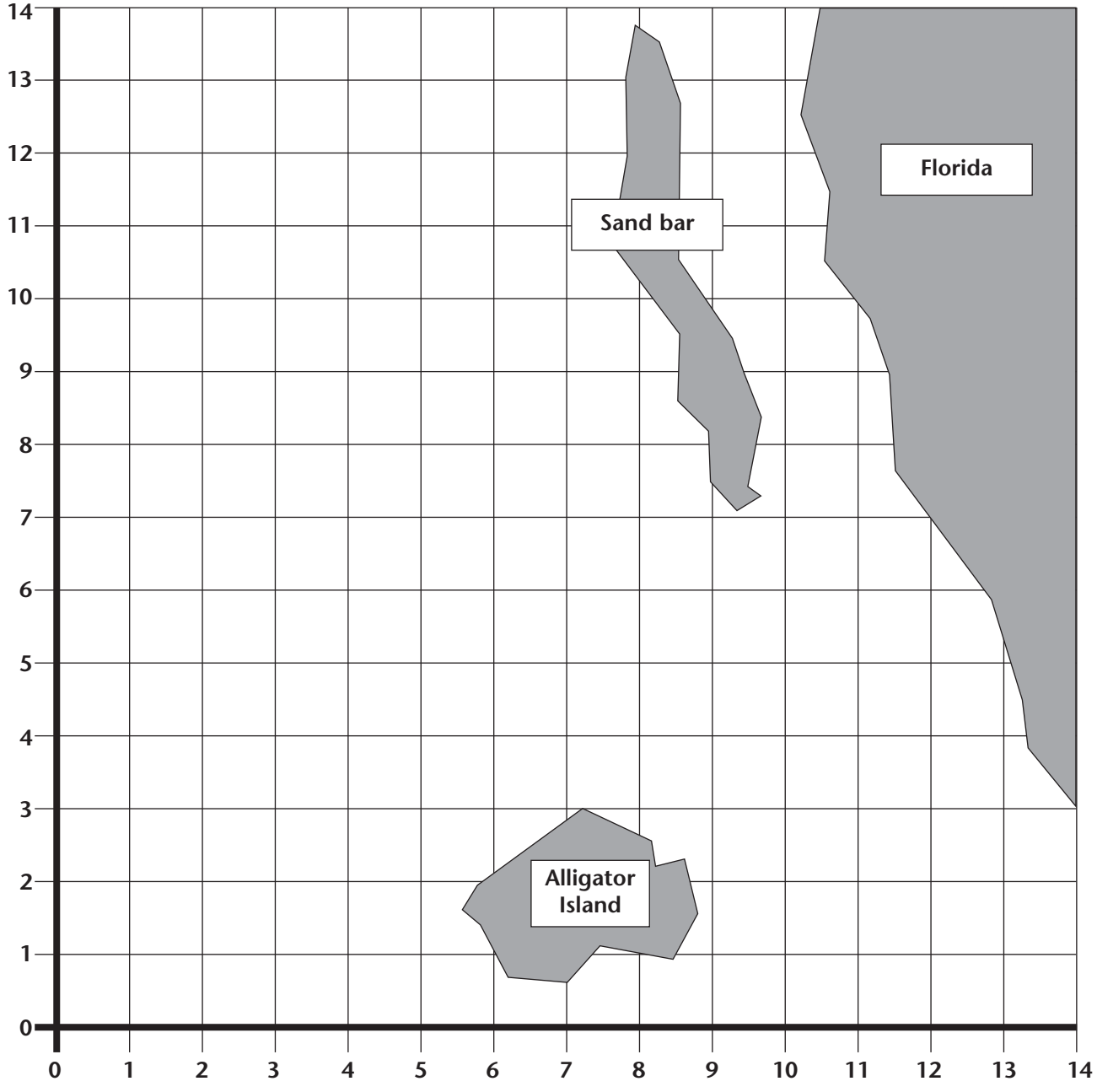
Measurement (distance, rate), Ratio — 3

The map at right shows the route of the *S.S. Central America* from the time that it left Panama, on September 3, 1857 to the time that it began to sink, on September 11. The journey included a one day stopover in Havana, Cuba.

Use the map to estimate the approximate speed of the vessel, in miles per hour, during its seven days of travel.

Sunken Treasure Map

Apply the rules on the next page to find the spaces in this grid that have the highest probability of containing a sunken treasure:



Find the Sunken Treasure

As you apply each rule, write a small ***H*** in the grid spaces with high probability, an ***M*** in the grid spaces with medium probability, and an ***L*** in the grid spaces with low probability.

Draw all lines lightly, in pencil, so that you can erase them easily.

Write in a letter only when the entire space of the grid fulfills the rule. (If the line that you draw goes through the grid space, do not put the letter into that grid space for that rule.)

Do not put letters in grid spaces which are partly or entirely covered by land.

When you have finished, the grid spaces that have only ***H***'s are the most likely locations of the sunken treasure, and the grid spaces with only ***L***'s are the least likely locations.

GAME 1

1. Draw in the lines that represent the equations $y = \frac{1}{2}x + 1$ and $y = 7$. Put an ***H*** in the grid spaces for which $y > \frac{1}{2}x + 1$ AND $y < 7$. Erase the lines.
2. Draw in the lines $y = -x + 12$ and $x = 8$. Put an ***L*** in the grid spaces for which $y > -x + 12$ AND $x < 8$. Erase the lines.
3. Draw in the lines $x = 3$ and $x = 6$. Put an ***M*** in the grid spaces for which $x < 3$. Put an ***H*** in the grid spaces for which $x > 3$ AND $x < 6$. Put an ***L*** in the grid spaces for which $x > 6$. Erase the lines.
4. Draw in the line $y = -1/3\ x + 6$. Put an ***L*** in the grid spaces for which $y < -1/3\ x + 6$. Erase the line.
5. Draw in the lines $y = x + 2$ and $y = 8$. Put an ***H*** in the grid spaces for which $y > x + 3$ AND $y < 8$. Erase the lines.

Congratulations! You should have only 1 grid space to search for the treasure.

GAME 2

1. Put an ***H*** in the grid spaces for which $(x - 4)^2 + (y - 5)^2 < 9$. Erase the lines.
2. Draw in the lines $y = 10$, $x = 6$ and $x = 11$. Put a ***L*** in the grid spaces for which $y < 10$ AND $x > 6$ AND $x < 11$. Put an ***L*** in the grid spaces for which $y > 10$ and $x < 6$. Erase the lines.
3. Draw in the line $y = 2x - 20$. Put an ***H*** in the grid spaces for which $y < 2x - 20$. Erase the line.
4. Draw in the line $y = -3/2\ x + 9$. Put an ***M*** in the grid spaces for which $y > -3/2\ x + 9$. Erase the line.

Congratulations! You should have only 2 grid spaces to search for the treasure.

Geometry (spherical coordinates)

The location of the *S.S. Central America* is described in one legal document as follows:

Northern Boundary: 31 degrees 37 minutes North Latitude;

Southern Boundary: 31 degrees 33 minutes North Latitude;

Western Boundary: 77 degrees 2 minutes West Longitude;

Eastern Boundary: 76 degrees 57 minutes West Longitude,

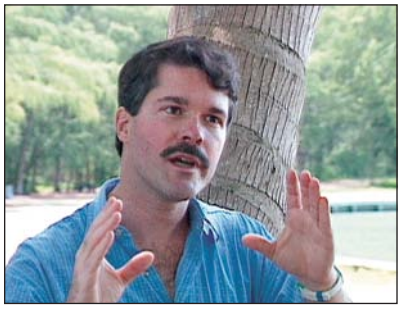
What is the area of this region? You can estimate it as follows:

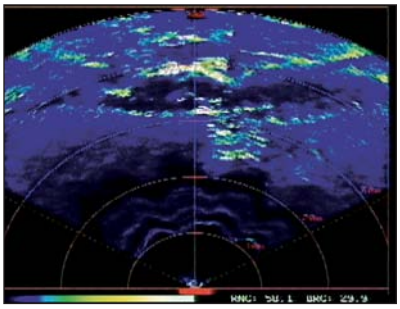
a) Assume the Earth is a sphere with a circumference of 25,000 miles (approximately true). There are 180 degrees of latitude on the surface of the Earth; these correspond to the distance along the circumference from the South Pole to the North Pole, which is 12,500 miles. What is the distance, therefore, between each degree of latitude?

b) There are 60 minutes of latitude in one degree. What is the distance between each minute of latitude?

c) At the equator, minutes of longitude have about this same separation, but they get closer together as you move towards the pole. At around 30 degrees latitude (the location in question), the minutes of longitude will be separated by a distance of about 66% of their separation at the equator. What is this distance?

Use the answers to (a), (b), and (c) to estimate the area, in square miles, in which the *S.S. Central America* was said to be located.





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Life Under the Ocean, #2004	A marine biologist studies the jellyfish-like animals living at 3,000 feet below the surface, where it is cold, dark and quiet.
Voyage of the Ventana Series, #2011-2015	Exploring the deep ocean canyons in Monterey Bay means going to depths no diver can tolerate. The solution is a high-tech underwater robot.