

# Tracking the Path of ANIMALS

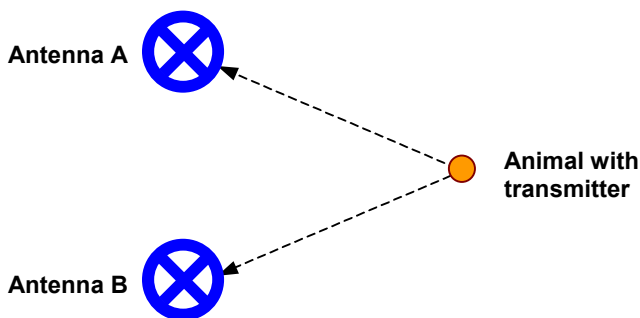
TEACHER



## Activity Overview

The agouti is a large rainforest rodent and a favorite prey of the ocelot. To hide from enemies, the agouti can run fast and swim. Powerful rear legs allow the agouti to bounce through the underbrush. Agoutis are always alert to possible predators and are ready to run away at the first sign of danger.

The Barro Colorado Island (BCI) provides researchers with the opportunity to study mammals like the agouti and the ocelot in their natural setting. Using tools, such as radio telemetry, researchers have been able to gain a great deal of knowledge about these and other mammals. Radio telemetry involves the use of transmitters and receivers to track the movement of the animals. The researchers, using a method called triangulation, then change the tracking information recorded into map coordinates. To determine the location of an animal at different times of the day, researchers plot coordinates on a map indicating the area the animal has traveled.



In this activity, students place an object in different positions on a surface to simulate the motion of an animal. Students will use a Motion Detector connected to a TI CBL 2™, or Vernier LabPro, and a TI-73 Explorer™ to measure the XY coordinates of the object. After determining the locations of the object, students will use the information to draw conclusions about its movements.

## Activity at a Glance

Grade: 4-9  
Subject: Science  
Category: Life Science,  
Physical Science  
Topic: Living Things,  
Animals, Motion

## Time Required

- Two 45-minute periods

## Level of Complexity

- Medium

## Materials\*

- TI-73 Explorer™
- TI CBL 2™ or Vernier LabPro
- TI-73 DataMate
- Motion Detector
- Masking tape
- Small wooden block or other rectangular prism
- 1 m long metric ruler



TI-73 Explorer™

\* This activity has been written for the TI-73 Explorer™ but you can easily substitute the TI-83 or TI-83 Plus. Also see Appendix A for steps on how to transfer DataMate to your graphing device and how to use DataMate for data collection.



# Tracking the Path of ANIMALS

## Concept Background

- The biodiversity of Barro Colorado Island (BCI) is astounding. The island occupies only 15 square kilometers, yet, it is home to roughly 110 mammal species. As a protected habitat, BCI is a living laboratory where scientists can study the interactions of animals and plants in their natural habitats.
- In Central America, 3,300 square kilometers of rainforest are lost each year to logging, hunting, and other human activities. Thousands of species are driven to extinction worldwide. Studying tropical mammals in their habitats helps scientists make wise conservation decisions for the world's remaining rainforests.
- Scientists study mammals in their natural habitats to observe how they compete with other species for food and space. They are using innovative techniques such as trip cameras and radio telemetry to monitor their activity without frightening mammals away.
- To locate an animal through triangulation, the automated system must receive directional readings from at least two antennas. The locations of the antennas are marked down on a map. Then two directional lines are drawn on the map, corresponding to the readings from the two antennas. If the directional readings are accurate, the animal should be found at the point where these two lines cross (see Activity Overview).

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Motion Detector



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## Preparation and Classroom Management Tips

- If your students are using a Calculator Based Ranger™ (CBR) with the CBL instead of a Motion Detector, procedural changes are not necessary. If the CBR is used without the CBL, this activity will require a few changes in the procedures.
- During the first period, you may consider Procedure Steps 1 – 10. Explain to students how to use the Motion Detector to measure distances.
- Make sure that the Motion Detector is at least 0.4 m away from the animal (rectangular object) to ensure accurate data collection.
- Discourage students from moving the object vertically between any two consecutive positions. This will result to an undefined slope since the change in horizontal position is zero.
- During the second period, perform the Data Analysis. Consider explaining slope before Question 6.
- This activity works well with students working in groups, or as a demonstration.
- Encourage students to answer the questions in Data Analysis in their *Journal*.
- Create your own student questions for use on your students' TI graphing devices using the Texas Instruments StudyCard applications.

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### — National Education Standards

#### *Science Standard A: Science as Inquiry*

Students design and conduct a scientific investigation. They use appropriate tools and techniques to gather, analyze, and interpret data. Students communicate scientific procedures and explanations.

#### *Math Standard: Numbers and Operations*

Students should develop an understanding of numbers: ways to represent and manipulate them, the relationships among different numbers, and the relationships between number systems.

#### *Math Standard: Geometry*

Students should develop an understanding of the properties of two- and three-dimensional shapes, transformations, symmetry, and develop their use of visual and spatial reasoning to solve problems.

#### *Geography Standard 1: The World in Spatial Terms*

Students should learn to view the world in spatial terms and organize information about people, places, and environments in a spatial context.

#### *Geography Standards 4–6: Places and Regions*

Students should learn about the physical and human characteristics of places and regions.

#### *English Language Arts Standard 3:*

Students apply strategies to comprehend, interpret, evaluate, and appreciate texts.

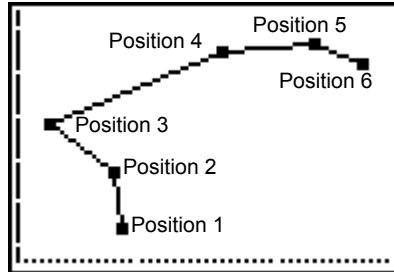


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## Data Analysis

**Table 1**

	<b>X Coordinate (m)</b>	<b>Y Coordinate (m)</b>
Position 1	60	50
Position 2	59	63
Position 3	51	74
Position 4	72	90
Position 5	83	92
Position 6	89	87



Note: The numbers and graph shown above are only given as an example. It is likely that students will have different XY coordinates.

- 1 Q. The graph on your graphing device connects each two positions with a line. That line shows the distance between two positions. By observing the graph, between which two positions was the distance the greatest? Explain your thinking.
 

A. *Answers will vary. Students should recognize that the longest line segment represents the greatest distance between two positions.*
- 2 Q. Between which two positions was the distance the least? Explain your thinking.
 

A. *Answers will vary. Students should recognize that the shortest line segment represents the least distance between two positions.*
- 3 Q. Between which two positions did the animal (rectangular object) move the furthest? Explain your thinking.
 

A. *Answers will vary. Students should recognize that the animal moved the furthest between those positions where the distance on the graph was the greatest.*
- 4 Q. Between which two positions did the animal (rectangular object) move the least? Explain your thinking.
 

A. *Answers will vary. Students should recognize that the animal moved the least between those positions where the distance on the graph was the least.*
- 5 Q. Compare the path you drew on the terrain with the graph on your graphing device. *Hint: Does the path on the graphing device look like a scale down version of the path on your terrain?*

A. *Answers will vary. Students should recognize the similarity of the paths.*
- 6 Q. Double the vertical distance between Position 1 and Position 2. Use the slope formula to find the slope again. How did the slope change?
 

A. *When the vertical distance doubles the slope is twice the original value.*

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### Vocabulary

**Arboreal** Living and foraging in trees.

**Biodiversity** A measure of the number and variety of species within a region.

**Crepuscular** Active at dusk and dawn.

**Echolocation** A method some bats use to navigate in the dark. The bats make high-pitched calls and interpret their echoes to determine the locations of objects.

**Habitat** The environment in which an organism normally lives or occurs.

**Home range** The area used by an animal in the course of its typical daily activities.

**Mammal** A warm-blooded animal that gives birth to live young and produces milk to feed them.

**Map coordinates** Two numbers, (latitude and longitude), which give the location of a point on a map.

**Nocturnal** Active at night.

**Ordered pairs** A pair of numbers (X coordinate, Y coordinate) that indicate the position of a point in the coordinate Plane.

**Population** All of the individuals of a single species that make up a specific group or occur in a specific habitat.

**Predator** An animal that consumes other animals.

**Prey** An animal hunted or caught for food. Also, to hunt, catch, or eat prey.

**Radio telemetry** The use of radio transmitters and receivers to track the movement of animals.

**XY coordinates** Two numbers, (X,Y), which give the position of a point. X is the distance measured parallel to the X-axis. Y is the distance measured parallel to the Y-axis.



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- 7** Q. Divide the vertical distance between Position 1 and Position 2 by two. Use the slope formula to find the slope again. How did the slope change?
- A. *When the vertical distance is divided by two the slope is one half the original value.*
- 8** Q. Copy Table 2 into your journal. Enter the slope of a line for each line segment in the table.
- A. *Answers will vary.*
- 9** Q. Examine your completed Table 2.
- a. Identify the line segments that have a slope with a positive value.
- A. *Answers will vary.*
- b. Identify the line segments that have a slope with a negative value.
- A. *Answers will vary.*
- c. Identify the line segments that have a slope with a zero value.
- A. *Answers will vary.*
- 10** Q. Compare the values for slope with your graph on the TI-73 Explorer™.
- a. If a line segment has a positive value for slope, what is the direction of the line segment? *Hint: Does it point upward, downward, or is it flat?*
- A. *A line segment that has a positive value for slope points upward.*
- b. If a line segment has a negative value for slope, what is the direction of the line segment?
- A. *A line segment that has a negative value for slope points downward.*
- c. If a line segment has a zero value for slope, what is the direction of the line segment?
- A. *A line segment that has a zero value for slope is horizontal.*
- 11** Q. Examine your sketch of the graph you completed in your journal. Describe how the slope values you listed in Table 2 relate to the steepness of the line segments in your graph.
- A. *Steeper line segments have greater slope values than flatter lines.*

