

Hikers: Solving Through Multiple Representations

Description: Students use tables, graphs, and equations to represent and solve a real-world problem about two hikers walking at different speeds in opposite directions along the same trail.

Technology Strength: An animated simulation of the problem helps students understand the situation. Coloring provides a direct link between the table and the graphs of lines, not merely a link by way of the plotted points. A moveable plotted point supports the concept of a function. Dragging a point to the intersection of the lines helps students understand what that point represents.

Objectives: Use a table, graph, and equation to represent and solve a real-world problem; understand interrelations among tables, graphs, and equations; realize that numerical information can be represented in multiple ways

Prerequisites: Solve linear equations by balancing; calculate distances from rates and times; represent as an algebraic expression a pattern in a table of linear data; convert decimals to fractions and parts of hours to minutes

Suggested Grade Level: 7 to 8

Sketchpad Level: Intermediate

Suggested Duration: 45 minutes

Suggested Classroom Setting: Whole Class, Student Pairs. This activity, designed for use by student pairs, can be easily modified for whole-class use.

Preparation: Review the Activity Notes. Preview the student sketch. Work through the steps on the worksheet and make a copy of the worksheet for each student. See the presentation sketch for an example of completed student work.

Materials: None

Student Worksheet(s): Hikers

Student Sketch: Hikers.gsp

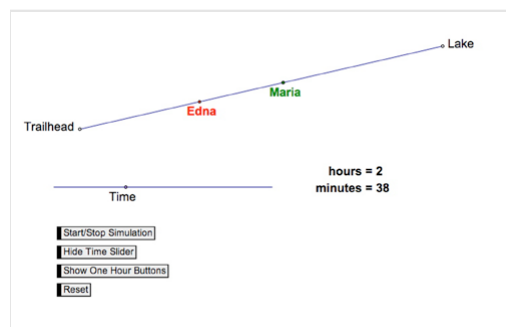
Presentation Sketch: Hikers Present.gsp

Vocabulary: Equation, graph, axes, intersection, linear, plot expression and point, represent, predict, estimate

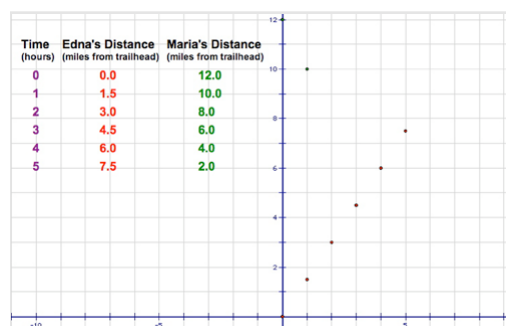
Sketchpad Version: GSP5

Using the Sketch:

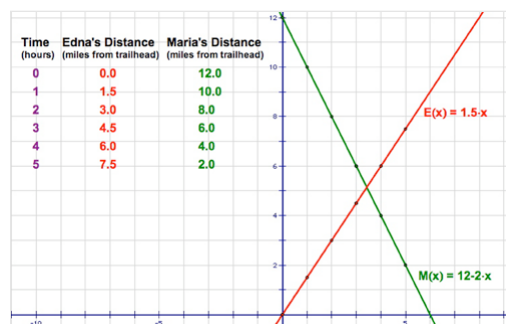
After introducing the problem, you can use the page “Simulation” from the presentation sketch as a basis for a class discussion about what is happening in this situation. The first illustration shows what students will see if you press *Show Time Slider*. Dragging point *Time* will change the positions of the hikers. You can also press *Show One Hour Buttons* to view the motion of each hiker every hour. As a class, you can use the simulation to estimate when the two hikers will meet.



Students create a table of the distance of each hiker from the trailhead after each hour and enter these values into the table in the student sketch. Then they select pairs of values from the table to plot points. The second illustration shows what a student's sketch will look like after plotting all of the points representing Maria's distance over time and the first two points representing Edna's distance over time.



Students then construct point *T* on the *x*-axis, measure its *x*-coordinate, and label it *Time*. They calculate the distance of each hiker from the trailhead in terms of *Time* and use these dynamic values to plot a point for each hiker. After observing the traces of the plotted points created by dragging point *T*, students plot a function for each hiker, as shown in the third illustration. Finally, they solve the problem by constructing a point on one of the function plots, measuring its coordinates, and dragging it to the point of intersection, as well as by solving the system of equations algebraically.



Sketch Tips:

Sketch Tips show skills needed in this activity, and the step at which the skill is first used.

Sketch Tip	Tip Sheet or Tip Video
Step 2: Change to a different page using page tabs	Moving Between Pages
Step 2: Change the value of a number (parameter)	Changing Parameters
Step 3: Select, deselect, and drag objects with the Arrow tool	Using the Arrow Tool
Step 3: Plot a point by selecting two values and using Graph Plot as (x,y)	Plotting Points
Step 4: Construct a point on an object with the Point tool	Using the Point Tool
Step 4: Measure the coordinates of a point using Measure Abscissa , Measure Ordinate , or Measure Coordinates	Measuring Coordinates
Step 4: View and change an object's properties using Edit Properties	Changing Properties
Step 5: Calculate an expression using Number Calculate	Using the Calculator
Step 5: Click a value in the sketch to enter it into the Calculator	Using the Calculator
Step 6: Trace an object using Display Trace	Tracing
Step 8: Erase traces using Display Erase Traces	Tracing
Step 8: Plot a function using Graph Plot New Function	Plotting Functions