

Classroom Activity

Graphing the Grand Canyon

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Introduction

One of the wonders of the natural world, the Grand Canyon is 277 river-miles long, an average of ten miles wide and nearly one mile deep. It was first established as a forest reserve by President Benjamin Harrison in 1893 and became an official national park in 1919.

While the view from the rim is breathtaking and attracts many tourists on its own, more adventurous visitors may journey to the inner canyon. The inner canyon may only be reached by a demanding, two-day hike or mule trip. Mule rides into the canyon have been popular since the opening of the Bright Angel Trail in 1891. These approximately seven-hour mule trips to Plateau Point depart daily year-round from the head of the Bright Angel Trail. Descending about 3,200 feet to the Tonto Platform and Plateau Point, the Colorado River can be seen 1,320 feet below. The activities that follow connect the Grand Canyon to mathematics content commonly studied in 8th grade.

Objectives and Standards Addressed

Objectives

1. Identify functions as linear based on information given in a table or graph.
2. Find the slope of a linear function from data.
3. Discover the meaning of slope involving real-world data.

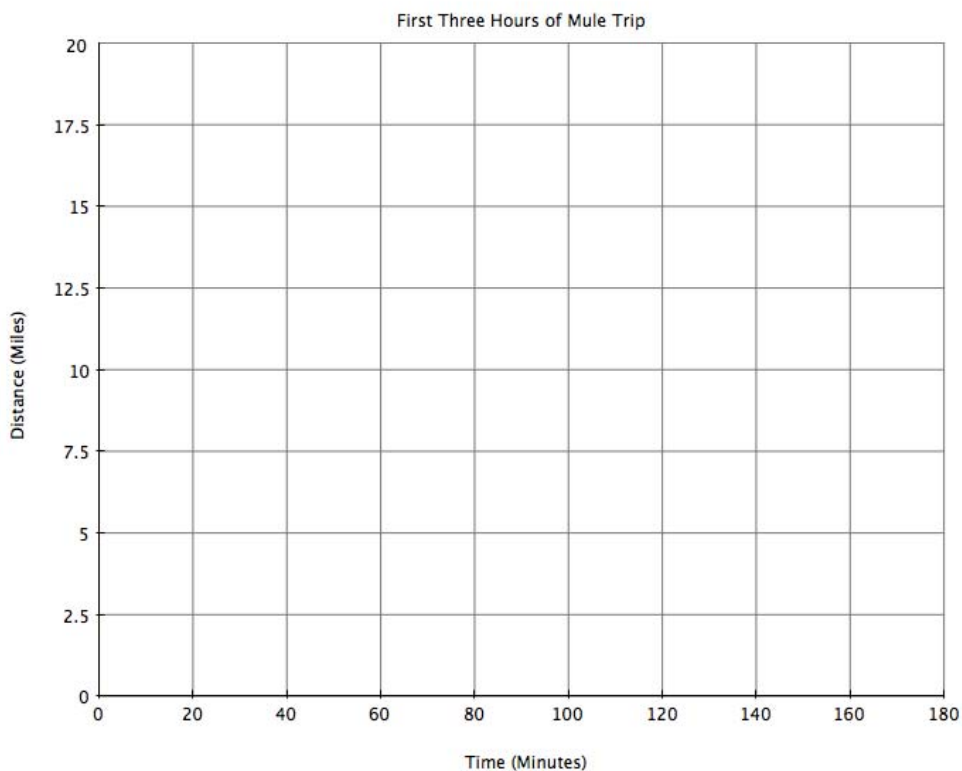
Patterns, Functions and Algebra Standard

4. Identify functions as linear or nonlinear based on information given in a table, graph, or equation.
5. Extend the uses of variables to include covariants where y depends on x .
6. Describe the relationship between the graph of a line and its equation, including being able to explain the meaning of slope as a constant rate of change and y -intercept in real-world problems.

Activity 1

Mules walk steadily at about 6 miles an hour. It takes 3 hours to descend into the canyon. Fill out the table representing the distance traveled by the mule as a function of time.

<i>time</i> (minutes)	<i>distance</i> (miles)
10	
30	
60	
90	
120	
150	
180	



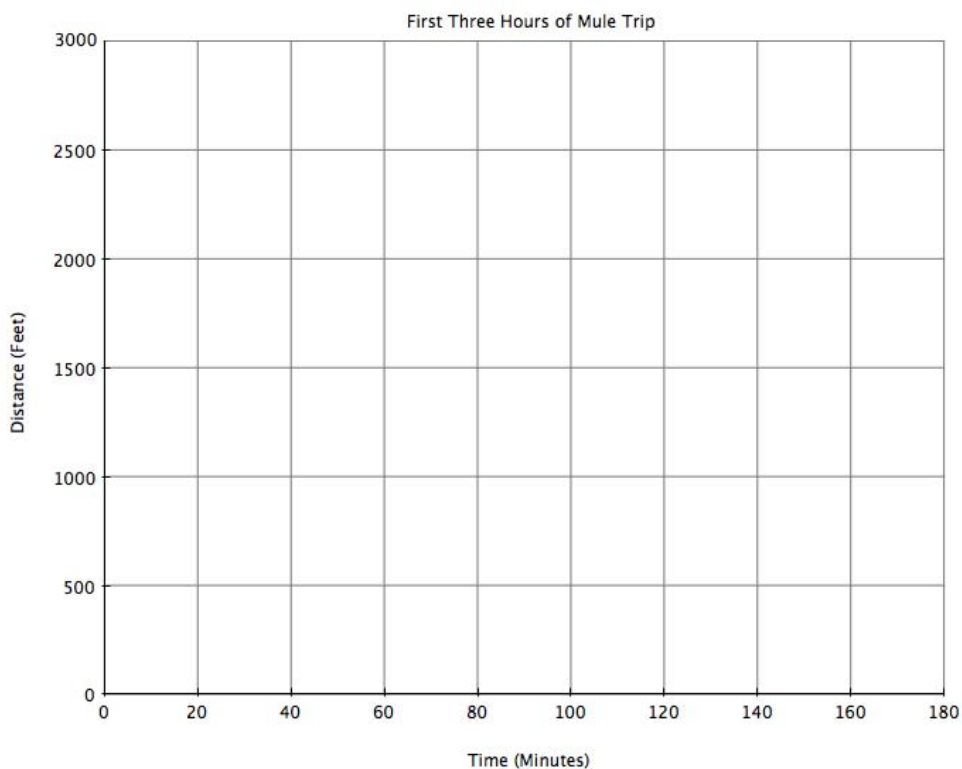
Questions to Consider

1. Find the slope of the graph.
2. What does the slope represent?
3. What is the total distance the mule traveled?

Activity 2

While the mule was traveling this distance, it traveled 3,200 feet vertically into the canyon. Fill out the below table representing the vertical distance the mule traveled as a function of time. Round to the nearest tenth of a foot.

<i>time</i> (minutes)	<i>distance</i> (feet)
20	
40	
60	
80	
100	
120	
140	
160	
180	



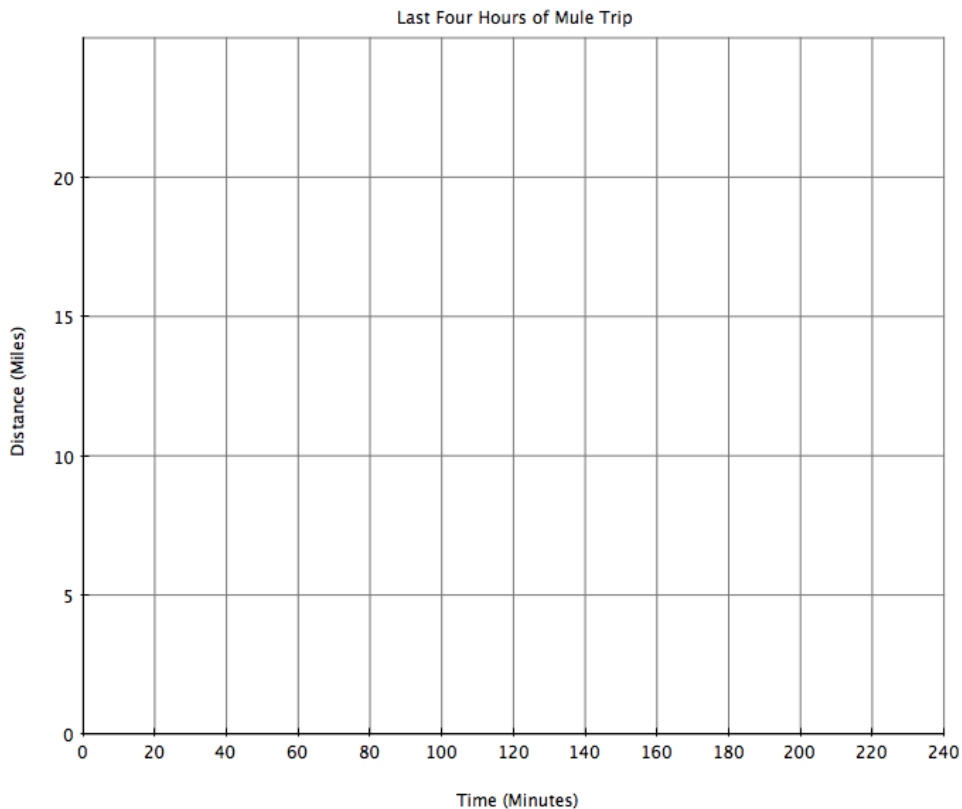
Questions to Consider

1. Find the slope of the graph.
2. What does the slope represent?

Activity 3

Mules walk steadily at about 6 miles an hour. It takes four hours to return to the head of Bright Angel Trail. Fill out the table below representing the distance traveled by the mule as a function of time.

<i>time</i> (minutes)	<i>distance</i> (miles)
10	
30	
60	
90	
120	
150	
180	
210	
240	



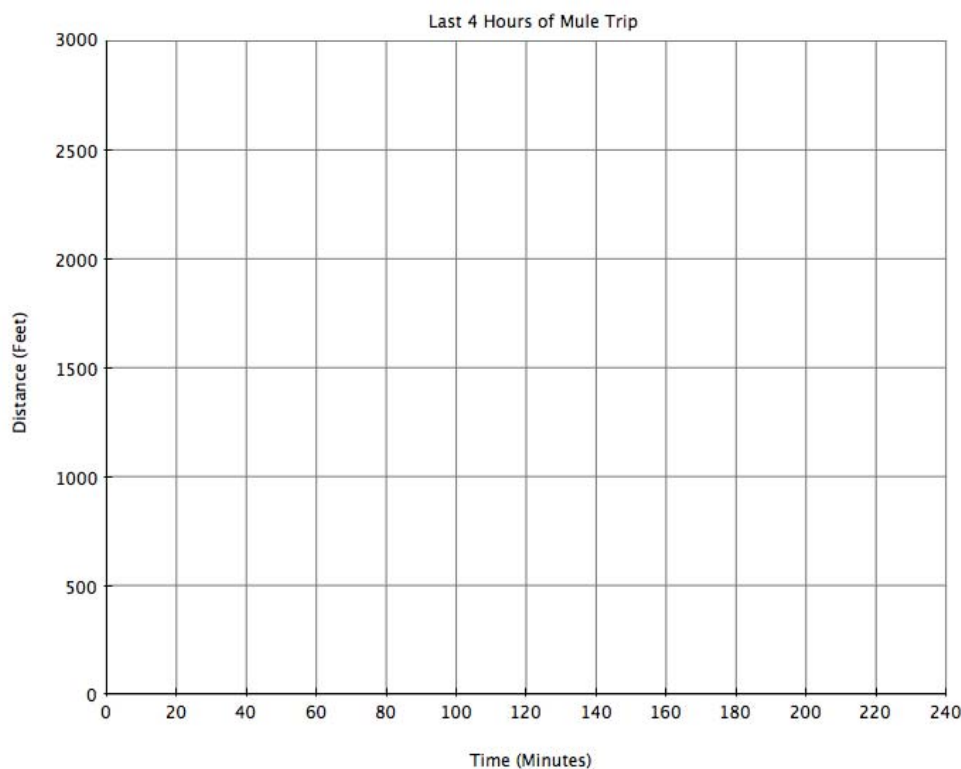
Questions to Consider

1. Find the slope of the graph.
2. What does the slope represent?
3. What is the total distance the mule traveled?

Activity 4

While the mule was traveling this distance, it traveled 3,200 feet vertically into the canyon. Fill out the table below representing the vertical distance the mule traveled as a function of time. Round to the nearest tenth of a foot.

<i>time</i> (minutes)	<i>distance</i> (feet)
20	
40	
60	
80	
100	
120	
140	
160	
180	



Questions to Consider

1. Find the slope of the graph.
2. What does the slope represent?

Application

1. While driving on a mountain road, you see a sign that says “10% Grade.” What does this mean? What is its relationship to slope?
2. While a mule travels down a path with 20% low grade, it descends 3,200 feet vertically into the canyon. How do you find the actual walking distance of the mule? How do you calculate how far the mule traveled horizontally?
3. During hot summer days, from the head of the Bright Angel Trail to Plateau Point, the temperature changes. Can this be represented using a function?

“Memories are not stored in their entirety, as books on a shelf. Rather, during traversal of a brain connectivity path, stages along the path add to the reconstruction of the memory: the memory becomes ‘assembled’ incrementally along the path. ... clues are picked up and assembled, and later clues might be instructions to go back and pick up prior ones.”

Lynch, G. & Granger, R. (2008). *Big brain: The origins and nature of human intelligence*, 115. Palgrave MacMillan. New York, NY.