Slope and Topographic Maps

Lesson Plan

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Goal: The goal is for students to gain a more intuitive understanding of slope. This will be accomplished using topographic maps to illustrate the connection between slope studied in algebra class and the steepness of terrain. The advantage of this lesson is that students can relate slope to something they can experience with the senses such as walking up a steep hill. A secondary goal is to introduce students to topographic maps.

Grade and Course: ninth grade Algebra I

KY Standards: **MA-11-3.3.1** Students will apply algebra or graphing in the coordinate plane to analyze and solve problems (e.g., finding the final coordinates for a specified polygon, finding midpoints, finding the distance between two points, finding the slope of a segment).

Objectives: The students will:

1. learn the basics of reading a topographic map
2. calculate the average slope between two points on a topographic map
3. understand the connection between slope and the steepness of terrain

Resources/materials needed: The following items are needed:

- lecture slides to introduce topographic maps (below)
- worksheet (below)
- the maps used for this lesson were purchased from TopoZone but any topographic map will do

Description of Plan: The lesson begins with a lecture introducing topographic maps and an explanation of how such maps may be used to calculate the average slope between two points. The students are then asked to complete a worksheet that involves the calculation of several slopes.

Lesson Source: original

Instructional Mode: A lecture followed by a worksheet activity with maps.

Date Given: February, 2007

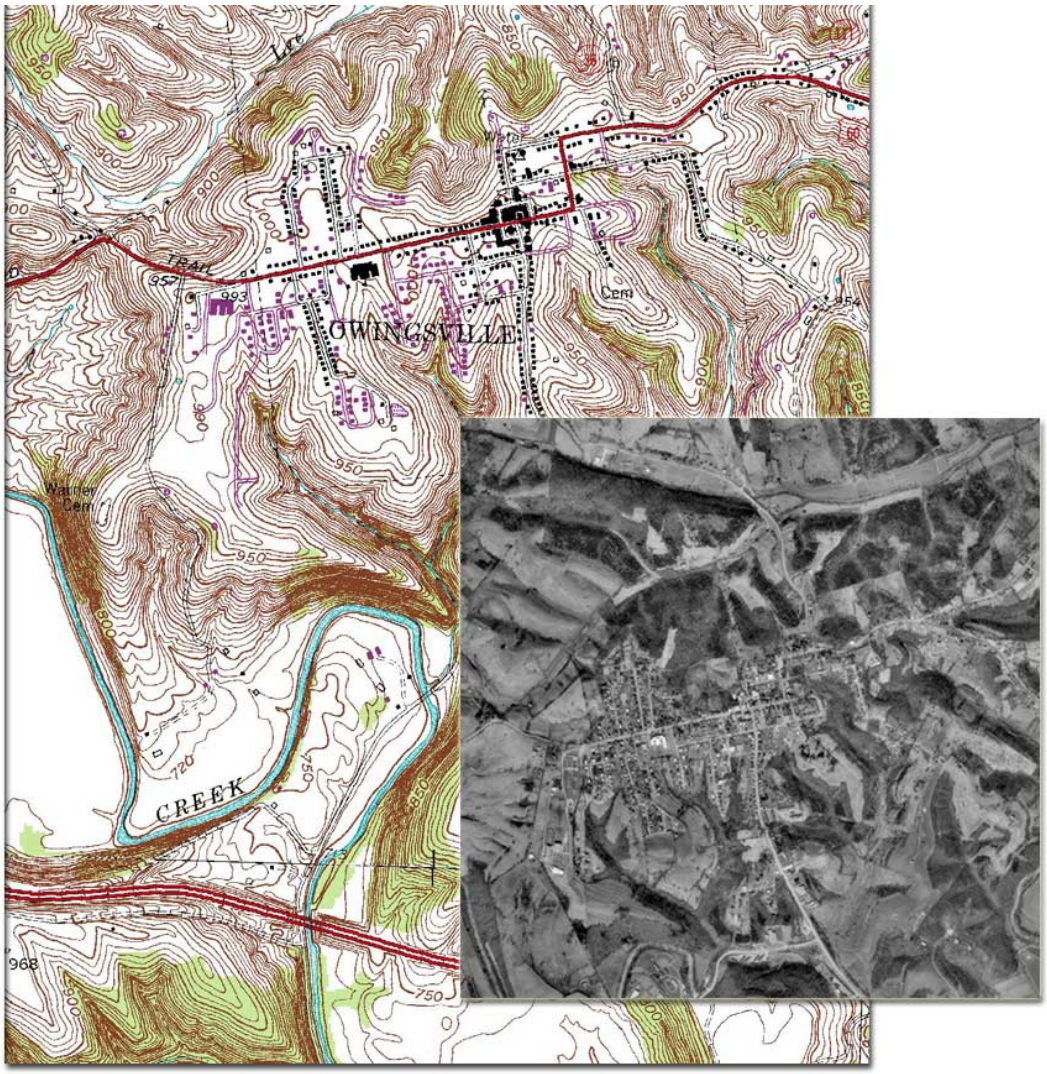
Estimated Time: The lecture portion of this lesson is fairly long so that most of the worksheet was assigned as homework and discussed the following day. A day and a half should be allowed for this lesson.

Date Submitted to Algebra^3: May 9, 2007

Slope and Topographic Maps

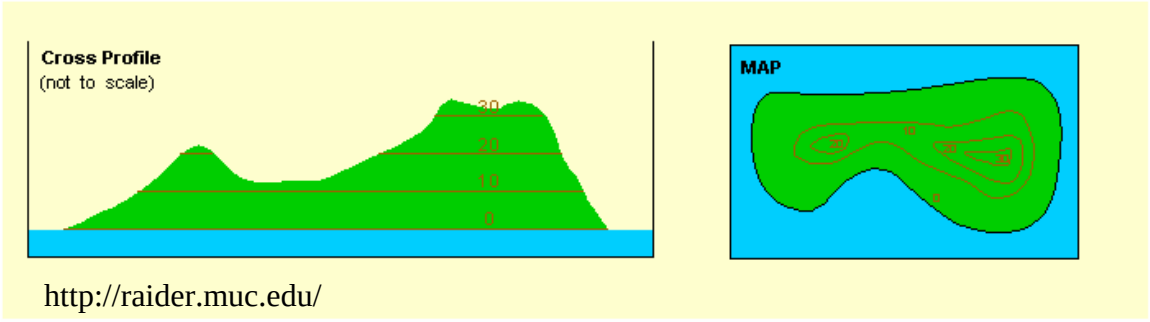
Have you ever traveled a long way out in the countryside either hunting, mountain biking, or just for a hike? How did you find your way around? Chances are you used a topographic map.

Topographic Maps are representations of the real world, complete with hills and valleys, on a flat surface. Below is a topographic map of Owingsville along with an aerial image of the town:



How are topographic maps able to show three-dimensional objects like hills on a two-dimensional object like a piece of paper? They do it by using contour lines.

Contour Lines are curves that connect points of equal elevation. Each contour line on a map has a number that represents the elevation of the line (usually the height above sea level).



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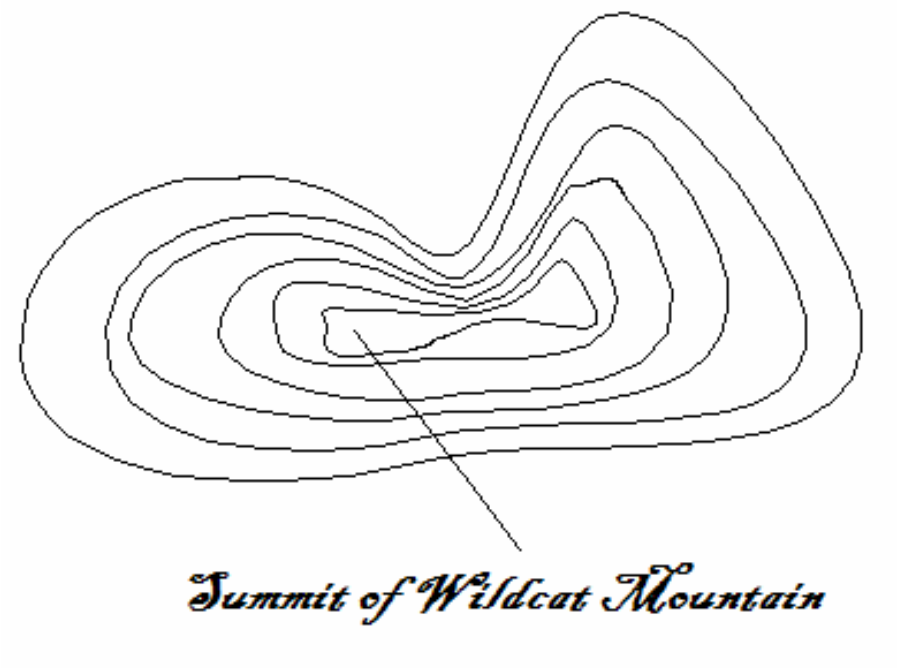
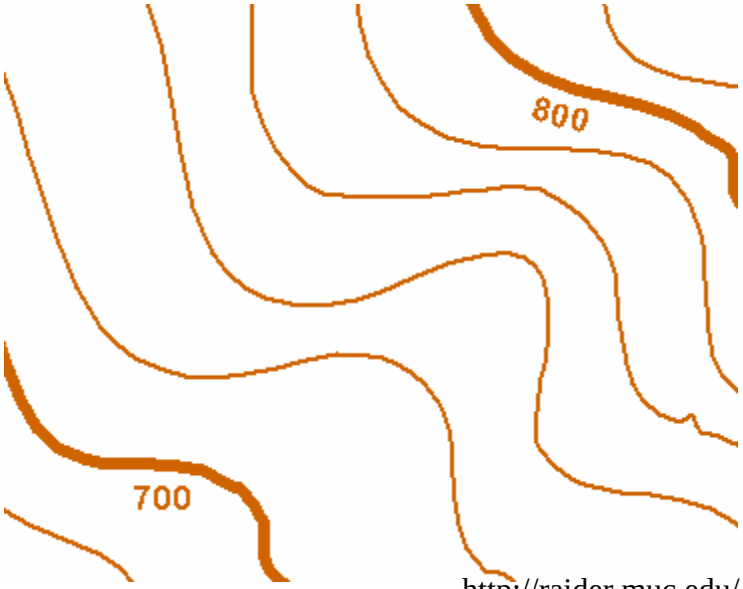
The **Contour Interval** is the change in elevation between two contour lines. If the contour interval of the map below is 20 meters, how high is Wildcat Mountain?



Index Contours are the bold contour lines which are labeled with an elevation. What in the contour interval of the map below?



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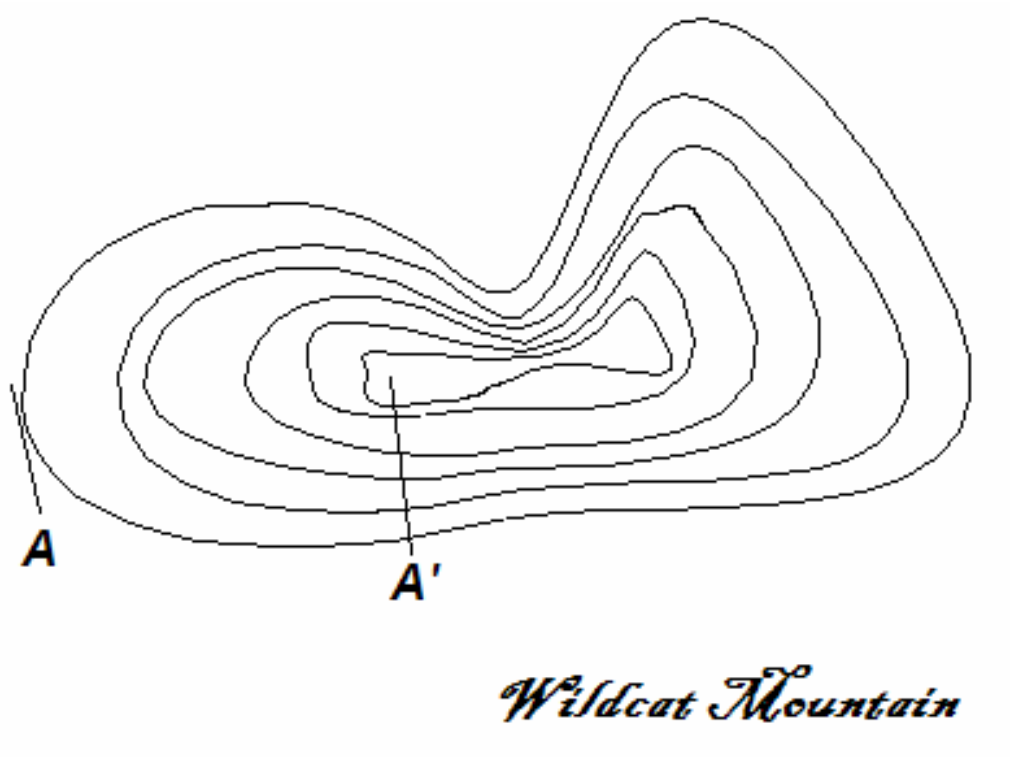
Contour Maps also have a horizontal map scale so that you can find the horizontal **distance** between two points. This makes it possible to calculate the **AVERAGE SLOPE** between two points on a contour map.

1. Measure the distance between the two points.
2. Use contour lines to find the height difference between the two points.
3. Now just use the formula for slope that you learned in class!

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{CHANGE\ IN\ ELEVATION}{HORIZONTAL\ DISTANCE}$$

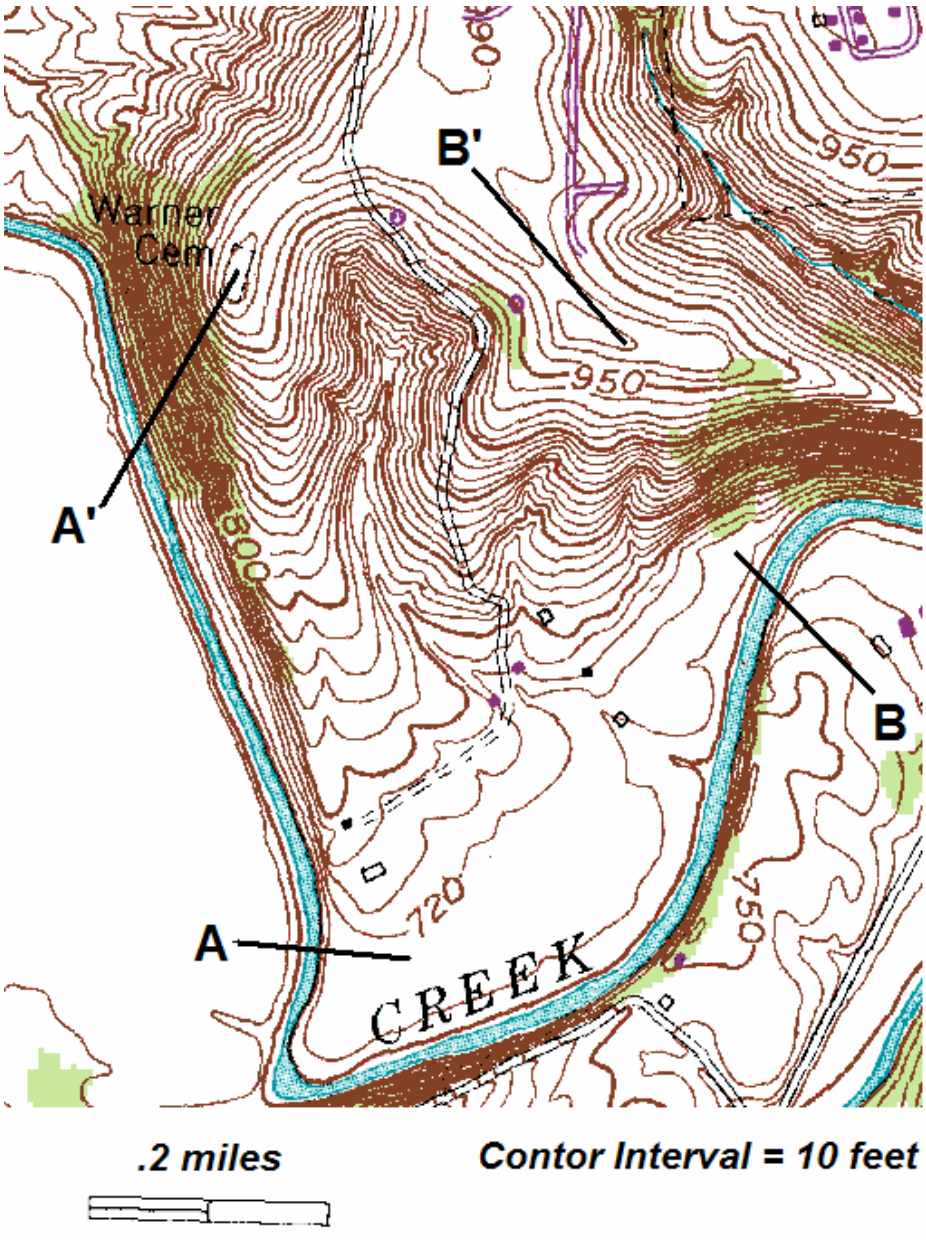
If the distance from ***A*** to ***A'*** is half a mile, what is the slope of the west side of Wildcat Mountain?



Worksheet

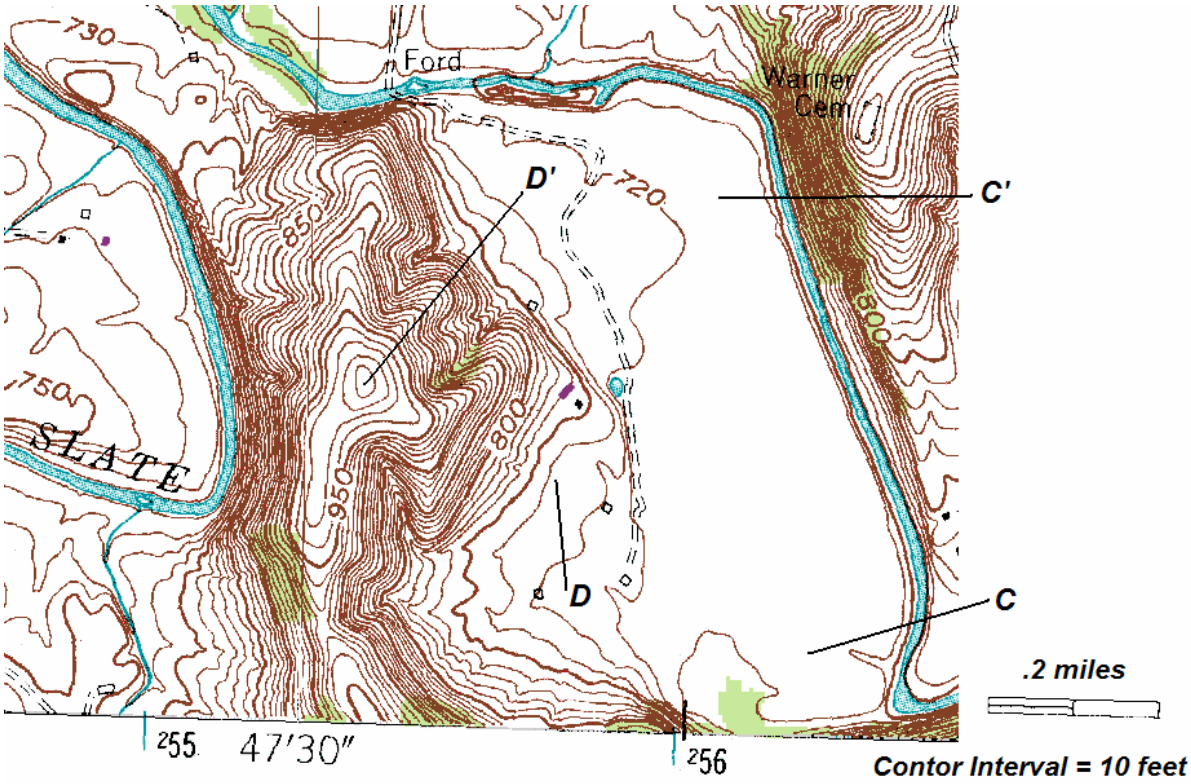
1. Find the average slopes from **A** to **A'** and from **B** to **B'**. Express your answer in feet per mile and as feet per foot.

   a. If you had to walk up the hill, which route would you prefer to take?



2. Find the average slope from **D** to **D'**. Express your answers as feet per mile and feet per foot.

b. Now what is the average slope from **D'** to **D**?



3. Find the average slope from **C** to **C'**.