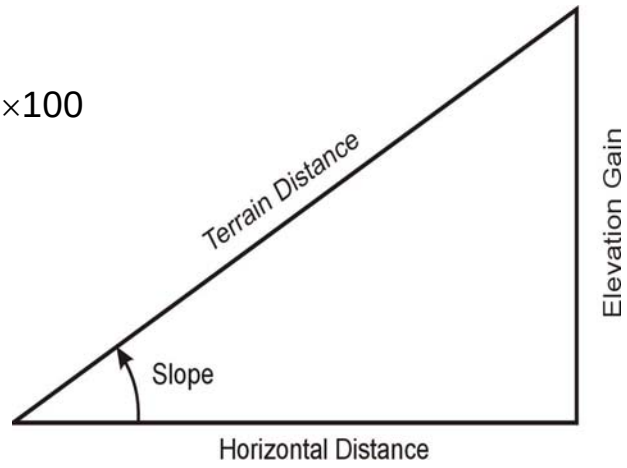
SLOPE CALCULATION WITH TOPO!®

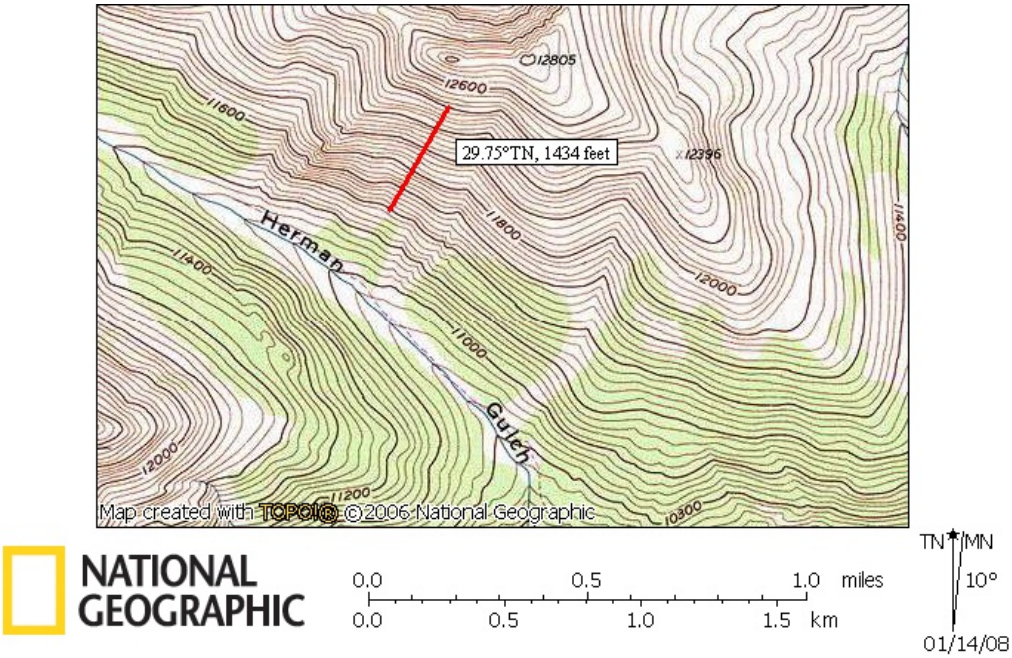
By Joe Griffith, March 2008

Mapping programs are powerful tools for measuring slopes. This is a short tutorial on how to use National Geographic's TOPO!® to estimate the slope of an area. Other mapping programs have similar capabilities. The triangle below is a reminder of the relationships among the quantities we will be using.

$$\text{grade [\%]} = \frac{\text{elevation gain}}{\text{horizontal distance}} \times 100$$

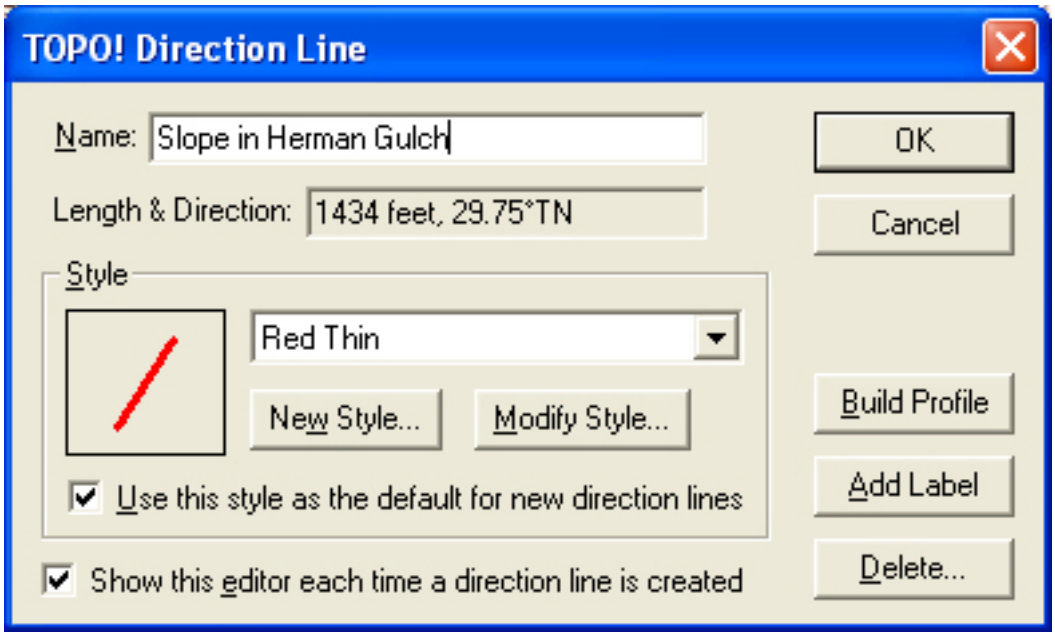


Use the Compass Tool to place a straight line on the slope you want to measure. In the map below, our line is in the upper left corner. If you place the cursor on the line, the program displays the direction and horizontal distance of the line.

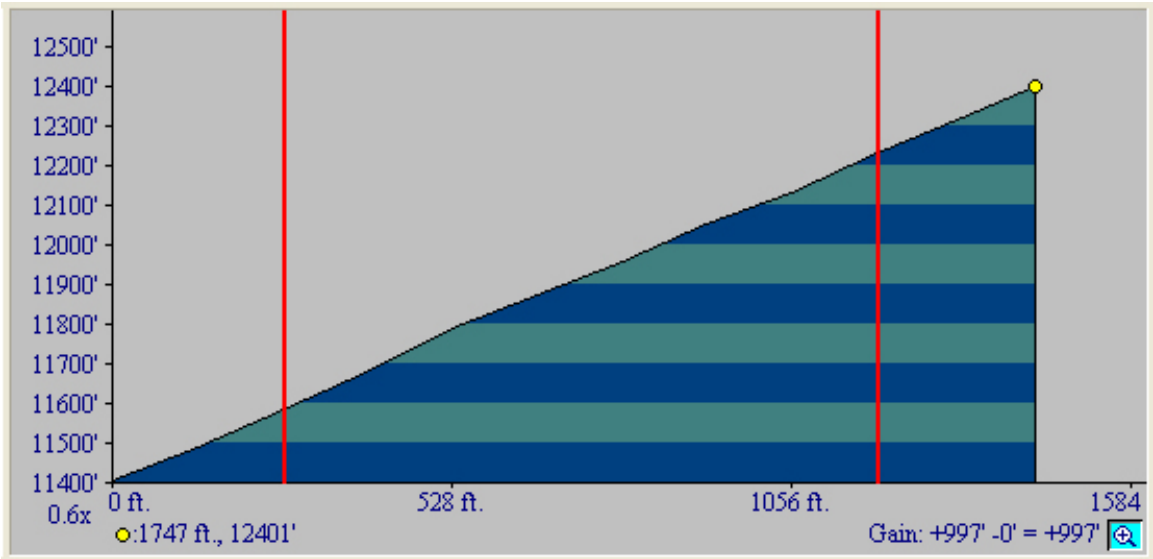


Map created with TOPO!© National Geographic Maps
http://www.nationalgeographic.com/topo

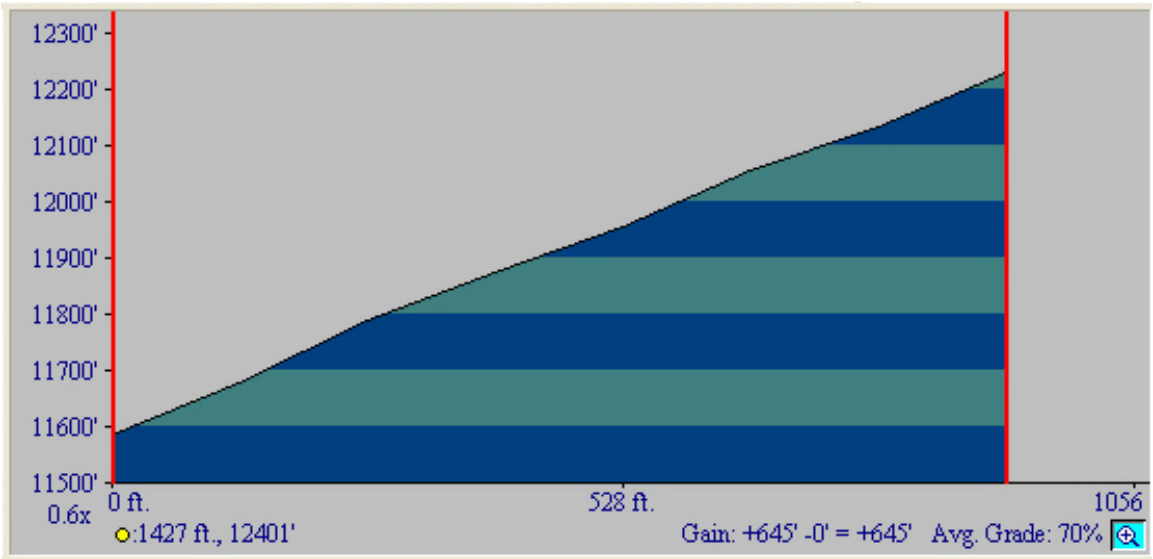
Creating the line activates a dialog box, which allows you to build a profile by clicking on the Build Profile button in the lower right corner. This dialog box also appears when you right click on the line.



The program should display the profile at the bottom of the screen. Click on the magnifying glass in the lower right corner to split the pane into two profiles. The left profile should look something like the one below. The dark, vertical lines can be moved to select the region to be measured. The 1747 ft number in the lower left is, by the way, the terrain distance of the profile.



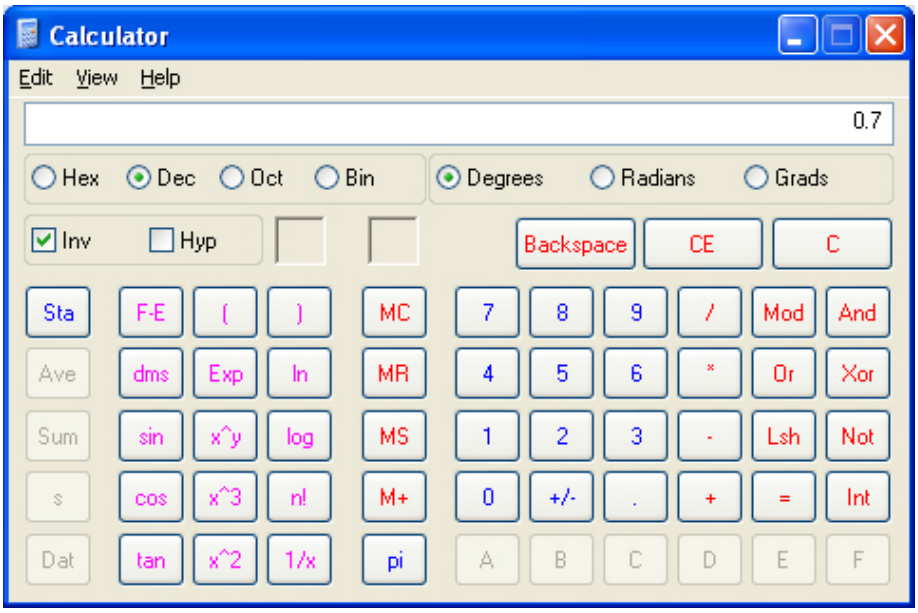
The right pane is shown below. It is a plot of the profile between the two vertical lines in the left pane. Notice that the average grade, 70%, is given in the lower right corner.



TOPO! doesn't give the slope in degrees, but it is easy to calculate with this formula:

$$\text{slope} = \text{inv tan (grade/100)}$$

If you don't have a scientific calculator, Microsoft Windows™ provides one under Accessories. It usually starts up in Standard mode, but you can change it to Scientific mode with the View pull-down menu.



To get the slope in this case, enter 0.7, set the left radio button to Dec, set the right one to Degrees, and click the Inv box. Clicking on the tan button in the lower left corner produces the desired slope, 35°. This area of Herman Gulch could be hazardous in winter.