Steep hikes

Fall is such a nice time of year for hiking. The mosquitoes are usually absent because of early frosts at the higher elevations, the tree colors are beautiful, and the temperatures are cool.

This year when I went hiking I encountered some weird numbers that I didn’t know how to interpret. I did some research and am excited to share it with you.

During the drive to the mountains, when the road had a steep section, I saw warning signs like this one.

What does that mean? 6% doesn’t sound very steep but it was on a warning sign so maybe that is very steep.

Then at the hike trailhead there was another mention of percent grade change. Are these the same things? What percent change is steep and what is just moderate?

I looked up percent grade change and found two different ways of calculating it. Bicyclists, road builders, and hikers all use this notion.

During road construction, surveying equipment is used to find the change in vertical climb of the road as compared to the horizontal distance of the road. The steepness of a road is just like the slope of a line only it is usually expressed in percent. The steepness of a road has a lot to do with its safety. Bicyclists will need to use breaks constantly on a steep decline. Heavy trucks will labor up and speed down. So, like the slope of a line, the percent elevation change is rise and it significantly effects the safety of driving on a road.

Slope is a fraction but percent grade change is slope x 100% so that it becomes a percent.

If a road changes elevation by 200 feet in 2 miles then it’s slope is;

\[ \frac{\text{rise}}{\text{run}} = \frac{200 \text{ feet}}{2 \text{ miles} \times 5280 \text{ feet per mile}} = 0.0189 = 1.9\% \text{ grade change} \]

1. We drove through Franconia Notch, NH to get to the mountain we were going to hike, Mt Pierce. The roadway rose in elevation from 1,000 feet to 1,950 feet in about 4 miles. What is the Parkway’s average percent grade change? Please show your work.

The Mount Washington Auto Road is famous for ruining the transmission of automobiles or burning out their brake pads on the way down. The roadway begins on Route 16 in Glen, NH at 1,600 feet elevation and rises to a parking area just below the summit of Mt Washington at 6,288 feet in 7.6 miles of curvy, steep roadway.

2. What is the percent grade change of this roadway?

Elevation 1,600 feet

\[
\frac{\text{rise}}{\text{run}} = \frac{6288 \text{ feet} - 1600 \text{ feet}}{7.6 \text{ miles} \times 5280 \text{ feet per mile}} = \approx 1.9\% \text{ grade change}
\]
Oh no, I don't have the horizontal measure from the base of the mountain to right under the peak. But, I think I can use the Pythagorean Theorem to figure out the run.

3. Use your calculator and the Pythagorean Theorem to find what must be the distance from the base of the Mount Washington Auto Road to directly under the peak of Mount Washington.

4. Now use the calculated rise and run to find the average slope of the road.

5. Change the slope into percent grade change.

This same situation occurs when calculating the percent grade change of a hike. I guess it is not very easy to measure the horizontal distance from the base of the trail to directly under the peak of the mountain.

Our climb up Mt Pierce was 3.1 miles long. That sounds a lot easier than it was. The elevation gain was from 1,920 feet to 4,312 feet. The measure 3.1 miles was not the horizontal change from where we started to right under the peak. 3.1 miles was the actual trail length ... the hypotenuse of the right triangle shown below.

6. Use your calculator and the Pythagorean Theorem again to figure the base of the right triangle shown above. That is the run of this calculation.

7. What is your calculated rise?

8. What is the slope of this hike?

9. What is the percent grade change?

10. Now that you've calculated percent grade change for 3 situations, make some conclusions about the percent grade change of a steep road, a moderate trail, and an easy bike path.

11. Do some research and find examples of percent grade changes for two of the above situations. Show or explain how you determined your answer.

Source: White Mountain Guide

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