

## GROUP WORK I, SECTION 5.4

### Clearing the Hill

The late actor Jimmy Stewart drove a very old car. In fact, when he drove it up a certain hill on Route 66 (near the giant dinosaur) it would decelerate until it hit the top, and then accelerate down the hill until he could barely control it. It usually took him a full 3.25 minutes to go from the bottom of the hill on one side to the bottom of the hill on the other.

When he told the story, he would usually specify that after driving one minute, his speed was 0.4 miles/minute.

If we take the time he started up the hill as  $t = 0$ , then one model for his acceleration in miles/minute<sup>2</sup> is given by  $t - 1.5$  where  $t$  is in minutes. Notice that this model is only valid for his time on the hill. We make no claim for its validity before the start of the climb ( $t = 0$  minutes) or after the finish time ( $t = 3.25$  minutes).

1. Find a formula for his velocity at time  $t$ , and one for the distance traveled at time  $t$ . Include units in your answer.
2. What was his starting velocity in miles per hour? What was his final velocity in miles per hour? What was his minimum velocity in miles per hour?
3. When did he reach the top of the hill?
4. How far did he travel from start to finish?

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- 5. Bonus question:** You may have noticed that Stewart was speeding when he approached the hill. Under normal circumstances, he would have been loath to break the laws of his state. But he knew that if he started at 65 miles per hour, he would not have made it to the other side. What would have happened, and how do you know? What is the slowest speed at which he could have started and still made it over the hill?
- 6.** When Jimmy told this story on the Tonight Show, he exaggerated about how big the hill was. He told the host that it took him six minutes to traverse it. The host quickly determined he was not telling the truth. Assuming that the acceleration model  $[a(t) = t - 1.5]$  was still accurate, and assuming that Jay Leno knew some calculus, how did he see through Jimmy Stewart's story?