MTH 252 — Lab 1
Total Distance

Officer Tommy Boy Hopkins and his evil brother Angry Mike are at it again. It seems that a hit and run accident took place the other night at midnight near Galloping Gulch, 40 miles from town. Farmer Bob claims that he witnessed the offending car traveling at approximately 60 miles per hour when his prize-winning Holstein, Bessie, was hit. Tommy Boy had figured his evil brother was up to no good that night and had planted a hidden camera in Angry Mike’s car before Angry Mike left town at 11:00 p.m. Unfortunately, the resolution was so bad that he could only read the speedometer and the dashboard clock on the night in question. Tommy Boy states that not only was Angry Mike out driving that night, but at the time in question, was traveling 60 miles per hour and his car seemed to hit something. In his defense, Mike says that he had not yet arrived at Galloping Gulch but that he does remember hitting a nasty bump around midnight.

Your goal is to figure out which brother is correct. The following questions will help you achieve this goal. You may assume that Angry Mike’s speed never decreased over the course of the entire trip.

<table>
<thead>
<tr>
<th>Time</th>
<th>11:00 pm</th>
<th>11:10 pm</th>
<th>11:20 pm</th>
<th>11:30 pm</th>
<th>11:40 pm</th>
<th>11:50 pm</th>
<th>Midnight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Velocity, mph</td>
<td>0</td>
<td>30</td>
<td>40</td>
<td>45</td>
<td>50</td>
<td>53</td>
<td>60</td>
</tr>
</tbody>
</table>

Use only the data provided above to answer the following questions. Put all your work on a separate sheet of paper.

1. What is the maximum possible distance that Angry Mike could have traveled between 11:00 p.m. and midnight? Clearly show your calculations.

2. What is the minimum possible distance that Angry Mike could have traveled between 11:00 p.m. and midnight? Clearly show your calculations.

3. Now, assume that you are an investigating officer writing up a report of the incident. Your report should be a paragraph long and contain AT MINIMUM the following:
   - A description of the incident and the available evidence. Please do not copy the description above but rather rephrase in your own words.
   - A description of the calculations that you made in questions (1) and (2) above, including an explanation of how you know that they really do give the maximum and minimum distance traveled by Angry Mike’s car over the time in question.
   - A discussion of whether or not there is sufficient evidence to conclude that Angry Mike reached Galloping Gulch at or before midnight. Remember, use only the data in the above table to support any claims that you make.
Now, consider the following more complete list of data, also compiled that night. Continue to assume that Angry Mike’s speed never decreases over the entire one-hour period. Answer the questions again using the more complete data. As before, put all of your work on a separate sheet of paper.

<table>
<thead>
<tr>
<th>Time</th>
<th>11:00 pm</th>
<th>11:05 pm</th>
<th>11:10 pm</th>
<th>11:15 pm</th>
<th>11:20 pm</th>
<th>11:25 pm</th>
<th>11:30 pm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Velocity, mph</td>
<td>0</td>
<td>25</td>
<td>30</td>
<td>38</td>
<td>40</td>
<td>43</td>
<td>45</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Time</th>
<th>11:35 pm</th>
<th>11:40 pm</th>
<th>11:45 pm</th>
<th>11:50 pm</th>
<th>11:55 pm</th>
<th>Midnight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Velocity, mph</td>
<td>49</td>
<td>50</td>
<td>51</td>
<td>53</td>
<td>58</td>
<td>60</td>
</tr>
</tbody>
</table>

4. What is the maximum possible distance that Angry Mike could have traveled between 11:00 p.m. and midnight? Clearly show your calculations.

5. What is the minimum possible distance that Angry Mike could have traveled between 11:00 p.m. and midnight? Clearly show your calculations.

6. Write the same type of paragraph that you did for number 3, basing your conclusions on the more complete data. How do your conclusions change, if at all?

7. Do the following assuming Angry Mike’s velocity never decreases:
   (a) Sketch a graph of Angry Mike’s velocity vs. time that is consistent with the data table above and where Angry Mike moves as slowly as possible at each instant in time.
   (b) Sketch a graph of Angry Mike’s velocity vs. time that is consistent with the data table above and where Angry Mike moves as rapidly as possible at each instant in time.
   (c) What can you conclude about Angry Mike’s whereabouts given the table of data and the fact that Angry Mike’s velocity never decreases?
   (d) What can you conclude about Angry Mike’s whereabouts if it is NOT known that that his velocity never decreases?

8. **FOOD FOR THOUGHT**
   A car initially going 50 ft/sec brakes at a constant rate (constant negative acceleration), coming to a stop in 5 seconds.
   (a) Graph the velocity from $t = 0$ to $t = 5$.
   (b) How far does the car travel?
   (c) How far does the car travel if its initial velocity is doubled, but it brakes at the same constant rate?