Math 111 Homework 1 Hints/Solutions

It may take some time to get used to the type of homework in this course. The hints below should help you get going on the more difficult problems this week. I typically won’t post hints after the first week.

Here are a couple general strategies to always try:

1. **UNDERSTAND THE GRAPH:** Make a small table and get a few points from the graph. This will help you understand what the graph is telling you. A very common mistake is to misread the given graph.

2. **UNDERSTAND THE QUESTION:** Carefully read the question. Label every ‘noun’ related to the course with the corresponding variable. Make sure you know what you are being asked to find.

3. **USE FORMULAS AND DEFINITIONS:** Once you understand the graph and the question, then you should think about all the formula, definitions and relationships that you know from lecture and the text. That is, you should look up everything you know about the terms (for example, if the question asks about Average Trip Speed, then you can write down ATS = (total dist)/(total time) = ‘the slope of a secant line through the graph at t=0 and the current point’)

You will get help with the prologue in quiz section on Thursday, so my hints here only pertain to Worksheets 1 and 2.

**WORKSHEET 1**

**PROBLEM 13(e):** “Find a time at which the average speed over the next 5 minutes is equal to the average speed over the 5-minute interval starting at t = 15.”

**HOW TO SOLVE THE PROBLEM:** Your answer should be a time (the beginning of a 5 minute interval) where the average speed is that same as the average speed from 15 to 20. So first we need to understand what the average speed from 15 to 20 is. The long way is to approximate the values at 15 and 20 and compute the average speed (it looks to me that the points are approximately (15, 9.2) and (20,10.5)) and then look for a 5-minute interval that appears to have the same slope.

Here’s a faster way:

a) Draw the secant line through the points on the graph at t=15 and t=20.

b) Roll, or slide, your ruler down (always staying parallel to the secant line). The ruler will intersect the graph a various points.

c) Stop when the ruler intersects the graph in two points that are 5 minutes apart.

To me, it looks like the secant from 40 to 45 has the same slope.

So your **answer would be at approximately t = 40.**

**PROBLEM 14(a):** “If Car B travels 40 miles in the first hour, how far does Car A travel in that time?”

**HOW TO SOLVE THE PROBLEM:** Your answer should be a distance. Make sure you understand the graph (a table might be helpful)!

At one hour, Car A is ahead of Car B by 5 miles (read the intro and look at the graph).

At one hour, Car B has traveled 40 miles.

Thus, **Car A has traveled 45 miles.**
PROBLEM 15(b): “How far has the car traveled during the first 10 minutes?”

HOW TO SOLVE THE PROBLEM: Your answer should be a distance. Once again, make sure you understand the graph (a table might be helpful!)

At 10 minutes, the Average Trip Speed is 3 miles per minute (from the graph). So the car averaged 3 miles per minute from the start to 10 minutes later.

Note ATS = \frac{\text{TOTAL DISTANCE (SINCE } t = 0)}{\text{TOTAL TIME (SINCE } t = 0)}.

Using this formula, 3 = \frac{\text{TOTAL DISTANCE}}{10 \text{ minutes}}.

The total distance traveled in the first 10 minutes is 30 miles.

WORKSHEET 2

PROBLEM 8(b): “Which of the following most closely resembles the graph of pressure from \( t = 2 \) to \( t = 2.5 \)?”

HOW TO SOLVE THE PROBLEM: You are being asked to identify the graph of pressure (or total pressure) between the two given times. In this problem, I believe a table makes things much more clear especially since the graph is a little difficult to understand. Here is the table I got (make sure you know where these values are coming from):

<table>
<thead>
<tr>
<th>time</th>
<th>0</th>
<th>0.25</th>
<th>0.5</th>
<th>0.75</th>
<th>1.0</th>
<th>1.25</th>
<th>\cdots</th>
<th>2.0</th>
<th>2.25</th>
<th>2.5</th>
</tr>
</thead>
<tbody>
<tr>
<td>total pressure</td>
<td>27</td>
<td>26.85</td>
<td>26.75</td>
<td>26.6</td>
<td>26.55</td>
<td>26.75</td>
<td>\cdots</td>
<td>27.05</td>
<td>26.95</td>
<td>26.75</td>
</tr>
</tbody>
</table>

So what is happening to pressure from 2 to 2.5? The pressure is going down, so it must be either the third or fourth pictures.

To decide which one, we can make a rough sketch of the points we have (note that the pressure drops more from 2.25 to 2.5 than from 2.0 to 2.25. The answer is the fourth graph.

(Note: We can solve such a problem without a table, but the table makes it easier to understand and it makes you less likely to make a mistake. So take the time to make tables when you are confused.)

PROBLEM 9(b): “Assume that Juan was 64 inches tall on his 14th birthday. How tall was he 6 months later?”

HOW TO SOLVE THE PROBLEM: You are being asked to give his total height at 14 years and 6 months. In this problem, like the one before, you really should make a table if you are confused. Note that 14 years old corresponds to 24 months on the graph (since it is years since his 12th birthday). Also note that the graph is in INCHES PER MONTH but the tick marks are for EVERY THREE MONTHS. So the first tick mark is at approximately at (3, 0.275). This means that Juan grew 0.275 inches per month for the first three months for a total of \(0.275 \times 3 = 0.825\) inches of growth in the first three months.

Here is the table I got (I started the table at 14 years since we are given that information).

<table>
<thead>
<tr>
<th>time (months since Juan’s 12th birthday)</th>
<th>24</th>
<th>25</th>
<th>26</th>
<th>27</th>
<th>28</th>
<th>29</th>
<th>30</th>
</tr>
</thead>
<tbody>
<tr>
<td>total height (inches)</td>
<td>64</td>
<td>64.155</td>
<td>64.31</td>
<td>64.465</td>
<td>64.59</td>
<td>64.715</td>
<td>64.84</td>
</tr>
</tbody>
</table>

Note: For the months 25, 26, and 27, I used the approximation of 0.155 inches per month from the graph. For the months 28, 29, and 30, I used the approximation of 0.125 inches per month from the graph.

My answer is 64.84 inches. (which is slightly bigger than the answer in the back of the book because the book approximated slightly different values than I did, both answers would receive full credit).