Math 111 Homework 3 Hints/Solutions

Carefully read through the review for week 3. It contains some useful hints for solving problems in WS 7.

Worksheet 6

PROBLEM 8: "Find the following quantities from the graph."

HOW TO SOLVE THE PROBLEM:

PART (a): Here are the translations:

1. $\frac{f(6)-f(1)}{5}$ = the slope of the secant line to the f graph from $x = 1$ to $x = 6$.
2. $\frac{f(3.05)-f(3.0)}{0.05}$ = the slope of the secant line to the f graph from $x = 3$ to $x = 3.05$.
3. $f(7) - g(7)$ = the difference in height between the f and g graphs at $x = 7$.

You should be able to use these translations to get your answer from the graph.

PART (b)(ii): $\frac{f(x)}{x}$ = the slope of the diagonal line to the f graph. You should be looking for an interval of length 2 when the slope of the diagonal line goes up. The lowest that the diagonal line gets is at about 6.7, then it starts to go up. So 6.7 to 8.7 would be a correct answer (7 to 9 would also be correct).

PART (d): Translate each. Approximate a couple of the values in the given interval and plot your points. Then see which of the graphs match up.

For example, for (iii) $f(x+0.3) - f(x)$= the change in height on the f graph from x to $x + 0.3$.

At $x = 5$, $f(x + 0.3) - f(x)$ would be a negative value (about -.5 say) since the graph of f goes down from 5 to 5.3. At $x = 6$, $f(x + 0.3) - f(x)$ would be close to zero (about -0.01) since the graph of f is almost flat from 6 to 6.3. At $x = 7$, $f(x + 0.3) - f(x)$ would be a postivie value (about 0.7 say) since the graph of f goes up from 7 to 7.3.

Only one of the graphs given goes from negative to positive. So (iii) must match up with (C).

Worksheet 7

PROBLEM 8: Notice that you should be able to immediately recognize that (a)(b)(e) all deal with differences in heights on the graph and (c)(d) both deal with slopes.

PART (c): You are given that overall average weight is 0.01 (you are given the slope and you need to find the time). If you are given a slope, then you need to draw a reference line (see the week 3 review). Draw a reference line with slope 0.01. The reference line should start at $(0, 2.0)$. So another point would be (1, 2.01) and (2,2.02) and (60,2.60). Draw the line. The time where there is an intersection with B is the answer.

PART (d): You are given an interval from $t = 54$ to $t = 60$ and you are asked to find the incremental rate of change. All you need to do is draw to the secant line and find the slope.

PROBLEM 9(e): 'Find a 2-month time interval, if any exists, over which the incremental rate of change $\frac{f(t+0.1)-f(t)}{0.1}$ changes from positive, to zero, to negative.'

This is about slopes of secants over an interval from t to $t + 0.1$ (these will almost look like tangent lines). Is there a region where the slope of the secants change from positive to zero to negative. Touch your ruler to the edge of the graph and move it with the slope of the curve. You will see that the slope is positive from 0 to 3. It is zero at 3. It is negative from 3 to 9. It is zero at 9. It is positive from 9 to 12.

So the graph changes from positive to zero to negative around 3. So the interval from 2 to 4 would work as an answer.

PROBLEM 10(g): 'Find a time t greater than 4 when $\frac{I(t+0.25)-I(t)}{0.25} < \frac{I(t)}{t}$.'

The left-hand side = the slope of the secant line from t to $t + 0.25$.

The right-hand side = the slope of the diagonal line at t.

You are looking for times where the diagonal slope (*i.e* from 0 to t) is bigger than the secant slope (*i.e.* from the same t to $t + 0.25$). Put your ruler on the graph and compare these diagonals and secants and various times. You will find that after $t = 8$ the secants slope get fairly low, but the diagonal slope are still higher. Any time after $t = 8$ would be correct.

Worksheet 8

PROBLEM 15(e): 'Give an interval of values of q, if any exist, over which MR and MC are both increasing.'

Recall

MR = the slope of the secant line to TR over a 1 unit interval and

MC = the slope of the secant line to TC over a 1 unit interval.

Since the units in the graph are 10, 1 unit will be small. So the secant line will almost look like a tangent line. Sketch a graph of TC (by shifting VC up 200).

Now look for times when the slope of the TC graph and the slope of the TR graph are both getting bigger.

When you put your ruler on the TR graph and start to move it, you will realize that the slope of the secants are getting smaller as you move from left to right. Thus, MR is always decreasing. So No INTERVAL EXISTS.