Calculus BC  
Unit 1: Foundations of the Derivative  
Day One  

Situation #1  

A crash test dummy is in the race for 45 minutes (not necessarily the first 45 minutes), and has gone 50 miles, traveling at a constant speed throughout. He then crashes into a wall. Draw a graph of his distance as a function of time, and then calculate the speed of the car in miles per hour the instant he hits the wall.

Situation #2  

A second crash test dummy also goes 50 miles in 45 minutes, but starts from a parked position and goes faster and faster. She then crashes into a wall. Draw a graph of her distance as a function of time, and then calculate the speed of the car in miles per hour the instant she hits the wall.

Some Additional Information:  

After 44.5 minutes, she has gone 48.925 miles.  
After 44.75 minutes, she has gone 49.459 miles.  
After 44.9 minutes, she has gone 49.783335 miles.

Two Definitions of Velocity:  

Average velocity  
Instantaneous velocity
3. A car starts at a high speed, and its speed then decreases slowly. Sketch a graph of the distance the car has traveled as a function of time.

4. For the function shown in Figure 2.7, at what labeled points is the slope of the graph positive? Negative? At which labeled point does the graph have the greatest (i.e., most positive) slope? The least slope (i.e., negative and with the largest magnitude)?

5. Match the points labeled on the curve in Figure 2.8 with the given slopes.

<table>
<thead>
<tr>
<th>Slope</th>
<th>Point</th>
</tr>
</thead>
<tbody>
<tr>
<td>-3</td>
<td></td>
</tr>
<tr>
<td>-1</td>
<td></td>
</tr>
<tr>
<td>0</td>
<td></td>
</tr>
<tr>
<td>1/2</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
</tr>
</tbody>
</table>

6. For the graph $y = f(x)$ shown in Figure 2.9, arrange the following numbers in ascending (i.e., smallest to largest) order:
   - The slope of the graph at $A$.
   - The slope of the graph at $B$.
   - The slope of the graph at $C$.
   - The slope of the line $AB$.
   - The number 0.
   - The number 1.

7. The graph of $f(t)$ in Figure 2.10 gives the position of a particle at time $t$. List the following quantities in order, smallest to largest.
   - $A$, the average velocity between $t = 1$ and $t = 3$,
   - $B$, the average velocity between $t = 5$ and $t = 6$,
   - $C$, the instantaneous velocity at $t = 1$,
   - $D$, the instantaneous velocity at $t = 3$,
   - $E$, the instantaneous velocity at $t = 5$,
   - $F$, the instantaneous velocity at $t = 6$. 

Figure 2.7

Figure 2.8

Figure 2.9

Figure 2.10