Math 111 - Quiz 1

September 11, 2015

Instructions: Show all of your work and mark your answers clearly.

1. You left your ice cream on the counter, and now it’s melting! The table below gives the amount of liquid ice cream in your bowl after t minutes.

<table>
<thead>
<tr>
<th>t (min)</th>
<th>10</th>
<th>20</th>
<th>30</th>
<th>40</th>
<th>50</th>
</tr>
</thead>
<tbody>
<tr>
<td>V (ml)</td>
<td>5</td>
<td>8</td>
<td>12</td>
<td>20</td>
<td>30</td>
</tr>
</tbody>
</table>

(a) Let P be the point (30, 12). Find the slopes of the secant lines through P and Q when Q is the point on the graph with t = 10, 20, 40, 50.

\[
\begin{align*}
\text{t = 10} & : \quad \frac{12 - 5}{30 - 10} = \frac{7}{20} \\
\text{t = 20} & : \quad \frac{12 - 8}{30 - 20} = \frac{4}{10} = \frac{2}{5} \\
\text{t = 40} & : \quad \frac{12 - 20}{30 - 40} = \frac{-8}{-10} = \frac{4}{5} \\
\text{t = 50} & : \quad \frac{12 - 20}{30 - 50} = \frac{-18}{-20} = \frac{9}{10}
\end{align*}
\]

(b) What do these slopes approximate?

The rate at which the ice cream is melting after 30 min.
or, the instantaneous rate of melting when t = 30.
2. Below is the graph of a function $f$. Evaluate the following limits using the graph. If the limit is infinite, say whether it is $\pm \infty$.

\[
\begin{align*}
\text{(a)} \quad \lim_{x \to 3} f(x) &= 2 \\
\text{(b)} \quad \lim_{x \to 7^-} f(x) &= \\
\text{(c)} \quad \lim_{x \to 9} f(x) &= 3 \\
\text{(d)} \quad \lim_{x \to 5^+} f(x) &= +\infty \\
\text{(e)} \quad \lim_{x \to 5^-} f(x) &= 2
\end{align*}
\]