Review for Exam 3

Overview

- Expect to see between eight and ten problems that look very much like homework problems. However, note that the graphing problems may very well be small pieces of homework type problems.

- You will have 50 minutes for the exam, so, on average, you will have to work a problem every 5 to 6 minutes.

- You are guaranteed a min/max word problem, and it will be worth more than 10 points.

Section 4.1

- Be able to find all the critical numbers for a function.

- Be able to find the absolute minimum or maximum value of a function. Also be able to find where it occurs.

Section 4.2

- Know how to compute $f(b)$ using the Mean Value Theorem on an interval $[a, b]$.

- Know that such computations require knowledge of $f(a)$ and some data about $f'$ at points between $a$ and $b$.

- Know that such computations are usually approximate, since the $f'$ data is usually approximate.

Section 4.3

- Be able to determine where a function is increasing, where it is decreasing and what its local extrema are.

- Be able to do this given any of the following: a formula for $f$, a formula for $f'$, a graph of $f$, or a graph of $f'$.

- Be able to determine where a function is concave up, where it is concave down, and what its inflection points are.
• Be able to do this given any of the following: a formula for f, a formula for f', a formula for f'', a graph of f', or a graph of f''.

• Be able to assemble this data into an accurate graph of f. One in which all local extrema, critical points and inflection points are clearly marked.

• It might help to use this table to keep track of the relationships between f, f' and f''.

<table>
<thead>
<tr>
<th></th>
<th>f'</th>
<th>f''</th>
</tr>
</thead>
<tbody>
<tr>
<td>increasing</td>
<td>positive</td>
<td></td>
</tr>
<tr>
<td>decreasing</td>
<td>negative</td>
<td></td>
</tr>
<tr>
<td>concave up</td>
<td>increasing</td>
<td>positive</td>
</tr>
<tr>
<td>concave down</td>
<td>decreasing</td>
<td>negative</td>
</tr>
</tbody>
</table>

Section 4.4

• Know how to apply L’Hospital’s Rule to limits of the form \( \frac{0}{0} \) and \( \frac{\infty}{\infty} \).

• Know that it DOES NOT APPLY to any other form.

• Know how to convert 0 \( \cdot \) \( \infty \) forms to \( \frac{0}{0} \) and \( \frac{\infty}{\infty} \).

• Know how to use \( \ln \) to convert exponential forms. Be sure to convert back after you take the limit.

Section 4.5

• If a problem asks for a complete graph of f, the following elements are required. For each element you are expected to obtain exact answers and show your work. Calculator approximations can help, but they are not enough.

  1. Intercepts of f.
  2. Domain of f.
  3. Asymptotic behavior of f. I.e., take the limits to find out what happens at the edges of the domain of f.
  4. Local extrema and any other critical points.
  5. Where f increases and where it decreases.
6. Where $f$ is concave up and where it is concave down.
7. Inflection points of $f$.
8. A graph of $f$ in which all of the above information is visible.

Section 4.7

- The will be a min/max word problem. Make sure you know how to do them.

Section 4.10

- Know how to antidifferentiate $x^r$, $e^x$, $\sin x$, $\cos x$, and any sum or constant multiple of these.
- You should also be able to antidifferentiate any function that is recognizable as a familiar derivative.
- Given $f'$ and one point on $f$, be able to recover $f$.
- Be able to apply this technique repeatedly if you are given $f''$, or $f'''$, or ....