Review for Exam 3

What follows is intended as a guide to focus your study for Exam 3. Read the Overview and the Study Tips. After that there is list of specific things you must know, arranged by section.

Overview

- Expect to see between six and eight problems that look very much like homework problems.
- You will have 50 minutes for the exam, so, on average, you will have to work a problem every 7 to 8 minutes. Clearly some problems (graphing and min/max) are longer than this, so you have to make up the time on the shorter problems.
- There will be at least one detailed graphing problem, requiring all the relevant computations with first and second derivatives. Graphing problem(s) will be worth at least 20% of the exam.
- There will be at least one min/max word problem. Min/Max word problem(s) will be worth at least 20% of the exam.

Study Tips

- You must be able to take derivatives quickly and accurately. There will be almost no credit awarded for just taking a derivative on this exam, but you can’t do ANY of the problems without this skill.
- You still need to know everything that you had to learn for Exam 2. You should also know all of the basic geometry formulas for triangles, circles and rectangles. The only trig identity you have to memorize is $\sin^2 t + \cos^2 t = 1$. You also have to know all the basic triangle trig definitions.
- There will be word problems on this exam. Always make it perfectly clear what any letters stand for when you write a solution to a word problem.

Section 3.10

- If a problem says “Use differentials to approximate...”, then you must solve it using the differential approximation formula

\[ f(x) \approx f(a) + f'(a)(x - a) \]
• Know how to use it. Be able to identify the “good” location and the “bad” location.
• Also know how to interpret “change” and “percent change”.

Section 4.2
• Know how to compute \( f(b) \) using the Mean Value Theorem on an interval \([a,b]\).

\[ f(b) = f(a) + f'(c)(b - a) \]

• 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.

Sections 4.3 and 4.4 (Graphing)
• Be able to determine where a function is increasing, where it is decreasing, where it has critical points, and what its local extrema are.
• Be able to determine all of this exactly from a formula for \( f \) or from a formula for \( f' \). (Calculator approximations will NOT receive credit.)
• Be able to determine where a function is concave up, where it is concave down, and what its inflection points are.
• Be able to determine this exactly from a formula for \( f \), a formula for \( f' \), or a formula for \( f'' \). (Calculator approximations will NOT receive credit.)
• Be able to assemble this data into an accurate graph of \( f \). That is, one in which all local extrema, critical points and inflection points are clearly marked. (Calculator approximations for this are useful, but you will still have to locate all interesting features exactly.)
• It might help to use this table to keep track of the relationships between \( f \), \( f' \) and \( f'' \).

<table>
<thead>
<tr>
<th>( f )</th>
<th>( f' )</th>
<th>( f'' )</th>
</tr>
</thead>
<tbody>
<tr>
<td>inc</td>
<td>&gt; 0</td>
<td></td>
</tr>
<tr>
<td>dec</td>
<td>&lt; 0</td>
<td></td>
</tr>
<tr>
<td>conc up</td>
<td>inc</td>
<td>&gt; 0</td>
</tr>
<tr>
<td>conc down</td>
<td>dec</td>
<td>&lt; 0</td>
</tr>
</tbody>
</table>
Section 4.5

- Know how to do min/max problems.
- Identify the quantity that must be minimized or maximized.
- Express it as a function.
- Graph it and locate the min/max exactly. Calculator graphs are useful, but you must locate the min/max algebraically. Calculator approximations will NOT receive credit.
- Answer the question.

Section 4.6

- 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 $\frac{0}{0}$ or $\frac{\infty}{\infty}$.
- Know how to convert exponential forms, and know how to convert your answer back.

Section 4.7

- You don’t have to memorize the Newton’s method formula. It’s too computational to make a good exam questions.
- You do, however, need to know how to find tangent lines and how to find where tangent lines intersect other things.