AP Calculus BC **Name: ________________________________**

Test #4 Outline

Test Date: 11/01/07

Sections: 3.1 – 3.5, 3.7 – 3.8

3.1 Linear Approximations

- Find a linear approximation
- Use a linear approximation to estimate a quantity

3.2 Indeterminate Forms and L'Hopital's Rule

- Recognize indeterminate forms $\left(\frac{0}{0},\ \frac{\pm\infty}{\pm\infty},\ \infty-\infty,\ 0\cdot\infty,\ 0^0,\ 1^\infty,\ \infty^0\right)$
- Evaluate limits using L'Hopital's rule (must be in $\frac{0}{0}$ or $\frac{\pm\infty}{\pm\infty}$ form)
- Use ln to evaluate limits ($0^0,\ 1^\infty,\ \infty^0$ forms)

3.3 Maximum and Minimum Values

- Find critical numbers ($f'(x)=0$ or $f'(x)$ undefined)
- Find absolute extrema on a closed interval (can occur only at critical numbers or end points)
- Extreme Value Theorem (a continuous function on a closed interval must have both an absolute max & min)
- Local extrema on an open interval (can occur only at critical numbers, but not all critical number result in a local extremum)

3.4 Increasing and Decreasing Functions

- $f'(x)>0 \Leftrightarrow f$ is increasing
- $f'(x)<0 \Leftrightarrow f$ is decreasing
- The First Derivative Test (used to find local extrema)
  - If *c* is a critical number for the function *f* (that is, $f'(c)=0$ or $f'(c)$ is undefined), then
    - $f(c)$ is a local (relative) minimum if $f'(c)$ changes from negative to positive at $x=c$
    - $f(c)$ is a local (relative) maximum if $f'(c)$ changes from positive to negative at $x=c$
    - $f(c)$ is not a local extremum if $f'(c)$ does not change sign at $x=c$
- Given the graph of f, choose the graph of f'
- Given the graph of f', choose the graph of f
- Given the graph of f', identify where *f* is increasing or decreasing, find local extrema, identify where *f* is concave up and concave down, and find points of inflection

3.5 Concavity and the Second Derivative Test

- $f(x)$ is concave up $\Leftrightarrow$ $f'(x)$ is *increasing* $\Leftrightarrow$ $f''(x) > 0$
- $f(x)$ is concave down $\Leftrightarrow$ $f'(x)$ is *decreasing* $\Leftrightarrow$ $f''(x) < 0$
- If the graph of *f* changes concavity (and is continuous) at a point, then this point is a *point of inflection*
- The Second Derivative Test (also used to find local extrema)
  - If *c* is a critical number for the function *f* (that is, $f'(c) = 0$ or $f'(c)$ is undefined), then
    - $f(c)$ is a local (relative) minimum if $f''(c) > 0$
    - $f(c)$ is a local (relative) maximum if $f''(c) < 0$
    - if $f''(c) = 0$ or $f''(c)$ is undefined, the Second Derivative Test yields no conclusion
- Given features for a function (increasing, decreasing, local extrema, concavity, points of inflection, asymptotes), sketch the graph of the function

3.7 Optimization

- Find a maximum or minimum for a given application.
- Find the closest/farthest point from a curve to a given point.

3.8 Related Rates

- Solve related-rate problems.

Extra practice: p. 339 #1, 2 (find dy and Δy if $x_0 = 1$ and $\Delta x = 0.1$), 3, 9-12, 14-16, 17-26, 27, 29, 31, 35, 36, [determine all significant features for 37-39, 42], 47 and p. 317 #16 and p. 325 #7, 8, 23
2000 AP Calc AB #3a-c and 2001 AP Calc AB #4
(does not include ALL types of problems)

Present on Wednesday, October 31 in-class:
Group 1: #19; Group 2: #20; Group 3: #21; Group 4: #22; Group 5: #23; Group #6: #24 Group 7: #25; Group 8: #26

Test format:

- 100 points total
- Although some questions will be similar in nature to questions from the text book, other questions may require you to apply the knowledge that you have obtained (from class notes, reading the text book, homework, tutorials) to solve original and challenging problems.
- Mostly multiple choice (80-90%) with some “AP style” free response (10-20%)
- No calculator