EXAM 2 REVIEW

Exam 2 will take place on Friday October 14th during our scheduled lecture time (3:35-4:25pm in Doherty Hall 2210). Here is some information.

- The exam will cover material from Sections 3.5-3.9 and 4.1-4.3 of our text.
- You'll need a scientific calculator to perform some of the computations. Graphing calculators will not be permitted.
- You may bring notes on the front and back of a **half sheet of paper**.
- The exam will have three sections, including around 5-7 true or false questions, 3-5 short answer questions, and 4-6 free response questions.

This review will not be collected for credit. Solutions will be posted by Thursday before the exam. Note that the problems on this review are not comprehensive, make sure to also study the material from the course recommended below.

Tips for studying

I recommend the following strategy:

1. Start early
2. Understand every problem on this review
3. Review all worksheets (there are blank copies and solutions on my site)
4. Review relevant concept quizzes.
5. Review examples from lecture.
6. Review previous homework assignments.
7. Do some additional odd-numbered problems from our text (note that the answers are in the back of the book).

Topics

Here are some key words to help you study.

1. Chapter 3: Differentiation Rules
    - Chain rule
    - Implicit differentiation
    - Derivatives of inverse functions
    - Derivatives of trig and inverse trig functions
    - Derivatives of exponential and logarithmic functions
    - Logarithmic differentiation

2. Chapter 4:
    - Related rates; I suggest you put the following on your notecard:
        - Formulas for the area of circles, rectangles and triangles
        - Formulas for volumes of boxes and spheres
        - Examples of modeling related rates problems using trigonometry
    - Linear approximation
    - Critical points
    - Local and absolute (or global) extrema

Practice Problems

True/False Questions:

1. True or False: If x is a function of t, then $\frac{d}{dt}(x^5) = 5x^4$

2. True or False: If $f(x) = \ln(10)$, then $f'(x) = \dfrac{1}{10}$.

3. True or False: If $y^2 = x^2 + 2x$, then $y' = 2x + 2$.

4. True or False: If $f(x) = x^{\cos(x)}$, then $f'(x) = \cos(x)x^{\cos(x)-1}$

5. True or False: If f is differentiable on $[a, b]$ then f has an absolute maximum value on this interval.

6. True of False: If c is a critical point, then f has a local extrema at c.

Free Response

1. Find the derivative of the following functions.

   a) $f(x) = x^{\tan(x)}$

   b) $g(x) = 2^x\sqrt{x}$

   c) $h(x) = \log_2(\arcsin(x))$

d) $k(x) = \dfrac{e^{4x}\sin(x)}{(x^2+1)^x}$

e) $\ell(x) = \dfrac{(x+1)^2\ln(x+1)}{e^{-2x}\sqrt{x}}$

f) $m(x) = \log(x)^{\arctan(x)}$

2. The graph of the equation $x^2 + xy + y^2 = 9$ has horizontal tangent lines at two points. Find these two points.

3. Find the equation of the tangent line to the curve $\sin(x + y) = 4x - 4y$ at the point (π, π).

4. Use linear approximation to give a reasonable estimate of $\sqrt{99.8}$.

5. Suppose that $f(2) = 3$, $g(2) = 2$, $f'(2) = 5$, and $g'(2) = -2$. Find $h'(2)$ if

a) $h(x) = f(g(x))$

b) $h(x) = f(x)^{g(x)}$

c) $h(x) = \ln(f(g(x))$

6. Find all critical points of $f(x) = x^3 + |2x - 1| + 1$ on $(-\infty, \infty)$. Then, find the absolute maximum and minimum value of this function on the inverval $[-2, 1]$.

7. Give an example of a continuous function that does not attain an absolute maximum or minimum values on an open interval (a, b).

8. Give an example of a function that does not attain an absolute maximum or minimum value on a closed interval $[a, b]$.

9. A conical clay pot is being constructed so that the radius of the base is always equal to the height of the cone and the volume of the cone is growing at 30 mm^3/ min. At what rate is the height growing after an hour?

10. A 15-foot long collapsible ladder is sliding down a wall. Beginning 10 feet from the wall, the foot of the ladder is moving away at a steady 2 ft/sec, while the ladder itself is collapsing at 0.5 ft/sec. How fast is the top of the ladder moving initially?

11. The minute hand on a clock is 3 in long and the hour hand is 2 in long. How fast is the distance between the tips of the hands changing at 3 o'clock?

12. Alice and Bob are standing on opposite sides of a 60 ft wide river that flows from East to West. They are standing directly across from one another when Alice starts jogging West at a rate of 12 ft/s. At the same time, Bob starts jogging East at 8 ft/s. How fast is the distance between them changing when Alice is 6 feet from her starting position and Bob is 4 feet from his starting position?