

## Final Exam Review MATH 2250, Fall 2017

**EXAM DATE/TIME:** Tuesday, December 12 7:00 – 10:00 pm

Location announced by your professor

### **Definitions and Theorems to State:**

- The (limit) definition of the derivative  $f'(x)$
- Mean Value Theorem
- The definition of continuity at  $x=a$
- Fundamental Theorems of Calculus (Part 1 and Part 2)
- Intermediate Value Theorem

### **Theorems to Use but not State (if you use one, say you are using it):**

- The Extreme Value Theorem
- First Derivative Test for Local Extrema
- Second Derivative Test for Concavity
- L'Hopital's Rule
- The relationship of continuity to differentiability
- The relationship of continuity to integrability
- second derivative test for local extrema

### **Terminology to be familiar with:**

- average rate of change, average velocity
- instantaneous rate of change
- average value of a function
- tangent lines and linearization of a function at a point

### **Formulas and Properties you will be responsible for:**

- Surface Area and Volume of spheres, cylinders, and boxes
- Area and Perimeter of circles, triangles, rectangles, and sectors
- Distance formula, Pythagorean theorem
- Properties of logarithmic and exponential functions
- Trigonometric identities (reciprocal, Pythagorean)
- other precalculus-level formulas

### **Limits:**

- Be able to find the limits and one-sided limits of functions (even if not continuous), both analytically and graphically
- Find limits that approach infinity or have an infinite limit
- Be able to use L'Hopital's Rule to find limits (and identify the appropriate indeterminate forms that allow you to do so)
- Applications of continuity, including the Intermediate Value Theorem
- Verify continuity (analytically and graphically)
- Be able to "repair" a removable discontinuity by (re)defining the function at that x-value

### **Derivatives:**

- Be able to find the derivative  $f'(x)$  from the definition
- Be able to use rules to find the derivative; know all rules from back of book through inverse trig function (no hyperbolic or parametric, no arcsec, arccot, or arccsc)
- Implicit Differentiation
- Be able to find an equation of the tangent line at a point
- Be able to understand/interpret the slope of a function
- Logarithmic differentiation

### **Applications of Derivatives**

- Applications involving a tangent line
- Be able to find and use linearization
- Position, velocity, acceleration problems
- Applied rates of change other than position, velocity, and acceleration
- Related rates
- Understand the relationship between (first and second) derivatives and curve behavior; curve sketching from derivative information
- Optimize a function on a closed interval
- Applied Optimization (open and/or closed domain)

### **Integration**

- Antiderivatives: most general antiderivative as well as initial value problems
- Understand the definite integral as (signed) area
- Be able to use the definite integral to compute and interpret
  - signed area
  - total area
  - area between two curves
  - average value of a function
- Estimate a definite integral using well-chosen sums with a small number of rectangles (Left, Right, Midpoint)
- Express a right endpoint Riemann sum with  $N$  rectangles of equal width in summation form.
- Recognize a definite integral when written as a limit of a Riemann Sum
- Compute definite integrals:
  - by interpreting it as area
  - by Evaluation Theorem (FTC 2)
  - by integration via substitution

### **Penalties (approximately 20% of problem's points value for each issue):**

- Improper use of  $+C$  or missing  $+C$
- Improper use of limit notation
- Improper use of integral or sigma
- Improper use of "=" (like  $y = \cos^2(x) = -2\cos(x)\sin(x)$ )
- Improper algebraic notation (missing parentheses, etc.)

**Remarks for students:**

-Problems may combine multiple topics/techniques.

-It is not necessary to simplify.

-Calculator TI 30 only, but NO TI-30X PRO! Final answers are preferred in symbolic form (like  $\sqrt{3}$  or  $e^2$ ) but a FINAL decimal approximation must be correct to 3 decimal places.

-You will leave your backpacks at the front of the room; a backpack that rings or buzzes will be taken out to the hallway and left there.

-No bathroom breaks unless you have a documented medical condition. Let your instructor know in advance.