Final Exam Review **MATH 2250**

Fall 2018 University of Georgia

EXAM DATE/TIME: Thursday, December 6, 7:00 p.m. - 10:00 p.m.
Location announced by your professor

Definitions and Theorems to State:

-The (limit) definition of the derivative of $f(x)$

-The definition of continuity at $x = a$

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

-The Extreme Value Theorem (Closed Interval Method)

-First derivative test for local extrema

-L'Hopital's rule

-The relationship of continuity to differentiability

-Second derivative test for local extrema

-Fundamental Theorems of Calculus (Part 1 and Part 2)

-Intermediate Value Theorem

Properties you will be responsible for:

-Properties of logarithmic and exponential functions

-other precalculus-level formulas (in addition to those listed below)

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

-Determine horizontal asymptotes and vertical asymptotes of a function; justify your answer using one or more limits

-Be able to use L'Hopital's Rule to find limits (and identify and state the appropriate indeterminate forms that allow you to do so)

-Applications of continuity, including the Intermediate Value Theorem

-Verify continuity (analytically and graphically)

-Determine intervals on which a function is continuous

-Be able to "repair" a removable discontinuity by (re)defining the function at that x-value

-Determine the value of a parameter that makes a piecewise function continuous where the two pieces meet

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(x), arccot(x), or arccsc(x))

-Implicit differentiation

-Be able to compute derivatives at specific points using limited information (e.g. a table)

-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

Proof-based Problems:
-Use differentiation of the appropriate inverse function to verify the differentiation rule for $\ln(x)$
-Use differentiation of the appropriate inverse function to verify the differentiation rule for $\arcsin(x)$, $\arccos(x)$, and $\arctan(x)$ (including an appropriate right triangle diagram or a Pythagorean identity)

Applications of Derivatives
-Applications involving a tangent line
-Be able to find and use the linearization
-Be able to find and use the differential
-Position, displacement, 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
-Determine all extrema of a function on a closed interval
-Applied optimization (open and/or closed interval); justify that you have a max or min

Integration
-Antiderivatives: most general antiderivative as well as initial value problems
-Understand the definite integral as (signed) area
-Apply properties of the definite integral
-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), and interpret your answer
-Express a right endpoint Riemann sum with N rectangles of equal width in summation form, using only the summation symbol, k, N, and numbers
-Compute a definite integral:

- by interpreting it as area
- by Evaluation Theorem (FTC 2)
- by integration via substitution

Terminology to be familiar with (in addition to terminology listed in sections above):
-average rate of change/secant slope, average velocity
-instantaneous rate of change/tangent slope

-average value of a function
-tangent lines and linearization of a function at a point
-domain
-critical points (critical numbers), inflection points
-increasing, decreasing, concave up, concave down
-local (relative) extrema
-absolute (relative) extrema

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, incorrect variable name, etc.)

Remarks for students:
-Problems may combine multiple topics/techniques.
-You do not have to simplify your answers.
-Calculator **TI 30XS Multiview only**! No other calculators are allowed, and sharing of calculators is not allowed.
-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 smart watches are allowed during the exam; your cell phone may not be on your person and must be stored in a backpack, purse, or other storage item left at the front of the classroom.
-No bathroom breaks unless you have a documented medical condition. Let your instructor know in advance.

Formulas to Remember

- Distance between (x_1, y_1) and (x_2, y_2): $d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$
- Triangles and Trig
  - perimeter (add up side lengths)
  - area: $A = \frac{1}{2}bh$
  - Be able to use properties of similar triangles.
  - Pythagorean Theorem for right triangles: $a^2 + b^2 = c^2$
  - right triangles and acute angle trig: SOH-CAH-TOA
  -

$\tan(x) = \dfrac{\sin(x)}{\cos(x)}$	$\cot(x) = \dfrac{\cos(x)}{\sin(x)}$
$\csc(x) = \dfrac{1}{\sin(x)}$	$\sec(x) = \dfrac{1}{\cos(x)}$

  - $\sin^2(x) + \cos^2(x) = 1$

- Your trig differentiation formulas assume that your angle is in radians. (Why?)

- Circles
  - area: $A = \pi r^2$
  - circumference: $C = 2\pi r$
  - Equation of the circle of radius r centered at (h, k): $(x - h)^2 + (y - k)^2 = r^2$
- Rectangles
  - area: $A = lw$
  - perimeter: $P = 2l + 2w$
- Cylinder
  - volume: $V = \pi r^2 h$
  - surface area: $S = 2\pi r^2 + 2\pi rh$ (includes base and lid)
- Rectangular prisms
  - volume: $V = lwh$
  - surface area: $S = 2lw + 2wh + 2lh$ (includes top and base)