TOPICS and Concepts for the Math 150 Advancement Exam

NOTE:

- A calculator, cell phone, translator, dictionary or any similar device is NEVER allowed.
- NO formulas will be given
- The problems on the "Samples" exam contain similar to but not exactly like, problems on the actual Advancement Exam. Further, the Advancement Exam may contain problems that are not expressly shown on the "Samples Exam".

The Advancement Exam for Math 150 may include, but will not be limited to:

1. Evaluate various types of limits graphically, numerically, and algebraically, and analyze properties of functions applying limits including one-sided, two-sided, finite and infinite limits.
2. Develop a rigorous epsilon-delta limit proof for simple polynomials.
3. Recognize and evaluate the "limit" using the common limit theorems and properties.
4. Analyze the behavior of algebraic and transcendental functions by applying common continuity theorems, and investigate the continuity of such functions at a point, on an open or closed interval.
5. Calculate the derivative of a function using the limit definition.
6. Calculate the slope and the equation of the tangent line of a function at a given point.
7. Calculate derivatives using common differentiation theorems.
8. Calculate the derivative of a function implicitly.
9. Solve applications using related rates of change.
10. Apply differentials to make linear approximations and analyze propagated errors.
11. Apply derivatives to graph functions by calculating the critical points, the points of non-differentiability, the points of inflections, the vertical tangents, cusps or corners, and the extrema of a function.
12. Calculate where a function is increasing, or decreasing, concave up or concave down by applying its first and second derivatives respectively, and apply the First and Second Derivative Tests to calculate and identify the function's relative extrema.
13. Solve optimization problems using differentiation techniques.
14. Recognize and apply Rolle's Theorem and the Mean-Value Theorem where appropriate.
15. Apply Newton's method to find roots of functions.
16. Analyze motion of a particle along a straight line.
17. Calculate the anti-derivative of a wide class of functions, using substitution techniques when appropriate.
18. Apply appropriate approximation techniques to find areas under a curve using summation notation.
19. Calculate the definite integral using the limit of a Riemann Sum and the Fundamental Theorem of Calculus. Apply the Fundamental Theorem of Calculus to investigate a broad class of functions.
20. Apply integration in a variety of application problems: including areas between curves, arclengths of a single variable function, and volumes.
21. Estimate the value of a definite integral using standard numerical integration techniques which may include the Left-Endpoint Rule, the Right-Endpoint Rule, the Midpoint Rule, the Trapezoidal Rule and Simpson's Rule.
22. Calculate derivatives of inverse trigonometric functions, and hyperbolic functions.
23. Calculate integrals of hyperbolic functions and of functions whose anti-derivatives give inverse trigonometric functions.