Outline for Exam 1

1. Precalculus and beginning kinematics – lines, slopes, etc., displacement, speed, average velocity

2. Limits - notation, definition, computation, algebraic techniques

3. Beginning differential calculus - average velocities as approximations of instantaneous velocity, slopes of secant lines as approximations of the slope of the tangent line, obtaining better and better approximations, definition of derivative

4. Derivatives - computing derivatives from the definition, applying the derivative to find velocity functions and slopes of tangent lines, various computation rules (sum, product, quotient, etc.), generalized power rule, implicit differentiation, Leibniz notation, higher-order derivatives

5. Kinematic-graphic relationships - relationship between average velocity and slopes of secant lines, relationship between instantaneous velocity and slope of tangent lines, relationships between position-time graphs and velocity-time graphs and acceleration-time graphs, ability to sketch the graph of motion based on a description of motion and vice versa

6. Velocity and position vectors

7. Kinematic connections between derivatives, antiderivatives, and curve sketching - \( v(t) = x'(t) \), \( a(t) = v'(t) = x''(t) \), meaning of slopes of tangents in a position-time graph or a velocity-time graph

8. Problem solving involving motion under constant acceleration in one dimension

9. Problems on \( F = ma \)

10. Riemann sums as approximations for displacement and for area under a curve, limits of Riemann sums and the definite integral, the Fundamental Theorem of Integral Calculus