MATH 150: OUTLINE FOR THE FINAL

FUNCTIONS and TRIGONOMETRY REVIEW (CHAPTER 1)

Finding the (implied) domain of a function
Even / odd functions and symmetry of their graphs
Composite functions
Finding exact trigonometric values
Trigonometric functions and identities (Memorize and use Fundamental and Advanced Identities; use Product-to-Sum and Sum-to-Product Identities)
Domains, ranges, and graphs of the six basic trigonometric functions
Simplifying trigonometric expressions and verifying trigonometric identities
Solving trigonometric equations

LIMITS AND CONTINUITY (CHAPTER 2)

Finding limits using basic properties and such tools as simple evaluation; sign analysis; limit forms; "long-run" limits involving $\lim\limits_{x\to\infty}$ or $\lim\limits_{x\to-\infty}$: dividing a numerator and a denominator by the highest power of (say) x in the denominator, short cuts for rational functions, dominant term substitution ("DTS") short cuts
One-sided vs. two-sided limits
Recognizing when a limit does not exist (DNE); ∞ and $-\infty$ are special cases
Horizontal asymptotes ("HAs") and "long-run" limits; know short cuts
Vertical asymptotes ("VAs") and infinite limits at a point; sign analysis; know short cuts
Indeterminate forms, especially Limit Form 0/0:
    Tools include factoring and canceling/dividing, rationalizing; VAs vs. holes
Squeeze (Sandwich) Theorem: applying it in "local" and "long-run" cases
Rigorous ε-δ definition of $\lim\limits_{x\to a} f(x) = L$
Continuity
    Defining it at a point, on an open interval, [recognize it] on other interval types
    Classifying discontinuities: removable, jump, infinite
    Where is f continuous / discontinuous?
    The Intermediate Value Theorem (IVT) and the idea of the Bisection Method for approximating a zero (root) of f

DERIVATIVES (CHAPTER 3)

Rectilinear motion and projectile problems
    position $s(t)$, velocity $v(t)$, acceleration $a(t)$; units
The limit definition of the derivative and using it to find derivatives
Tangent lines, normal lines, and their equations; derivatives as slopes of tangent lines
Average rate of change on an interval vs. instantaneous rate of change at a point
Basic differentiation rules such as the Linearity, Product, Quotient, Power, and Chain Rules (leading to Generalized Power and Trigonometric Rules)
Notation for derivatives, including higher-order derivatives
Where is f differentiable / not differentiable? Also: corners, cusps, vertical tangent lines
Finding $D_x(\sin x)$ and $D_x(\cos x)$ using the limit def'n of derivative ← **<u>not</u> on the Final**
Finding derivatives of other trigonometric functions using the Quotient or Reciprocal rule
Differentials and linearization of functions
Implicit differentiation ("Imp Diff")
Related rates
    If you get word problems on the Final, they will not involve elaborate setups.

APPLICATIONS OF DERIVATIVES (CHAPTER 4)

Finding critical numbers ("CNs") & corresponding points, "PINs," inflection points (IPs)
The Extreme Value Theorem (EVT) and finding absolute maximum and minimum points
for the graph of a function on a closed interval
Rolle's Theorem and the Mean Value Theorem (MVT) for Derivatives
Using the First and Second Derivative Tests to classify points at critical numbers (CNs)
as local maximum points, local minimum points, or neither.
Using the first derivative to see where a function f is increasing vs. decreasing
Using the second derivative to see where the graph of f is concave up vs. concave down
Optimization problems (see my comment under Related rates)
Rectilinear motion and projectile problems
Newton's Method for approximating a zero (root) of f

INTEGRALS (CHAPTER 5)

Indefinite integrals (write " $+ C$ ") vs. definite integrals (think "sum of signed areas")
Solving differential equations subject to initial conditions, including physical applications
Basic rules: Linearity, Power, Trigonometric
u-substitutions
When evaluating definite integrals: Change the limits of integration immediately,
or work out the corresponding indefinite integral first and then apply the FTC
Using geometry to evaluate definite integrals
Defining a definite integral as a limit of Riemann sums
Properties of integrals
The Mean Value Theorem (MVT) for Integrals, f_{av}: average value of f on an interval
The Fundamental Theorem of Calculus (FTC), parts I and II
Part II is essential for evaluating definite integrals
Numerical approximation of definite integrals
Left-hand, Right-hand, and Midpoint Riemann Approximations using rectangles
Trapezoidal Rule and Simpson's Rule ← (formulas would be given)

APPLICATIONS OF INTEGRALS (CHAPTER 6)

Finding areas (Tools include: Solving an equation for a variable, finding intersection
points, finding which graph is on the top / bottom / right / left of a region, etc.)
Finding volumes by using cross sections, including…
Finding volumes of solids of revolution using the Disk / Washer Method
Finding volumes of solids of revolution using the Cylinder (Cylindrical Shells) Method
Arc length and surface areas of surfaces of revolution

LOGARITHMIC and EXPONENTIAL FUNCTIONS (CHAPTER 7)

Defining $\ln x$
Differentiation and integration
Logarithmic differentiation ("Log Diff") and laws of logarithms
Integrating $\tan x, \cot x, \sec x, \csc x$: proofs and results
Working with e and bases other than e; Change of Base Property

INVERSE TRIGONOMETRIC and HYPERBOLIC FUNCTIONS (CHAPTER 8)

Evaluating and differentiating inverse trigonometric functions;
integrals yielding inverse trigonometric results can require unusual u-substitutions
Graphs, domains, and ranges of the three basic inverse trigonometric functions
Using right triangles when combining trigonometric and inverse trigonometric functions
Hyperbolic functions: definitions, evaluations, identities, derivatives, integrals