Math 0120
Final Exam Review

Express sets of real numbers in inequality and interval notation
Evaluate exponents
Functions
  Linear functions
  Quadratic functions:
    Vertex, solve equations by factoring or using the quadratic formula
    Difference quotient
Limits
Rules of limits, Summary of rules of limits p. 81

Average rate of change: Slope of secant line:
\[ \frac{f(x+h) - f(x)}{h} \quad (\text{between } x \text{ and } x+h) \]
Between \( x = a \) and \( x = b \):
\[ \frac{f(b) - f(a)}{b - a} \]
(Instantaneous) rate of change: slope of tangent line:
\[ \lim_{h \to 0} \frac{f(x+h) - f(x)}{h}; \text{ derivative;} \ f'(x) \quad (\text{DESL, p.105}) \]
Units and interpretation of derivative
Equation of a tangent line
Prime and Leibniz notation for derivative
Differentiation formulas and rules: \textit{Simplification and use of more than one rule}
  Constant multiple
  Sum or difference
  Product
  Quotient
  Chain
  Generalized power rule
Marginal Cost, Revenue, Profit; Average quantities, Marginal average quantities
Higher-order derivatives. \textit{Look specifically for higher-order derivatives}
  Distance, velocity, acceleration (Velocity is rate of change of distance, acceleration is rate of change of velocity)
Critical numbers of a function
Extreme points and inflection points of a function
\textbf{Graphing a function} using the first and second derivatives, including sign diagrams
\textbf{Optimization}
  Continuous function on a closed interval
  Enclosures
  Profit
  Rectangular box
  Poster
  Harvest size
  Materials to construct a box, poster, or cylindrical container
  Inventory costs
\textit{*** The second derivative test for absolute extreme values, p. 212}

\textbf{Implicit differentiation and related rates}

\textbf{Exponential and Logarithmic functions}
  Domain, range, and properties of exponential and logarithmic functions
  Derivatives of exponential and logarithmic functions
Four interpretations of derivative: (instantaneous) rate of change, slope of tangent line, marginals, velocity (for distance function)

When asked for one of these and not instructed to use the definition of derivative, use the formulas.

**Antiderivatives**

**Indefinite integrals:** \( \int f(x) dx = F(x) + C \)

- Rewrite or expand before integration, if necessary.
- Know the basic formulas, given in #1 - #4 in the back cover of the textbook.
- Be familiar with examples in which data is given for the evaluation of the constant of integration.
  - These include marginal analysis.

**Definite integrals and area**

- Riemann sums with a specified number of rectangles to approximate.
- Areas of triangles, rectangles, trapezoids to evaluate.
- The Fundamental Theorem of Calculus to evaluate.
- Definite integrals are real numbers and do not contain “+ C”.

**Average value of a function on [a,b]:**

\[
\text{f}_{\text{avg}} = \frac{1}{b-a} \int_{a}^{b} f(x) \, dx
\]

**Area between two curves**

- Interval \([a,b]\) is given.
- Find the points of intersection within \([a,b]\)
- Use the points of intersection to divide \([a,b]\) into subintervals
- Integrate the upper curve minus the lower curve on each subinterval
  - (Area under a curve is the area between the curve and the x-axis.)

**Area bounded by two curves:**

- No interval will be given.
- Find all points of intersection: \(c_1 < c_2 < \ldots < c_n\).
- Use the points of intersection to divide \([c_1, c_n]\) into \(n-1\) subintervals.
- Integrate the upper curve minus the lower curve on each subinterval.

**Consumers’ surplus**

**Producers’ surplus**

**Differentials**

**Integration by substitution:**

- Know the basic formulas, given in #5 - #7 in the back cover of the textbook

**Integration by parts:**

- Know the basic formula, given in #8 in the back cover of the textbook
- Review the rules on pages 414 and 420 of the textbook

**Relative rate of change**

**Elasticity of demand**

**Functions of two variables:**

- Find the domain of a function of 2 variables.
- Find the first- and second-order partial derivatives
- Find the critical points and classify them using the D-test.
- Use the method of Lagrange Multipliers to find a constrained optimum.