MA 2300

MATHEMATICS FOR MANAGEMENT

COURSE OBJECTIVES

Text: Brief Calculus And Its Applications by Goldstein, Lay, and Schneider, seventh edition.

0. Functions

1. Express an inequality

1. Given a. linear function: Find and interpret the slope and the y-intercept; find the x-intercept; and, sketch the graph.
2. Compute the slope of a line given two points on the line.
3. Without finding the equation of the line, sketch the graph of a line given a point on the line and the slope of the line.
4. Determine if two given lines are parallel.
5. Write the equation of a line in the xy-plane given
   (a) two points on the line;
   (b) a point on the line and the slope of the line; or
   (c) a point on the line and the equation of a parallel line (or the slope of a parallel line).
6. Know and be able to use the rules for finding the derivative of a function.
7. Find and evaluate the first or second derivative of a function.
8. Interpret the derivative of a function f as the slope of a line tangent to the graph of f. Find the equation of the tangent line at a point.
9. Use Limit Theorems I - VI and the rules for finding the limits of polynomial and rational functions to find $\lim_{x \to a} f(x)$.
10. Find $\lim_{x \to \infty} f(x)$ where $f(x)$ is a rational function.
11. Find and interpret the average and instantaneous rates of change of a function.
12. Apply the marginal concept to functions representing cost, revenue, or profit.

2. Applications Of the Derivative

1. Given an unspecified function $y = f(x)$ and the following information:
   (a) Values of x for which the derivative of the function, $f'(x)$, is zero;
   (b) Intervals on which the derivative of the function, $f'(x)$, is positive;
   (c) Intervals on which the derivative of the function, $f'(x)$, is negative;
   (d) Values of x for which the second derivative of the function, $f''(x)$, is zero;
   (e) Intervals on which the second derivative of the function, $f''(x)$, is positive;
   (f) Intervals on which the second derivative of the function, $f''(x)$, is negative;

(g) Some points on the graph (including, possibly, x- and y-intercepts); interpret the information given and use it to sketch the graph of the function.

2. Find all relative extreme points for a speci¯ed function.

3. Distinguish between relative, absolute and endpoint extreme points. and/or endpoint extreme points when appropriate.

4. Find the points of in°ection for a speci¯ed function.

5. Sketch the graph of a. speci¯ed function showing extreme points, points of in°ection, and, if they exist, the x ¡ and y ¡ intercepts.

6. Solve an applied optimization problem using a given function.

7. Given appropriate information, construct the objective function and the constraint equation. Then optimize the function subject to the constraint.

8. Given the necessary information, construct the demand equation, the cost function, the revenue function, and the pro¯t function.

9. Solve optimization problems involving demand, cost, revenue and pro¯t functions.

3. Techniques Of Di®erentiation

1. Use the Product and Quotient rules, when appropriate, to di®erentiate functions.

2. Understand and be able to use The Chain Rule to di®erentiate composite functions.

4. The Exponential and Natural Logarithm Functions

1. Evaluate exponential functions (any base) and sketch the graph of the function $f(x) = e^x$

2. Know the rules for di®erentiating e^x and $e^{g(x)}$, where $g(x)$ is a di®erentiable function.

3. Find the derivative of a function involving the exponential function base e. Interpret this derivative as the rate of change or as the slope of the tangent line, and ¯nd the equation of the tangent line, given a value for x.

4. Find relative maximum and minimum points for functions involving the exponential function.

5. Evaluate and sketch the graph of the function $f(x) = \ln x$.

6. Know the rules for di®erentiating $\ln x$ and $\ln(g(x))$.

7. Find the derivative of a function involving the natural logarithm function. Interpret this derivative as the rate of change or as the slope of the tangent line, and ¯nd the equation of the tangent line, given a value for x.

8. Find relative maximum and minimum points for functions involving the natural logarithm function.

9. Use the properties of the natural logarithm (LI - LIV, p. 316) to combine logarithmic terms into a single logarithm and to rewrite a function involving the natural logarithm in terms of logarithms with simpler arguments.

10. Know and be able to use the relationships $e^{\ln x} = x$ (for $x > 0$) and $\ln(e^x) = x$ (for any x), to solve equations involving exponential functions or natural logarithms.

5. Applications of the Exponential and Natural Logarithm Functions

1. Use the exponential change model $P(t) = P_0e^{kt}$ to
   (a) calculate the amount P present at time t, given P_0; k, and t.
   (b) determine the value of either P_0; k or t, given appropriate information.
   (c) write the exponential change function which models a physical situation, given information about that situation.

2. Use the compound interest formula $A = Pe^{rt}$ to
   (a) compute the amount A present at time t, given P; r, and t. ;
   (b) determine the value of either P; r, or t, given appropriate information.
   (c) write the compound interest function which models an investment situation, given information about that situation.

6. The De¯nite Integral

1. Understand the concept of antidi®erentiation and ¯nd all antiderivtatives of a given function.

2. Compute an inde¯nite integral using Theorem II and integration rules (2) - (6) on p. 66.

3. Know the connection between the antiderivatives of a function and the inde¯nite integral of a function.

4. Given appropriate information, determine the value of the constant of antidi®erentiation (the constant of inde¯nite integration), C.

5. Use a Riemann Sum to approximate the area under the graph of a function.

6. Evaluate definite integrals.

7. Use a definite integral to find the area, between the graph of a function $f(x)$ and the x-axis (assuming $f(x) \geq 0$). Interpret the area as a physical quantity (the net change in the function over a specified interval).

7. Functions Of Several Variables

1. Given a function of several variables, evaluate the function at a given point and interpret the value obtained.

2. Sketch the level curves of a. function of two variables at various heights. Sketch the level curve of a function of two variables which passes through a specific point.

3. Find all first order partial derivatives of a function several variables. In addition, for a function $f(x, y)$, find $\frac{\partial^2 f}{\partial x^2}$, $\frac{\partial^2 f}{\partial y^2}$, $\frac{\partial^2 f}{\partial x \partial y}$, and $\frac{\partial^2 f}{\partial y \partial x}$.

4. Interpret the (first-order) partial derivatives of a function of several variables as rates of change.

5. Use The Second Derivative Test For Functions OF Two Variables to determine if the function $f(x, y)$ has a relative minimum, relative maximum or neither at a given point or to determine that no conclusion can be drawn.

6. Use The Method Of Lagrange Multipliers to find all points at which a function of two or three variables has a,possible maximum or minimum, subject to a given constraint.