Mon 13 Oct 2014

- Wed Oct 15: Midterm Exam, 6:30 – 8:00 pm, location: POSC A211 (Poultry Science Auditorium)

2.3 Techniques for Computing Limits

Be able to do questions similar to 1-48, pg. 73

- Know and be able to compute limits using analytical methods (e.g. limit laws, additional techniques)
- Be able to evaluate one-sided and two-sided limits of functions
- Know the Squeeze Thm and be able to use this theorem to determine limits

Note: Material from sections 2.1 and 2.2 are foundational to the chapter. The material may not be explicitly tested, but the topics in these sections are foundational to later sections.

Problems from Past Midterm

Evaluate the following limits:

$$\lim_{x \to 3} \frac{x^2 - x - 6}{x^2 - 9} =$$

$$\lim_{q \to 0} \frac{\sec q \tan q}{q} =$$

2.4 Infinite Limits

Be able to do questions similar to 17-30, pg. 83

- Be able to use a graph, a table, or analytical methods to determine infinite limits
- Be able to use analytical methods to evaluate one-sided limits
- Know the definition of a vertical asymptote and be able to determine whether a function has vertical asymptotes

2.5 Limits at Infinity

Be able to do questions similar to 9-30 and 38-46, pg. 92

- Be able to find limits at infinity and horizontal asymptotes
- Know how to compute the limits at infinity of rational functions and algebraic functions
- Be able to list horizontal and/or vertical asymptotes of a function

2.6 Continuity

Be able to do questions similar to 9-44, pg. 103-104

- Know the definition of continuity and be able to apply the continuity checklist
- Be able to determine the continuity of a function (including those with roots) on an interval
- Be able to apply the Intermediate Value Thm to a function

- **No need to examine problems from section 2.7**

Problem from Past Midterm

Determine the value of *k* so the function is continuous on $0 \le x \le 2$.

$$f(x) = \begin{cases} x^2 + k & 0 \le x < 1 \\ -2kx + 4 & 1 < x \le 2 \end{cases}$$

3.1 Introducing the Derivative

Be able to do questions similar to 11-32, pg. 132

- Know the definition of a derivative and be able to use this definition to calculate the derivative of a given function.
- Be able to determine the equation of a line tangent to the graph of a function at a given point
- Know the 3 conditions for when a function is not differentiable at a point, and why these three conditions make a function not differentiable at the given point

3.2 Rules for Differentiation

Be able to do questions similar to 7-41, pg. 142-143

- Be able to use the various rules for differentiation (e.g., constant rule, power rule, constant multiple rule, sum and difference rule) to calculate the derivative of a function.
- Know the derivative of e^x
- Be able to find slopes and/or equations of tangent lines

Example

Given that $y = 3x + 2$ is tangent to $f(x)$ at $x = 1$ and that $y = -5x+6$ is tangent to $g(x)$ at $x = 1$, write the equation of the tangent line to $h(x) = f(x)g(x)$ at $x = 1$.

Wed 15 Oct

- MIDTERM TO-NITE! 6:30-8p
- location: POSC A211 (Poultry Science Auditorium)
- Thurs-Fri: Related Rates, possibly 4.1

3.3 The Product and Quotient Rules

Be able to do questions similar to 7-42 and 47-52, pg. 152-153

- Be able to use the product and/or quotient rules to calculate the derivative of a given function
- Be able to use the product and/or quotient rules to find tangent lines and/or slopes at a given point
- Know the derivative of e^{kx}
- Be able to combine derivative rules to calculate a derivative of a function

3.4 Derivatives of Trigonometric Functions

- **Be able to do questions similar to 1-55, pg. 161-162**
- Know the two special trigonometric limits

$$\lim_{x \to 0} \frac{\sin x}{x} = 1 \qquad \lim_{x \to 0} \frac{\cos x - 1}{x} = 0$$

and be able to use them to solve other similar limits

- Know the derivatives of sin x, cos x, tan x, cot x,

  sec x, and csc x, and be able to use the quotient rule to derive tan x, cot x, sec x, and csc x
- Be able to calculate derivatives (including higher order) involving trig functions using the rules for differentiation

Review: 3.4 Derivatives of Trigonometric Functions

Exercise: Calculate the derivative of the following functions:

$$f(x) = (1 + \sec x)\sin^3 x$$

$$g(x) = \frac{\sin x + \cot x}{\cos x}$$

3.5 Derivatives as Rates of Change

Be able to do questions similar to 11-18, pg. 171-172

- Be able to use the derivative to answer questions about rates of change involving:
  - Position and velocity;
  - Speed and acceleration;

3.6 The Chain Rule

Be able to do questions similar to 7-43, pg. 180-181

- Be able to use both versions of the Chain Rule to the find the derivative of a composition function
- Know and be able to use the Chain Rule for Powers (e.g., $\frac{d}{dx}\left[(g(x))^n\right] = n\left(g(x)\right)^{n-1} g'(x)$)
- Be able to use the Chain Rule more than once in a calculation involving more than two composition functions

Problem from Past Midterm

Evaluate:

$$\frac{d}{dx} x^3 \sec(2x)$$

3.7 Implicit Differentiation

Be able to do questions similar to 5-26 and 33-46, pg. 189

- Be able to use implicit differentiation to calculate $\frac{dy}{dx}$
- Be able to use the derivative found from implicit differentiation to find the slope at a given point and/or a line tangent to the curve at the given point
- Be able to calculate $\frac{dy}{dx}$ when working with functions containing rational exponents

Review: 3.7 Implicit Differentiation

- Use implicit differentiation to calculate $\frac{dy}{dx}$ for

$$e^{2x} = \sin(xy)$$

If $\sin x = \sin y$, then $\frac{dy}{dx} =$ ____ and $\frac{d^2y}{dx^2} =$ ____

A. $\frac{\cos y}{\cos x}; \frac{\tan y \cos^2 x - \sin x \cos y}{\cos^2 x}$

B. $\frac{\cos x}{\cos y}; \frac{\tan y \cos^2 x - \sin x \cos y}{\cos^2 y}$

C. $\frac{\cos x}{\cos y}; \frac{\cos y(\sin x - \sin y)}{\cos^2 y}$

D. $\frac{\cos y}{\cos x}; \frac{\cos y(\sin x - \sin y)}{\cos^2 x}$

3.8 Derivatives of Logarithmic/Exponential Functions

Be able to do questions similar to 9-22, 26-34, and 43-50, pg. 199-200

- Be able to compute derivatives involving *ln x,* $\log_b x$ and b^x
- Be able to use logarithmic differentiation to evaluate *f'(x).*

3.9 Derivatives of Inverse Trig Functions

Be able to do questions similar to 7-28, pg. 208

- Be able to compute derivatives involving arcsinx and arctanx.
- Know the 6 rules for computing derivatives of inverse trig functions.