

MATH 3200, Fall 2009  
Study Guide 1. Quiz will be on Tues., Aug. 25, 2009)

**Reading** Read sections 1.1, 1.2

**Key Terms/Concepts**

- Classifying Differential Equations
  - Ordinary vs. Partial
  - Linear vs. nonlinear
  - Order
  - System of differential equations
- Solutions
  - Verifying solutions to a differential equation
  - Solution on an interval
  - General Solution
  - Trivial solution
  - Explicit solution vs. implicit solution
- Initial value problem
- Graphical solutions
  - Slope field
  - phase portrait
  - direction field

**Review of Differentiation/Integration Techniques** Please review the following differentiation and integration techniques:

- Essential derivatives: (functions you should be able to differentiate instantly)
  - $x^n, n \neq -1$ .
  - $\ln |kx|$  for  $k \neq 0$ .
  - $\sin(kx)$  and  $\cos(kx)$  for any  $k$ .
  - $e^{(kx)}$  for any  $k$ .
- Essential integrals: (functions you should be able to integrate instantly).
  - $x^n, n \neq -1$ .
  - $1/x$ .

- $\sin(kx)$  and  $\cos(kx)$  for any  $k$ .
- $e^{(kx)}$  for any  $k$ .
- Chain Rule:  $\frac{d}{dx}f(g(x)) = f'(g(x))g'(x)$ .  
Practice problems: Take the derivative of the following functions:
  - \*  $\sin x^2$ .
  - \*  $\ln 3x^2$ .
  - \*  $e^{\sin x}$ .
- Product Rule:  $\frac{d}{dx}f(x)g(x) = f'(x)g(x) + f(x)g'(x)$ .  
Practice:
  - \*  $\sin 2x \cos 3x^2$ .
  - \*  $x^2 e^{3x}$ .
  - \*  $\frac{x}{\sin x}$ .
- Integration by parts:  $\int u dv = uv - \int v du$ .  
Practice: Use integration by parts to integrate the following functions:
  - \*  $x \sin x$ .
  - \*  $x^2 \ln x$ .
  - \*  $x e^{-2x}$ .

**Study Problems (any of these problems may appear on the quiz)**

- Section 1.1: 1,3,5,7,9,11,16, 17, 19, 21, 29, 45, 47, 49, 55, 59
- Section 1.2: 1, 3, 5, 7, 9, 13, 14, 15, 17