MATH 242: TEST 1 STUDY GUIDE

§1.1 Differential Equations and Mathematical Models

- **differential equation**
- **initial condition** and **initial value problem**
- the **order** of a differential equation
- a **solution** of a differential equation
- **ordinary** vs. partial differential equation
- verifying that a given function is a solution (particular or general) to a differential equation

§1.2 Integrals as General and Particular Solutions

- **general** and **particular** solutions
- solving equations of the following form using integration:

$$\frac{dy}{dx} = f(x)$$

- Newtonian mechanics (position, velocity, and acceleration)

§1.3 Slope Fields and Solution Curves

- **slope field**
- **solution curve**
- existence and uniqueness of solutions (see Theorem 1)

§1.4 Separable Equations and Applications

- **separable** differential equations:

$$\frac{dy}{dx} = g(x)h(y)$$

- **implicit** vs explicit solutions
- solving separable equations using separation of variables
- applications: natural growth and decay, cooling and heating

§1.5 Linear First-Order Equations

- **linear first-order equations**:

$$\frac{dy}{dx} + P(x)y = Q(x)$$

- solving linear first-order equations using **integrating factors**

$$\rho(x) = e^{\int P(x)dx}$$

- mixture problems

§1.6 Substitution Methods and Exact Equations

- **substitution**
- **homogeneous** equations:

$$\frac{dy}{dx} = F\left(\frac{y}{x}\right)$$

- **Bernoulli** equations:

$$\frac{dy}{dx} + P(x)y = Q(x)y^n$$

- **exact** equations
- solving Bernoulli and homogeneous equations through substitution methods