Review Test 2

- 6.4: Arc Length

  $L = \int_a^b \sqrt{(\frac{dx}{dt})^2 + (\frac{dy}{dt})^2}dt$ for parametric equations $x = f(t)$ and $y = g(t)$ and $a \leq t \leq b$

  $L = \int_a^b \sqrt{(\frac{dy}{dx})^2 + 1}dx$ or $L = \int_a^b \sqrt{(\frac{dx}{dy})^2 + 1}dy$ for $y = f(x)$ and $x = g(y)$ respectively.

- 6.5: Average Value

  $$\text{avg. value} = \frac{1}{b-a}\int_a^b (f(x)dx)$$

- 6.6: Application of Integration
  - Spring Problems (Using Hooke's Law)

    $$W = \int_a^b kxdx$$

  - Work

    $W = \int F * d$. Use $W_i = F_i * d_i$, where $F_i = \rho * g * V_i$ is the force on the ith piece and d_i = depth/displacement of the ith piece.

  - Hydrostatic Force

    $F = \rho * g * A * d$. Use $F_i = \rho * g * A_i * d_i$, where A_i is the area of the ith piece and d_i is the depth of the ith piece.

    Note: For Hydrostatic Force and Work: $\rho * g$ =δ=the weight given in customary.

  - Moments and Centers of Mass

    $$m = \rho\int_a^b f(x)dx,\ M_y = \rho\int_a^b xf(x)dx,\ M_x = \rho\int_a^b \tfrac{1}{2}f(x)^2dx,$$
    $$(\bar{x}, \bar{y}) = (\tfrac{M_y}{m}, \tfrac{M_x}{m})$$

- 7.1: Modeling with Differential Equations
  - Identify possible solutions and equilibrium solutions.
  - Be able to verify a solution to a differential equation.

- 7.2: Direction Fields and Euler's Method
  - Be able to draw a direction field from a differential equation
  - Be able to identify the direction field of a given differential equation
  - Know how to find an estimate for y(x) for some x using Euler's method:

    $$y_{n+1} = y_n + hF(x_{n-1}, y_{n-1}) \text{ where } y' = F(x, y).$$

- 7.3: Separable Equations
  - Identify and solve separable equations.
  - Find orthogonal trajectories.
  - Solve mixing problems.