1. Use Euler’s method with a step size of $h = .25$ to approximate the value of $y(0.5)$ if $y' = t^2 - y^3$, $y(0) = 0$.

2. A differential equation representing a family of curves is given by

$$y' = \frac{x + y}{x}.$$  

Find the curve of this family which passes through the point $(3, 0)$.

3. Solve the initial value problem $\frac{dy}{dx} = \frac{xy^2 + 3x}{y + x^2y}$, $y(1) = 3$.

4. Solve the initial value problem $\frac{dy}{dx} = \frac{x}{x^2 - 3x + 2}$, $y(3) = 4$.

5. Find a general solution to the differential equation $\frac{dy}{dt} = 4 - y^2$.

6. Find a general solution to the differential equation

$$[4y^4 - (2y - 3)x]\frac{dy}{dx} - y = 0.$$ 

7. Solve the initial value problem

$$\cos(x)\frac{dy}{dx} + \sin(x)y = \cos(x); \quad y(\pi) = 4.$$ 

8. Do #28 in Section 8.4 of the textbook (page 588).

9. Do #26 in Section 8.5 of the textbook (page 598).

10. A radiocarbon dating test performed on an excavated oak chest showed that it was 822 years old. When compared with a piece of present-day oak, what percentage of C$^{14}$ is present in the oak chest that was tested? (For this problem, suppose the half-life of C$^{14}$ is 5700 years.)

11. Assuming $y = f(x)$, solve the following initial value problems.

   a.) $y''' - 6y'' + 12y' - 8y = 0; \quad y(0) = y'(0) = 2; \quad y''(0) = 3$.

   b.) $y''' + 2y'' + 5y' = 0; \quad y(0) = 1; \quad y'(0) = -4; \quad y''(0) = 6$. 

Exam 2 Review Assignment, due Tuesday, March 25\textsuperscript{th} by 5:00 p.m. (30 points)
12. Find a differential equation whose general solution is
\[ y(x) = e^{3x}(c_1 + c_2 x + c_3 \cos(2x) + c_4 \sin(2x)) \].

13. Find a general solution to the differential equation
\[ x \frac{dy}{dx} + 6y = 3xy^{1/3} \]
by following the steps given:

**Step I.** Suppose \( u = y^{1-4/3} = y^{-1/3} \). Then \( y = u^{-3} \). Find \( y' = \frac{dy}{dx} \) in terms of \( u' = \frac{du}{dx} \).

**Step II.** Substitute out the \( \frac{dy}{dx} \) and all of the powers of \( y \) from the original differential equation and replace them with \( \frac{du}{dx} \) and powers of \( u \), respectively.

**Step III.** Simplify the new equation to be of the form \( u' + P(x)u = Q(x) \), and solve this equation for \( u(x) \).

**Step IV.** Substitute \( y \) back in for \( u \) and solve for \( y(x) \).