Homework Exercises (to be turned in)

1. For each of the following differential equations, state the order and determine whether the equation is linear or nonlinear. Identify the independent and dependent variables.

   (a) $x\dfrac{d^3y}{dx^3} - \left(\dfrac{dy}{dx}\right)^4 + y = 0$

   (b) $\dfrac{d^2u}{dr^2} + \dfrac{du}{dr} + u = \cos(r+u)$

   (c) $(1-x)y'' - 4xy' + 5y = \cos x$

   (d) $t^5y^{(4)} - t^3y'' + 6y = 0$

   (e) $(\sin\theta)y''' - (\cos\theta)y' = 2$

2. Verify that the indicated function is an explicit solution of the given differential equation.

$$y' + 35y = 56; \qquad y = \frac{8}{5} - \frac{8}{5}e^{-35t}$$

3. Verify that the indicated family of functions is a solution of the given differential equation.

$$\frac{d^2y}{dx^2} - 8\frac{dy}{dx} + 16y = 0; \qquad y = c_1e^{4x} + c_2xe^{4x}$$

4. Find the value(s) of m so that the function $y = e^{mx}$ is a solution of $y'' - 5y' + 6y = 0$.

Additional Exercises (not turned in, do for your own practice)

5. For each of the following differential equations, state the order and determine whether the equation is linear or nonlinear. Identify the independent and dependent variables.

   (a) $5\dfrac{d^2x}{dt^2} + 4\dfrac{dx}{dt} + 9x = 2\cos(3t)$

   (b) $\dfrac{dy}{dx} = \dfrac{y(2-3x)}{x(1-3y)}$

   (c) $y\left[1 + \left(\dfrac{dy}{dx}\right)^2\right] = C$, where C is a constant

   (d) $\dfrac{\partial^2u}{\partial x^2} + \dfrac{\partial^2u}{\partial y^2} = 0$

   (e) $8\dfrac{d^4y}{dx^4} = x(1-x)$

6. Verify that the indicated function is an explicit solution of the given differential equation.

$$y'' + y = \tan x; \qquad y = -(\cos x)\ln(\sec x + \tan x)$$

7. Find the value(s) of m so that the function $y = x^m$ is a solution of $xy'' + 2y' = 0$.