MATH 2260 (Ordinary Differential Equations I) — Winter 2015
Homework #1

Due Date: Wednesday, January 21, in class or in marking box #31 by 5:00 PM. You must show all work to receive credit.

1. (20 points) For each of the following ODEs, state the order and if they are linear or nonlinear.

   (a) $y''' + x^3 y = \sin(x)$

   (b) $\sqrt{y^{(4)}} + (y'')^5 = e^{-x^3/2}$

   (c) $\frac{d^3 y}{dx^3} + \frac{d^5 y}{dx^5} + \frac{dy}{dx} = y^9$

   (d) $x^2 y' + \tan(x) y = 0$

   (e) $\sin(x) y' + y^{(2)} = e^{2x}$

2. (10 points) For each of the following ODEs, check if the given function is a solution to the ODE

   (a) $xy' - 2y = 0$, $y(x) = \frac{1}{x^2}$

   (b) $y'' + 2y' + y = 0$, $y(x) = cxe^{-x}$

3. (10 points) Find the general solutions to the following equations

   (a) $y' = x^2 e^{-x}$

   (b) $y^{(3)} = \cos(x)$

4. (10 points) Sketch the direction field and some integral curves for $y' = \frac{-y}{1+y^2}$.

5. (30 points) Solve the following ODEs.

   (a) $y' + \frac{1}{x} y = \frac{2}{x^2} + 4$ for $x > 0$

   (b) $y' + (2\sin(x)\cos(x))y = e^{-\sin^2(x)}$

   (c) $y' \ln|y| + x^2 y = 0$

6. (20 points) Solve the following initial-value problems

   (a) $xy' + 3y = \frac{2}{x(1+x^2)}$, $y(-1) = 0$

   (b) $y' = \frac{x^2 + 3x + 2}{y - 2}$, $y(1) = 4$