

MATH 2260 (Ordinary Differential Equations I) — Fall 2014
Homework #1

Due Date: Thursday, September 18, in class or in marking box #59 by 5:00 PM. You must show all work to receive credit.

1. (6 points) State the order of the following ODEs:

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

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

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

2. (12 points) For each of the following first-order ODEs, state if they are linear. If they are linear, state if they are homogeneous.

(a) $x^2y' + x^5y = 0$

(b) $x^3y' = x^7y^2$

(c) $\sin(x)y' + y = e^x$

(d) $y' + x \sin(y) = e^x$

3. (20 points) For each of the following ODEs, check if the given function is a solution to the ODE

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

(b) $\sin(x)y' + \cos(x)y = 1$, $y(x) = \cos(x)$

(c) $y^{(4)} + 16y = 0$, $y(x) = e^{2x}$

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

4. (12 points) Find the general solutions to the following equations

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

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

5. (10 points) Find the solution to the initial value problem $y'' = e^x + e^{-x}$, $y(0) = 1$, $y'(0) = 2$

6. (10 points) Sketch the direction field and some integral curves for $y' = \frac{-y}{1+y^2}$.

7. (10 points) Use separation of variables to find the general solution to $\cos^2(x)y' + y = 0$.

8. (20 points) Use variation of parameters to find the general solution to $y' - \frac{x}{x^2+1}y = e^{-x}(x^2+1)^{1/2}$.