

Math 3002: Problem Set 2

1. Rewrite each equation in the standard form of linear equations. Then solve each differential equation, showing and justifying all work:

(a)

$$y' = \frac{x - y \cos(x)}{\sin(x)}$$

(b)

$$y' = \frac{y + x^2}{2x}$$

(c)

$$xy' = x \sin(x) + y$$

(hint: integration by parts gives $\int x \sin(x) dx = \sin(x) - x \cos(x) + c$)

(d)

$$x^2 y' + xy = 12x^2$$

- (e) For each differential equation above, write the corresponding homogeneous version (i.e., replace $b(x)$ with 0, using the notation from class), and find the solution of these homogeneous equations. Recognize anything?

2. Find a solution to the following differential equations:

(a)

$$y' - 3y = 6$$

(b)

$$y' - 3y = x$$

- (c) If $y_a(x)$ is your solution from part (a), and $y_b(x)$ is your solution for part (b), define a new function

$$z(x) = y_a(x) + y_b(x)$$

Find a differential equation which $z(x)$ solves.

Can you relate this question to question 1(e)?