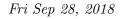
Worksheet 3







Problem 1

In the last worksheet, you were given a Chemical Reaction between CH_3Cl and NaOH, which combined in such a way that initial amount of CH_3Cl was α and the initial amount of NaOH is β for chemical. These two compounds combined to form an X amount of CH_3OH with some amount of NaCl. You were asked to write the mathematical model of differential equation for X(t).

 $CH_3Cl + NaOH \longrightarrow CH_3OH + NaCl$

Recall the differential equation for X(t). Is the differential equation linear or non-linear? Also state the reason for your answer.

Problem 2

Verify that the function y is a solution of the associated differential equation. Assume an appropriate interval of definition for each solution:

- (a) $2y' + y = 0; y = e^{-\frac{x}{2}}.$
- (b) $y' = 2xy^2; y = \frac{1}{4-x^2}.$

Problem 3

Answer the following for the differential equations in parts (a) to (d):

- (i) Identify the independent and dependent variables
- (ii) Identify the order of differential equations, and state the reason.
- (iii) Write the differential equation in general form
- (iv) Write the differential equation in normal form
- (v) Identify if the differential equation is linear or non-linear and state the reason.

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

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

(c)
$$\frac{d^2y}{dx^2} = \sqrt{1 + \left(\frac{dy}{dx}\right)^2};$$

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

Problem 4

Consider the differential equation $y' = \sqrt{y^2 - 9}$. Determine whether the existence of unique solution theorem guarantees a unique solution through the given points:

- (a) (1,4)
- (b) (5,3)
- (c) (2, -3)
- (d) (-1,1)