ASSIGNMENT-1

Due date : 5 March '24

I.

Verify that the given function satisfies the differential equation and find a value of C that satisfies the initial condition :

$$y' + y \tan x = \cos x \; ; \; y(x) = (x + C)\cos x \; ; \; y(\pi) = 0$$

II. Solve :

(a) $\frac{dy}{dx} = \frac{x}{\sqrt{x^2+9}}$; $y(4) = 2$

(b) $\frac{dy}{dx} = y^2 + 2$

III. Use the existence-uniqueness theorem to deduce whether the following IVPs have a unique solution or not :

(a) $\frac{dy}{dx} = \sqrt{x-y}$; $y(2) = 2$

(b) $\frac{dy}{dx} = \sqrt{x-y}$; $y(2) = 1$.

(If it does have a unique solution

give an example of a rectangle where the hypotheses are satisfied.)

IV. The half-life of radioactive cobalt is 5.27 years. Suppose a nuclear accident has left the level of cobalt radiation in a certain region at 100 times the level acceptable for human habitation. How long will it be until the region is again habitable?

V. Write down a differential equation that is a mathematical model of the following situation:

"In a city with fixed population of P persons, the time rate of change of the number N of those persons infected with a certain contagious disease is proportional to the product of the number who have the disease and the number who do not."