Assignment 2

AI1110: Probability and Random Variables

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ICSE 2017 Grade 12

Question (1.X) : solve the equation:

$$\frac{dy}{dx} = 1 - xy + y - x$$

Solution:

$$\frac{dy}{dx} = 1 - xy + y - x \tag{1}$$

Some standard results used:

i $\int x^n dx = \frac{x^{n+1}}{n+1} + c$

ii $\int \frac{1}{x}\, dx = \log_e x + c$

Using Variable Separable method,

$$\implies \frac{dy}{dx} = 1 - x + y(1 - x) \tag{2}$$

$$\implies \frac{dy}{dx} = (1 - x)(1 + y) \tag{3}$$

$$\implies \frac{dy}{(1 + y)} = (1 - x)dx \tag{4}$$

Integrating both sides,

$$\implies \int \frac{dy}{(1 + y)} = \int (1 - x)dx \tag{5}$$

Using formula (ii) for LHS,

$$\implies \int \frac{dy}{(1 + y)} = \log_e \mid 1 + y \mid + c \tag{6}$$

Using formula (i) for RHS,

$$\implies \int (1 - x)dx = x - \frac{x^2}{2} + c \tag{7}$$

From (5), (6) and (7),

$$\implies \log_e \mid 1 + y \mid = x - \frac{x^2}{2} + c \tag{8}$$

where 'c' is the integration constant.

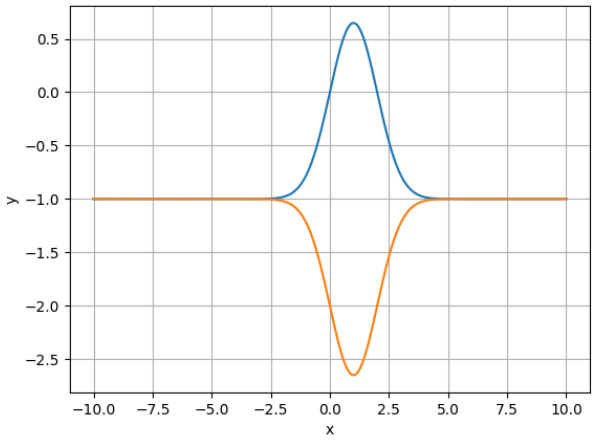

Fig. 1. graph for curve corresponding to equation (8).(where integration constant c is assumed to be 0