TUTORIAL 1: FIRST ORDER ORDINARY DIFFERENTIAL EQUATIONS

I. Solve the following differential equations

1. $\dfrac{dy}{dt} + 3y = t + e^{-2t}$.

2. $(1+x^2)\dfrac{dy}{dx} + 4xy = (1+x^2)^{-2}$.

3. $\dfrac{dy}{dx} = \dfrac{xy + 3x - y - 3}{xy - 2x + 4y - 8}$.

4. $x\sqrt{1+y^2}\ dx = y\sqrt{1+x^2}\ dy$.

5. $y' + 4x^2 y = (4x^2 - x)e^{-x^2/2}$.

6. $y^2 dx + (3xy - 1)dy = 0$.

7. $(y+1)dy + (xy^2 + 2xy - x)dx = 0$.

8. $(x + \tan y)dy = \sin 2y dx$.

9. $\dfrac{dy}{dx} = \dfrac{4x^3y^2 - 3x^2y}{x^3 - 2x^4y}$.

10. $\dfrac{dy}{dx} + x\sin 2y = x^3\cos^3 y$.

11. $(2xy + 3y^2)dx - (2xy + x^2)dy = 0$.

12. $3x(x + y^2)dy + (x^3 - 3xy - 2y^3)dx = 0$.

13. $\left(\dfrac{e^x \sin y}{y} - 2\sin x\right) dx + \left(\dfrac{e^x \cos y + 2\cos x}{y}\right) dy = 0$.

14. $\dfrac{dz}{dx} + \dfrac{z}{x}\log z = \dfrac{z}{x}(\log z)^2$.

II. Solve the following Initial value problem(IVP)

1. $\dfrac{dy}{dx} = \dfrac{e^{-x} - e^{x}}{3 + 4y}, \quad y(0) = 1.$
2. $t\dfrac{dy}{dt} + 2y = \sin t, \quad y(\pi/2) = 1, \quad y(\pi/2) = 1.$
3. $\dfrac{dy}{dx} - y \sin x = 2 \sin x, \quad y(\pi/2) = 1.$
4. $(x + ye^{y/x})\, dx - xe^{y/x}\, dy = 0, \quad y(1) = 0.$
5. $r \sin\theta - \cos\theta \dfrac{dr}{d\theta} = r^2, \quad r(\pi) = 1.$
6. $2(3x^2 + 2y^3 + 6y)dx + 3(x + xy^2)dy = 0, \quad y(1) = 2.$
7. $y(2xy + 1)dx - xdy = 0, \quad y(0) = -2.$