

**Department of Mathematics**  
**School of Computer Science Engineering and Technology**  
**Bennett University**

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**Course Name: Linear Algebra & ODEs**  
**Semester: Even**  
**Type: Core (L-T-P: 3-1-0)**

	CO1	CO2	CO3	CO4	CO5
Q1				✓	
Q2				✓	
Q3				✓	
Q4				✓	

**Tutorial Sheet 7**

1) Classify each of the following differential equation as linear or nonlinear. Also find the order and degree of differential equation:

(a)  $x^2 dy + y^2 dx = 0$ ; (b)  $\frac{d^2 y}{dx^2} + x \sin y = 0$ ; (c)  $\frac{d^6 y}{dx^6} + \frac{d^4 y}{dx^4} \frac{d^3 y}{dx^3} + y = x$ ;

(d)  $\left(\frac{dy}{dx}\right)^3 = \sqrt{\frac{d^2 y}{dx^2}} + 1$ .

2) Verify that  $y$  is a solution of the ODE. Determine from  $y$  the particular solution of the IVP.

(a)  $\frac{dy}{dx} = y - y^2$ ;  $y = \frac{1}{1 + ce^{-x}}$ ,  $y(0) = \frac{1}{4}$ ,

(b)  $\frac{dy}{dx} = y + e^x$ ;  $y = (x + c)e^x$ ,  $y(0) = \frac{1}{2}$ .

**Hint:** (a)  $y_p = \frac{1}{1+3e^{-x}}$ , (b)  $y_p = (x + \frac{1}{2})e^x$ .

3) Solve the following ODEs:

(a)  $\frac{dy}{dx} = (x + 1)e^{-x}y^2$ ; (b)  $\frac{dy}{dx} = \sec^2 y$ ;

(c)  $2xy \frac{dy}{dx} = y^2 - x^2$ ; (d)  $x \frac{dy}{dx} = y + 3x^4 \cos^2(y/x)$ ;  $y(1) = 0$ .

**Hint:** (a)  $y = \frac{1}{(x+2)e^{-x}-c}$ , (c)  $x^2 + y^2 = cx$ , (d)  $y = x \tan^{-1}(x^3 - 1)$ .

4) Solve the following ODEs:

(a)  $(x \tan(y/x) + y)dx - xdy = 0$ ; (b)  $(5x + 2y + 1)dx + (2x + y + 1)dy = 0$ .

**Hint:** (a)  $\sin(y/x) = cx$ , (b)  $5x^2 + 4xy + y^2 + 2x + 2y = c$ .