Q.1) Solve the following:

(a)$3x(xy-2)dx+(x^3+2y)dy=0$ [CO 2] [2]

(b)$(2\cos y+4x^2)dx-x\sin ydy==0$ [CO 2] [3]

Q.2) Find a homogeneous linear second order ordinary differential equation whose solution is the set of all straight lines in the xy-plane. [CO 1] [1]

Q.3)State whether the following differential euations are linear or non linear ,justify and solve:

(a)$xy'+2y=\frac{e^{3x}}{x}, x>0 with y(1)=1+\frac{e^3}{3}.$ [CO 2] [3]

(b)$x^2y\frac{dy}{dx}-xy^2=1$ [CO 2] [3]

Q.4) If x^2 and 1 are solutions of $yy''-xy'=0$ then so is any linear combination of these. State true or false and justify. [CO 4] [2]

Q.5)Solve the following Matrices related questions [CO 2] [6]

1. Find the Rank and Nullity of following Matrix:

$$A=\begin{bmatrix}4 & -22 & -14 & 1\\ 3 & 37 & 85 & 2\\ 2 & 10 & 31 & 4\\ 15 & 2 & 4 & 7\end{bmatrix}$$

2. Solve the given equation of form $AX=B$

$$A=\begin{Bmatrix}1 & 3 & 1\\ 1 & 2 & 4\\ 5 & 4 & 7\end{Bmatrix}, X=\begin{pmatrix}a\\ b\\ c\end{pmatrix} B=\begin{pmatrix}16\\ 4\\ 5\end{pmatrix}$$

3. Show that the following matrix is diagonalizable:

$$A=\begin{bmatrix}5 & 0 & 1\\ 2 & 3 & 11\\ 6 & 2 & 3\end{bmatrix}$$