Differential Equations Seminar: Week 1 Solutions

1.

$x'(t) = Cte^{\frac{t^2}{2}}$

$tx(t) = Cte^{\frac{t^2}{2}}$.

2.

$\mathbf{x}'(t) = \begin{pmatrix} 2\cos(2t) \\ -2\sin(2t) \end{pmatrix}$

$\begin{pmatrix} 0 & 2 \\ -2 & 0 \end{pmatrix} \mathbf{x}(t) = \begin{pmatrix} 0 & 2 \\ -2 & 0 \end{pmatrix} \begin{pmatrix} \sin(2t) \\ \cos(2t) \end{pmatrix} = \begin{pmatrix} 2\cos(2t) \\ -2\sin(2t) \end{pmatrix}$.

3.

(a) linear, inhomogeneous

(b) nonlinear

(c) linear, homogeneous

(d) nonlinear

4.

(a)

$\mathbf{u}' = \begin{pmatrix} 0 & 1 \\ -4 & -2 \end{pmatrix} \mathbf{u}$

(b)

$u_1' = u_2$

$u_2' = u_3$

$u_3' = -u_1 u_3 + \cos(t)$.