MA 138 Worksheet #26

Sections 10.4 & 11.1

4/11/24

1. Find the Jacobi matrix for $\mathbf{f}(x,y) = \begin{bmatrix} x+y \\ x^2-y^2 \end{bmatrix}$.

2. Find the Jacobi matrix for $\mathbf{f}(x,y) = \begin{bmatrix} e^{x-y} \\ e^{x+y} \end{bmatrix}$.

3. Find the Jacobi matrix for $\mathbf{f}(x,y) = \begin{bmatrix} 2x^2y - 3y + x \\ e^x \sin y \end{bmatrix}$.

4. Find a linear approximation to the vector-valued function $\mathbf{f}(x,y) = \begin{bmatrix} e^{2x-y} \\ \ln(2x-y) \end{bmatrix}$ at $(1,1)$.

5. Find a linear approximation to the vector-valued function $\mathbf{f}(x,y) = \begin{bmatrix} e^x \sin y \\ e^{-y} \cos x \end{bmatrix}$ at $(0,0)$.

6. Find a linear approximation to the vector-valued function $\mathbf{f}(x,y) = \begin{bmatrix} (x+y)^2 \\ xy \end{bmatrix}$ at $(-1,1)$.

7. (a) Assuming a, b, and k are constants, calculate the following derivative: $\dfrac{d}{dt}\left(\begin{bmatrix} a \\ b \end{bmatrix} e^{kt} \right)$.

(b) Find a value of k so that $\begin{bmatrix} 1 \\ -1 \end{bmatrix} e^{kt}$ is a solution to $\dfrac{d}{dt}\begin{bmatrix} x_1 \\ x_2 \end{bmatrix} = \begin{bmatrix} 7 & 2 \\ -4 & 1 \end{bmatrix}\begin{bmatrix} x_1 \\ x_2 \end{bmatrix}$.

(c) Find a value of k so that $\begin{bmatrix} 1 \\ -2 \end{bmatrix} e^{kt}$ is a solution to $\dfrac{d}{dt}\begin{bmatrix} x_1 \\ x_2 \end{bmatrix} = \begin{bmatrix} 7 & 2 \\ -4 & 1 \end{bmatrix}\begin{bmatrix} x_1 \\ x_2 \end{bmatrix}$.