Math problem set

1 Calculus

1. What is $\frac{d}{dx}x^{-1/2}$? (HINT: use the Power Rule)

2. What is $\frac{d}{dx}x^2\sin(x)$? (HINT: use the Product Rule: $\frac{d}{dx}f(x)\cdot g(x) = f'(x)g(x) + f(x)g'(x)$)

3. What is $\frac{d}{dx}e^{(2x^{-3})}$? (HINT: use the Chain Rule: $\frac{d}{dx}g(f(x)) = g'(f(x))\cdot f'(x)$)

4. What is $\frac{d}{dx}\sqrt{\frac{x-1}{x+1}}$?

5. What is $\frac{d}{dx_i}x_i\sum_{j=0}^{N-1}e^{x_j}$?

2 Linear Algebra

For the following let:

$$\mathbf{x} = \begin{bmatrix}2 & 3\end{bmatrix}, \qquad \mathbf{y} = \begin{bmatrix}1\\0\end{bmatrix}, \qquad \mathbf{M} = \begin{bmatrix}2 & 0\\1 & 1\end{bmatrix} \quad \text{and} \quad \mathbf{N} = \begin{bmatrix}1 & 0 & 0\\0 & 2 & 1\end{bmatrix}. \tag{1}$$

1. What is $\mathbf{x}\cdot\mathbf{y}$?

2. What is $\mathbf{y}\cdot\mathbf{x}^T$?

3. (True/False) Is $\mathbf{M}\cdot\mathbf{N}$ a valid operation? (what is the result?)
4. (True/False) Is $\mathbf{N}\cdot\mathbf{M}$ a valid operation? (what is the result?)
5. (True/False) Is $\mathbf{N}^T\cdot\mathbf{M}$ a valid operation? (what is the result?)
6. (True/False) Is $\mathbf{x}\cdot\mathbf{N}$ a valid operation? (what is the result?)