Q5.5

Find the gradient of the function

a) $f(x,y) = x^2y + yx^3 - y^2 + 2x + 4$

$$\nabla(f) = \begin{bmatrix} \frac{\partial}{\partial x}(f) \\ \frac{\partial}{\partial y}(f) \end{bmatrix} = \begin{bmatrix} \left(3x^2y + 2xy + 2\right) \\ \left(x^3 + x^2 - 2y\right) \end{bmatrix}$$

b) $f(x_1, x_2, x_3) = x_1 sin(x_2) + 2x_2x_3^2$

$$\nabla(f) = \begin{bmatrix} \frac{\partial}{\partial x_1}(f) \\ \frac{\partial}{\partial x_2}(f) \\ \frac{\partial}{\partial x_3}(f) \end{bmatrix} = \begin{bmatrix} \sin(x_2) \\ \left(x_1\cos(x_2) + 2x_3^2\right) \\ 4x_2x_3 \end{bmatrix}$$

c) $f(x_1, x_2) = x_2e^{-x_1}$

$$\nabla(f) = \begin{bmatrix} \frac{\partial}{\partial x_1}(f) \\ \frac{\partial}{\partial x_2}(f) \end{bmatrix} = \begin{bmatrix} \left(-e^{-x_1}x_2\right) \\ e^{-x_1} \end{bmatrix}$$