ALEX TE
COEN 240 - ML
Dr. Sumarsono

HOMEWORK 3
(partial derivative)

9/24/21

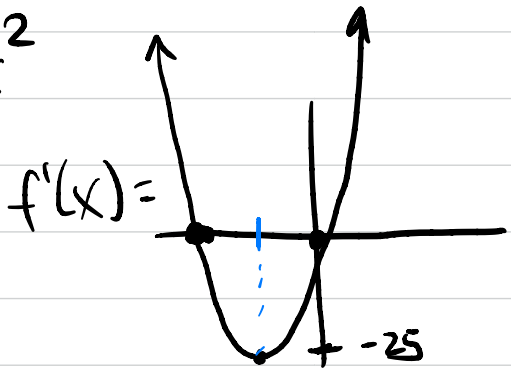
1. $f(x) = 5(x+47)^2$

$f'(x) = 10(x+47) \cdot 1 = 10(x+47)$

2. min/max of $f(x) = 3x^3 + 15x^2$

$f'(x) = 9x^2 + 30x$

$f''(x) = 18x + 30$



minimum at $X = -1.667$ @ -25.

Partial derivatives

3. $f(x,y) = 3x + 4y$

$\nabla_x f(x,y) = 3$ $\nabla_y f(x,y) = 4$

4. $f(x,y) = xy^3 + x^2y^2$

$\nabla_x f(x,y) = y^3 + 2xy^2$ $\nabla_y = 3xy^2 + 2x^2y$

5. $f(x,y) = x^3y + e^x$

$\nabla_x f(x,y) = 3x^2y + e^x \qquad \nabla_y = x^3$

6. $f(x,y) = xe^{2x+3y}$

$\nabla_x f(x,y) = e^{2x+3y} \cdot xe^{2x+3y} \cdot 2$

$= e^{2x+3y} \cdot 2xe^{2x+3y}$

$\nabla_y f(x,y) = xe^{2x+3y} \cdot 3 = 3xe^{2x+3y}$

7. $J(w_0,w_1) = \frac{1}{2m} \sum_{i=1}^{m} (w_0 + w_1 x^{(i)} - y_i)^2$

$\nabla_{w_0} J = \frac{1}{2m} \sum_{i=1}^{m} 2 \cdot 1 + 2 \cdot 1 + 2 \cdot 1 = \frac{1}{2m} \sum_{i=1}^{m} 2$

$\nabla_{w_1} J = \frac{1}{2m} \sum_{i=1}^{m} 2x^i + 2x^i + 2x^i \dots = \frac{1}{2m} \sum_{i=1}^{m} 2x^i$

8. $f(x) = \frac{1}{1+e^{-x}}$

$f'(x) = \frac{0 \cdot 1 + e^{-x} - (1 \cdot (-e^{-x}))}{(1+e^{-x})^2} = \frac{e^{-x}}{(1+e^{-x})(1+e^{-x})} = \frac{e^{-x}}{1+2e^{-x}+e^{-2x}}$