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# Assignment - 3

1). Find the derivative of the function $f(x) = 5(x + 47)^2$

$$f'(x) = 5 \times 2\,(x + 47) = 10(x + 47)$$

2). Determine the minimum and maximum of the function $f(x) = 3x^3 + 15x^2$. Then sketch it.

$$f'(x) = 3 \times 3x^2 + 15 \times 2x = 0$$

$$= 9x^2 + 30x = 0$$

$$x = 0 \quad ; \quad x = -3.33$$

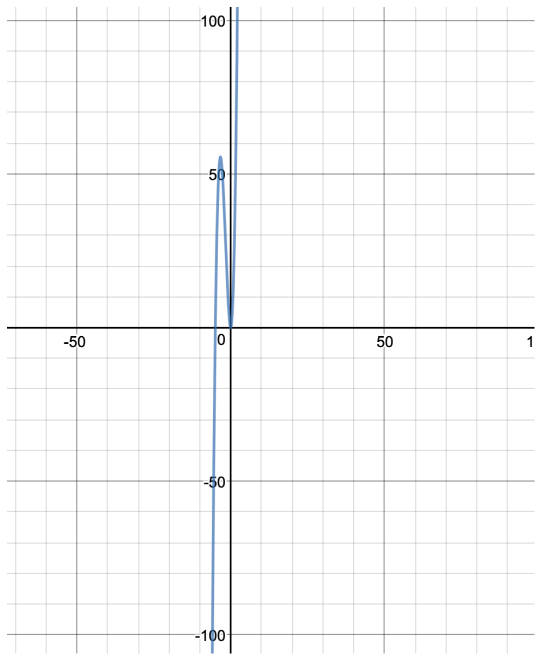
$$f''(x) = 18x + 30$$

$$f''(0) = 18(0) + 30 \quad > 0$$

$\therefore$ Minimum i.e, min $(0, 0)$

$$f''(-3.33) = 18(-3.33) + 30 \quad < 0$$

$\therefore$ Maximum i.e, max $(-3.33, 55.56)$




Find the partial derivatives $\frac{\partial f}{\partial x}$ and $\frac{\partial f}{\partial y}$ for the following functions:

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

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

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

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

3) $\frac{\partial f}{\partial x} = 3$ $\quad$ $\frac{\partial f}{\partial y} = 4$

4) $\frac{\partial f}{\partial x} = y^3 + 2xy^2$ $\quad$ $\frac{\partial f}{\partial y} = 3xy^2 + 2x^2y$

5) $\frac{\partial f}{\partial x} = 3x^2y + e^x$ $\quad$ $\frac{\partial f}{\partial y} = x^3$

6) $\frac{\partial f}{\partial x} = e^{2x+3y} + 2xe^{2x+3y}$

$\frac{\partial f}{\partial y} = 3xe^{2x+3y}$

7). Given the function $J(\mathbf{w})$:

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

Determine $\frac{\partial J(\mathbf{w})}{\partial w_0}$ and $\frac{\partial J(\mathbf{w})}{\partial w_1}$

$$\frac{\partial J(w)}{\partial w_0} = \frac{1}{m}\sum_{i=1}^{m}(w_0 + w_1 x^{(i)} - y_i)$$

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

8). Find the derivative of the function $f(x) = \frac{1}{1+e^{-x}}$

$$a = \frac{b}{c} \Rightarrow a' = \frac{b'c - c'b}{c^2}$$

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