Part-1.

a. 3D space $z = f(x,y) = ax + by + c$

$$\frac{dz}{dx} = a \qquad \frac{dz}{dy} = b \qquad \begin{bmatrix} a \\ b \end{bmatrix}$$

b. $z = f(x) = f(x_1, x_2, \cdots, x_N)$

$$= \sum_{i=1}^{N} a_i (x_i - b_i) + S$$

$$= a_1 x_1 + a_2 x_2 + \cdots + a_N x_N + d$$

$$= \begin{bmatrix} a_1 \\ a_2 \\ \vdots \\ a_N \end{bmatrix}$$

c. $f_x(x,y) = \left(\frac{\partial f(x,y)}{\partial x}\right) = 2A(x - x_0)$

$$f_y(x,y) = \left(\frac{\partial f(x,y)}{\partial y}\right) = 2B(y - y_0)$$

d. $x = \begin{pmatrix} 3 \\ 1 \\ 4 \end{pmatrix}$ $y = (2, 5, 1)$

[3×1] [1×3]

$A = \begin{bmatrix} 4 & 5 & 2 \\ 3 & 1 & 5 \\ 6 & 4 & 3 \end{bmatrix}$ $B = \begin{bmatrix} 3 & 5 \\ 5 & 2 \\ 1 & 4 \end{bmatrix}$

[3×3] [3×2]

$x^T = [3\ 1\ 4]$ $y^T = \begin{bmatrix} 2 \\ 5 \\ 1 \end{bmatrix}$

$A$ $B^T = \begin{bmatrix} 3 & 5 & 1 \\ 5 & 2 & 4 \end{bmatrix}$

$x \cdot x^T = \begin{bmatrix} 9 \\ 1 \\ 16 \end{bmatrix}$ $x \cdot y^T = \begin{bmatrix} 6 \\ 5 \\ 4 \end{bmatrix}$

$y * x = 15$ $x \cdot y = 0$

$A \cdot x = \begin{bmatrix} 25 \\ 30 \\ 24 \end{bmatrix}$ $A \times B = \begin{bmatrix} 39 & 38 \\ 19 & 37 \\ 49 & 50 \end{bmatrix}$

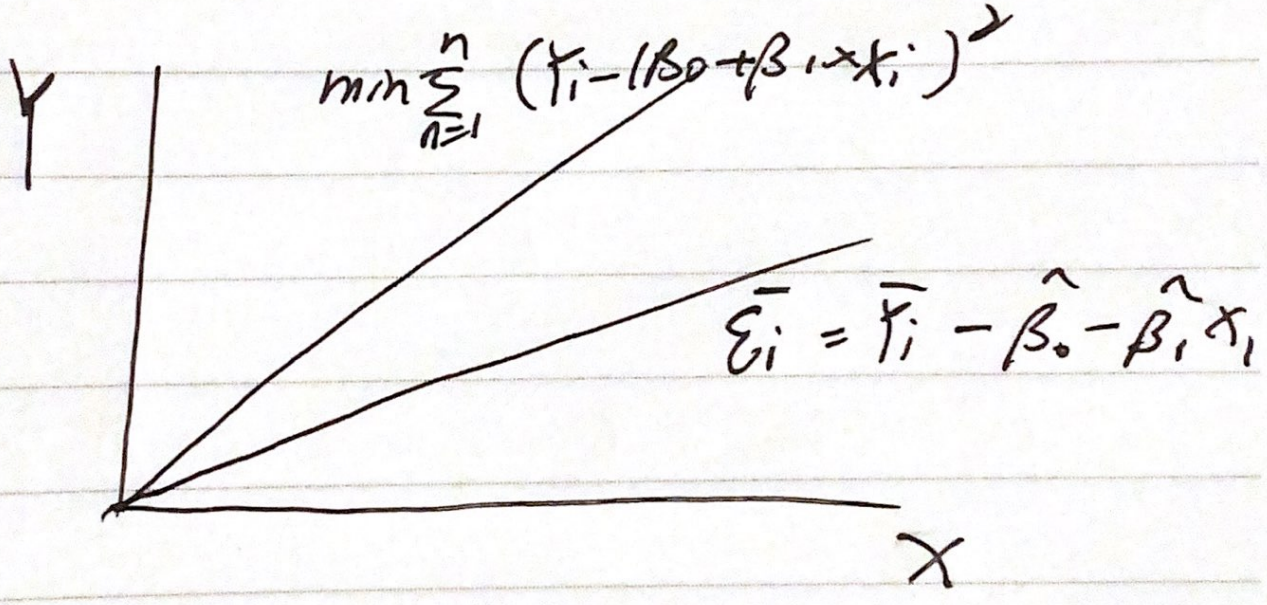
B.reshape(1,6) = [3 5 5 2 1 4]

Part-1 : LLS : Single-variable

{ liner function : $y = ax_1 + bx_2 + \cdots + nx_n$
liner regression :

$$y = \beta_1 x_1 + \beta_2 x_2 + \cdots + \beta_n x_n + \varepsilon$$

difference : $\varepsilon$




$$SST = \sum_{i=1}^{n} (Y_i - \bar{Y})^2$$

$$RSS = \sum_{i=1}^{n} (Y_i - \hat{\beta_0} - \hat{\beta_1} x_{i1} - \hat{\beta_2} x_{i2} - \cdots - \hat{\beta_p} x_{ip})^2$$

$$R^2 = \left(1 - \frac{RSS_1}{RSS_0}\right) \times 100\%$$