$X = [x1\ \ x2\ \ x3]^T$. $X_0 = (0\ 0\ 0)^T$

$f(x) = 0.5x_1^2+x_2^2+1.5x_3^2+x_1+2x_2+3x_3+2$

$\Delta f(x) = (x_1+1 \quad 2x_2+2 \quad 3x_3+3)^T$

$\Delta f(x_0) = (1\ \ 2\ \ 3)^T$

Newton Descent:

- ⇨ $X_1 = x_0 - \eta * \Delta f(x_0)$
- ⇨ $X1 = (0\ \ 0\ \ 0)^T - 0.1*(1\ 2\ 3\ )^T = -1 * (0.1\ \ 0.2\ \ 0.3\ )^T = (-0.1\ -0.2\ -0.3)^T$

Gradient Descent:

- ⇨ $X_1 = x_0 - H^{-1} * \Delta f(x_0)$
- ⇨ $X_1 = x_0 - H^{-1} * (\ \partial f/\partial x1 \quad \partial f/\partial x2 \quad \partial f/\partial x3\ )^T$
- ⇨ Hessian matrix = H =

$$\begin{bmatrix} \partial^2 f/\partial x1^2 & \partial^2 f/\partial x1\partial x2 & \partial^2 f/\partial x1\partial x3 \\ \partial^2 f/\partial x2\partial x1 & \partial^2 f/\partial x2^2 & \partial^2 f/\partial x2\partial x3 \\ \partial^2 f/\partial x3\partial x1 & \partial^2 f/\partial x3\partial x2 & \partial^2 f/\partial x3^2 \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 2 & 0 \\ 0 & 0 & 3 \end{bmatrix}$$

$$H^{-1} = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1/2 & 0 \\ 0 & 0 & 1/3 \end{bmatrix}$$

$$X1 = \begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix} - \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1/2 & 0 \\ 0 & 0 & 1/3 \end{bmatrix} * \begin{bmatrix} 2 \\ 4 \\ 6 \end{bmatrix}$$

$$X1 = \begin{bmatrix} -1 \\ -1 \\ -1 \end{bmatrix}$$