- Consider the following performance surface:

$$F(X) = 2x_1^2 + 5x_2^2 - 3x_1x_2$$

Assuming an initial point of **(1,2)** perform two steps of the steepest decent and show the result after each step. Assume learning rate $\alpha = 0.2$

- Consider the following performance surface:

$$F(X) = x_1^2 + 4x_2^2 - 2x_1x_2 + x_1 - 10$$

Assuming an initial point of **(2,1)** perform two steps of the steepest decent and show the result after each step. Assume learning rate $\alpha = 0.5$

- Consider the following performance surface:

$$\boldsymbol{F(X) = 5x_1^4 - x_2^3 + 3x_2 - 5x_1 + 6}$$

Take two steps of the steepest descent algorithm, **minimizing along a line to calculate alpha**. Use the following initial point: $\begin{bmatrix}1\\2\end{bmatrix}$

Show the resulting position after each step.

Hint: Direction along a line is in the direction of gradient

Position after the first step is:
Position after the second step is:

- Consider the following performance surface

$$\boldsymbol{F(X) = 2x_1^2 - 6x_1x_2 + 5x_2^2 + 4x_1 + 3x_2}$$

Given the initial point $\begin{bmatrix} -2 \\ 1 \end{bmatrix}$, take one step in the direction of $\begin{bmatrix} 5 \\ 1 \end{bmatrix}$ minimizing along a line to calculate alpha.

a. Show the resulting position after the step.

Position after the first step is:

b. Show that the gradient of $\boldsymbol{F(X)}$ at the point after the first step is orthogonal to the direction along which the minimization occurred.

- Consider the following performance surface:

$$\boldsymbol{F(X) = 2x_1^2 - 5x_2^2 + 3x_1x_2 + 6}$$

Take one steps of the steepest descent algorithm, **minimizing along a line to calculate alpha**. Use the following initial point: $\begin{bmatrix} 2 \\ 1 \end{bmatrix}$

Show the resulting position after one step.

Position after one step is:

1. Consider the following performance surface

$$\boldsymbol{F(X) = 2x_1^2 + x_2 - 3x_1x_2}$$

Given the initial point $\begin{bmatrix}\mathbf{2}\\ \mathbf{1}\end{bmatrix}$, take **two steps** of the **steepest descent algorithm**, minimizing along a line **at each step**.

Show the resulting position after each step.