

Assignment No.7

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Download latex-tikz codes and python codes from

<https://github.com/Panisha707/ASSIGNMENT07>

Question taken from

Optimization , exercises 2.22

1 QUESTION No 1

Find the shortest distance of the point $\begin{pmatrix} 0 \\ c \end{pmatrix}$ from the parabola $y = x^2$, where $\frac{1}{2} \leq c \leq 5$

2 SOLUTION

The given problem can be expressed as

$$\min_{\mathbf{x}} \|\mathbf{x} - \mathbf{P}\|^2 \quad (2.0.1)$$

$$\text{s.t. } \mathbf{x}^T \mathbf{V} \mathbf{x} + \mathbf{u}^T \mathbf{x} + d = 0 \quad (2.0.2)$$

where

$$\mathbf{V} = \begin{pmatrix} 1 & 0 \\ 0 & 0 \end{pmatrix} \quad (2.0.3)$$

$$\mathbf{u} = -\begin{pmatrix} 0 \\ 1 \end{pmatrix} \quad (2.0.4)$$

$$d = 0 \quad (2.0.5)$$

Let the point $\mathbf{P} = \begin{pmatrix} 0 \\ 3 \end{pmatrix}$,

The following code yields the minimum distance as $1.63784147\text{e-}06$ and the nearest point on the curve as

$$\mathbf{Q} = \begin{pmatrix} 0 \\ 3.00000164 \end{pmatrix} \quad (2.0.6)$$

https://github.com/Panisha707/ASSIGNMENT07/blob/main/min_dist.ipynb

The following code plots below Fig 2.1

https://github.com/Panisha707/ASSIGNMENT07/blob/main/parab_plot.ipynb

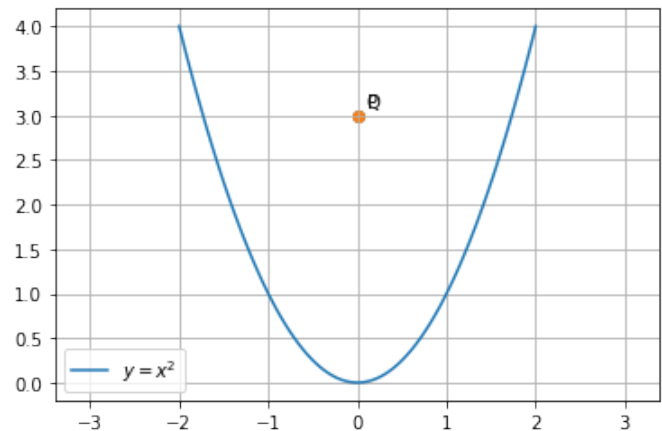


Fig. 2.1: \mathbf{Q} is closest to \mathbf{P}