Assignment 1

Hruday Beeravelli

Find Python Codes from below link

https://github.com/Hruday−Beeravelli/INTERNSHIP−IITH−1/blob/main/Assignment1/Assignment1.py

and latex-tikz codes from

https://github.com/Hruday−Beeravelli/INTERNSHIP−IITH−1/blob/main/Assignment1/Assignment1.tex

1 Examples 1

1.1 Question 7

Find the distance between the following pairs of points

$$\begin{pmatrix} am_1^2 \\ 2am_1 \end{pmatrix}, \begin{pmatrix} am_2^2 \\ 2am_2 \end{pmatrix} \tag{1.1.1}$$

1.2 Solution

The distance between two vectors is given by

$$\|\mathbf{A}-\mathbf{B}\| = \sqrt{\left(\mathbf{A}-\mathbf{B}\right)^{\intercal}.\left(\mathbf{A}-\mathbf{B}\right)} \tag{1.2.1}$$

Let $\mathbf{A} = \begin{pmatrix} am_1^2 \\ 2am_1 \end{pmatrix}, \mathbf{B} = \begin{pmatrix} am_2^2 \\ 2am_2 \end{pmatrix}$

$$\mathbf{A}-\mathbf{B} = \begin{pmatrix} am_1^2 \\ 2am_1 \end{pmatrix} - \begin{pmatrix} am_2^2 \\ 2am_2 \end{pmatrix} \tag{1.2.2}$$

$$= \begin{pmatrix} am_1^2 - am_2^2 \\ 2am_1 - 2am_2 \end{pmatrix} \tag{1.2.3}$$

$$= a\begin{pmatrix} m_1^2 - m_2^2 \\ 2\left(m_1 - m_2\right) \end{pmatrix} \tag{1.2.4}$$

$$= a\left(m_1 - m_2\right)\begin{pmatrix} m_1 + m_2 \\ 2 \end{pmatrix} \tag{1.2.5}$$

by using the property of $\|k\mathbf{A}\| = |k|\ \|\mathbf{A}\|$

$$\|\mathbf{A}-\mathbf{B}\| = \left\|a\left(m_1 - m_2\right)\begin{pmatrix} m_1 + m_2 \\ 2 \end{pmatrix}\right\| \tag{1.2.6}$$

$$= \left|a\left(m_1 - m_2\right)\right| \left\|\begin{pmatrix} m_1 + m_2 \\ 2 \end{pmatrix}\right\| \tag{1.2.7}$$

$$= \left|a\left(m_1 - m_2\right)\right| \sqrt{\begin{pmatrix} m_1 + m_2 \\ 2 \end{pmatrix}^{\intercal}\begin{pmatrix} m_1 + m_2 \\ 2 \end{pmatrix}} \tag{1.2.8}$$

$$= \left|a\left(m_1 - m_2\right)\right| \sqrt{\begin{pmatrix} m_1 + m_2 & 2 \end{pmatrix}\begin{pmatrix} m_1 + m_2 \\ 2 \end{pmatrix}} \tag{1.2.9}$$

$$= \left|a\left(m_1 - m_2\right)\right| \sqrt{\left(m_1 + m_2\right)^2 + \left(2\right)^2} \tag{1.2.10}$$

$$= \left|a\left(m_1 - m_2\right)\right| \sqrt{\left(m_1 + m_2\right)^2 + 4} \tag{1.2.11}$$

Distance between $(am_1^2, 2am_1)$ and $(am_2^2, 2am_2)$ is

$$= \left|a\left(m_1 - m_2\right)\right| \sqrt{\left(m_1 + m_2\right)^2 + 4} \tag{1.2.12}$$