Matrices Assignment - Circle

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Get Python code for the figure from

https://github.com/dukkipativijay/Fwciith2022/tree/main/Assignment%201/Codes/src

Get LaTex code from

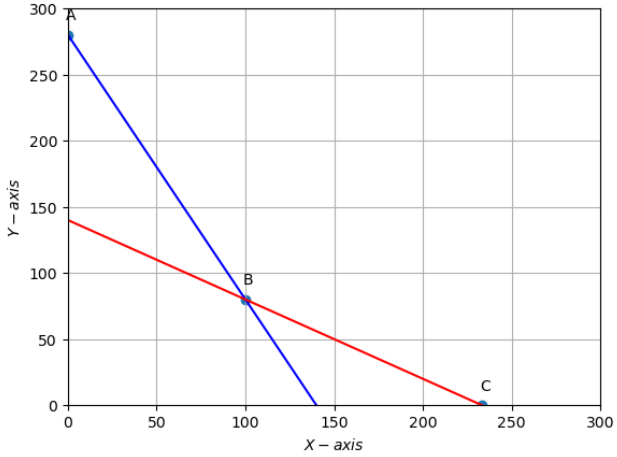
https://github.com/dukkipativijay/Fwciith2022/tree/main/Assignment%201%20-%20Assembly/Codes

1 Question

Class 12, Exercise 12.2, Q(10)

There are two types of fertilisers F_1 and F_2. F_1 consists of 10% Nitrogen and 6% Phosphoric acidand F_2 consists of 5% Nitrogen and 10% Phosphoric acid. After testing the soil conditions, a farmer finds that she needs atleast 14 kg of nitrogen and 14 kg of phosphoric acid for her crop. If F_1 costs Rs 6/kg and F_2 costs Rs 5/kg, determine how much of each type of fertiliser should be used so that nutrient requirements are met at a minimum cost. What is the minimum cost?

2 Solution



Let,

x = the number of Kg's of Fertiliser F_1

y = the number of Kg's of Fertiliser F_2

Fertiliser	Nitrogen	Phosphoric Acid
F_1	10%	6%
F_2	5%	10%
Total	14 kg	14 kg

Hence, the problem can be formulated as,

$$10\%\ of\ x + 5\%\ of\ y \geq 280$$

$$6\%\ of\ x + 10\%\ of\ y \geq 700$$

The above equations can be simplified as,

$$2x + y \geq 280$$

$$3x + 5y \geq 700$$

$$\text{Also, } x \geq 0,\ y \geq 0$$

Let Z be the total cost of the fertiliser mixture.

$$Z = \min_{x,y}(6x + 5y)$$

The above equations can be expressed in vector form as,

$$Z = \min_{x,y} \begin{pmatrix} 6 & 5 \end{pmatrix} \mathbf{x}$$

$$\begin{pmatrix} 2 & 1 \\ 3 & 5 \end{pmatrix} x \geq \begin{pmatrix} 280 \\ 700 \end{pmatrix}$$

$$\mathbf{x} \geq 0$$

Solving the above equations using cvxpy, we get

$$Z_{min} = Rs.1000$$

$$\mathbf{x} = \begin{pmatrix} 100 \\ 80 \end{pmatrix}$$