

ASSIGNMENT 1

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1 PROBLEM

Check which of the following are solutions of the following equation:

$$(1 - 2)x = 4 \quad (1.0.1)$$

a) $\begin{pmatrix} 0 \\ 2 \end{pmatrix}$ b) $\begin{pmatrix} 2 \\ 0 \end{pmatrix}$ c) $\begin{pmatrix} 4 \\ 0 \end{pmatrix}$ d) $\begin{pmatrix} \sqrt{2} \\ 4\sqrt{2} \end{pmatrix}$ e) $\begin{pmatrix} 1 \\ 1 \end{pmatrix}$

2 EXPLANATION

A point C lying on the line

$$(a \ b)x = d \quad (2.0.1)$$

At any distance λ from point x lying on the same line is given as

$$c = x + \frac{\lambda}{\sqrt{a^2 + b^2}} \begin{pmatrix} b \\ -a \end{pmatrix} \quad (2.0.2)$$

We have $\lambda = \sqrt{a^2 + b^2} \implies c = x + \begin{pmatrix} b \\ -a \end{pmatrix}$

3 SOLUTION

Equation of y axis is

$$(1 \ 0)x = 0 \quad (3.0.1)$$

For $(1 \ -2)x = 4$ (at y axis meet)

$$\begin{pmatrix} 1 & -2 \\ 1 & 0 \end{pmatrix} y_1 = \begin{pmatrix} 4 \\ 0 \end{pmatrix} \quad (3.0.2)$$

$$y_1 = \begin{pmatrix} 1 & -2 \\ 1 & 0 \end{pmatrix}^{-1} \begin{pmatrix} 4 \\ 0 \end{pmatrix} \quad (3.0.3)$$

$$y_1 = \begin{pmatrix} 0 \\ -2 \end{pmatrix} \quad (3.0.4)$$

Another point c_1 on the line is found using

$$c_1 = y_1 + \begin{pmatrix} -2 \\ -1 \end{pmatrix} \quad (3.0.5)$$

$$= \begin{pmatrix} 0 \\ -2 \end{pmatrix} + \begin{pmatrix} -2 \\ -1 \end{pmatrix} = \begin{pmatrix} -2 \\ -3 \end{pmatrix} \quad (3.0.6)$$

Equation for x axis is $(1 \ 0)y = 0$

$$\begin{pmatrix} 1 & -2 \\ 0 & 1 \end{pmatrix} y = \begin{pmatrix} 4 \\ 0 \end{pmatrix} \quad (3.0.7)$$

$$y = \begin{pmatrix} 1 & -2 \\ 0 & 1 \end{pmatrix}^{-1} \begin{pmatrix} 4 \\ 0 \end{pmatrix} \quad (3.0.8)$$

$$y = \begin{pmatrix} 4 \\ 0 \end{pmatrix} \quad (3.0.9)$$

4 CHECKING FOR ADDITIONAL SOLUTIONS

1) For $x = \begin{pmatrix} 0 \\ 2 \end{pmatrix}$, we have

$$(1 \ -2)x = 1 * 0 + -2 * 2 = -4 \neq 4$$

Hence not a solution.

2) For $x = \begin{pmatrix} 2 \\ 0 \end{pmatrix}$, we have

$$(1 \ -2)x = 1 * 2 + -2 * 0 = 2 \neq 4$$

Hence not a solution.

3) For $x = \begin{pmatrix} 1 \\ 1 \end{pmatrix}$, we have

$$(1 \ -2)x = 1 * 1 + -2 * 1 = -1 \neq 4$$

Hence not a solution.

4) For $x = \begin{pmatrix} \sqrt{2} \\ 4\sqrt{2} \end{pmatrix}$, we have

$$(1 \ -2)x = 1 * \sqrt{2} + -2 * 4\sqrt{2} = -7\sqrt{2} \neq 4$$

Hence not a solution.

Therefore, solution is only $\begin{pmatrix} 4 \\ 0 \end{pmatrix}$