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MATRIX ASSIGNMENT

0.1 Problem:

Construct a triangle ABC in which BC=8cm, $\angle B = 45^0$ and AB - AC = 3.5 cm.

0.2 Solution

The input parameters for this construction are

Symbol	Value	Description
BC	a	where a is 8cm
$\angle BC$	45^0	ΔABC
k	3.5	constant value

Caluclating Other Coordinate:
The coordinates of B and C are X_2,Y_2 respectively.
Let $\mathbf{A}$ = c$\times \begin{pmatrix}\cos\theta\\ \sin\theta\end{pmatrix}$
Using the Cosine formula in ΔABC,

$$b^2 = a^2 + c^2 - 2accos\mathbf{B} \quad (1)$$
$$(b+c)(b-c) = a^2 - 2accos\mathbf{B} \quad (2)$$

Given
$$c - b = k \quad (3)$$

Upon Simplifaction we get:-

$$(b+c)(-k) = a^2 - 2accos\mathbf{B} \quad (4)$$
$$-kc - kb + 2accos\mathbf{B} = a^2 \quad (5)$$
$$-kb - c(-k + 2acos\mathbf{B}) = a^2 \quad (6)$$

From the above, we obtain the matrix equation:-

$$\begin{pmatrix}-k & k+2acos\mathbf{B}\\ -1 & 1\end{pmatrix}\begin{pmatrix}c\\ b\end{pmatrix} = \begin{pmatrix}k\\ a^2\end{pmatrix}$$

$$\begin{pmatrix}-3.5 & 3.5+2(8)cos45^0\\ -1 & 1\end{pmatrix}\begin{pmatrix}c\\ b\end{pmatrix} = \begin{pmatrix}3.5\\ 64\end{pmatrix}$$

Augmented Matrix $\implies \begin{pmatrix}-3.5 & 3.5+2(8)cos45^0 & 3.5\\ -1 & 1 & 64\end{pmatrix}$

Reducing to echelon form:-

$$\left(\begin{pmatrix}1 & -1 & \frac{7}{2}\\ -\frac{7}{2} & \frac{78154172560113}{10000000000000} & 64\end{pmatrix} \xleftarrow{-R_1 \leftarrow R_1}\right)$$

$$\left(\begin{pmatrix}1 & -1 & \frac{7}{2}\\ 0 & 1 & \frac{5175000000000000}{43154172560113}\end{pmatrix} \xleftarrow{\frac{10000000000000R2}{43154172560113} \leftarrow R_2}\right)$$

$$\left(\begin{pmatrix}1 & 0 & \frac{732920792079209}{86308345120226}\\ 0 & 1 & \frac{5175000000000000}{43154172560113}\end{pmatrix} \xleftarrow{R1+R2 \leftarrow R_2}\right)$$

Reduced Echelon Form: $\left(\begin{pmatrix}1 & 0 & 8.491887905604763\\ 0 & 1 & 11.991887905604763\end{pmatrix}\right)$

$$\begin{pmatrix}c\\ b\end{pmatrix} = \begin{pmatrix}11.99\\ 8.49\end{pmatrix}$$

The vertices of Δ ABC are

$$\mathbf{A} = 11.99\begin{pmatrix}cos45\\ sin45\end{pmatrix} = \begin{pmatrix}8.4\\ 8.4\end{pmatrix}$$

$$\mathbf{B} = \begin{pmatrix}0\\ 0\end{pmatrix}$$

$$\mathbf{C} = \begin{pmatrix}8\\ 0\end{pmatrix}$$

Below python code realizes the above construction :

`https://github.com/kedareswari200/fwc-moudle1/blob/Matri_lines/triangle.py`

0.3 Construction