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MATRIX ASSIGNMENT

0.1 Problem:

Construct a triangle ABC in which BC=7cm, $\angle B = 75^0$ and AB + AC = 13 cm.

0.2 Solution

The input parameters for this construction are

Symbol	Value	Description
BC	a	where a is 7cm
AB	b	AB distance is b
AC	c	AC distance is c
$\angle BC$	75^0	ΔABC
C	$\begin{pmatrix} a \\ 0 \end{pmatrix}$	BC length is equal to a
A	$\begin{pmatrix} cos\theta \\ sin\theta \end{pmatrix}$	using the cosine formula in ΔABC

termux commands :

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bash line.sh.........using shell command
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Caluclating Other Coordinate:
Let the coordinates of A are X_2,Y_2 respectively.
Let $\mathbf{A} = \begin{pmatrix} \cos\theta \\ \sin\theta \end{pmatrix}$
Using the Cosine formula in ΔABC,

$$b^2 = a^2 + c^2 - 2ac cos\mathbf{B} \tag{1}$$

$$(b+c)(b-c) = a^2 - 2 \times a \times c cos\mathbf{B} \tag{2}$$

$$K(b-c) = a^2 - 2 \times a \times c cos\mathbf{B} \tag{3}$$

$$bk - ck + 2 \times a \times c \times cos\mathbf{B} = a^2 \tag{4}$$

$$bk - c(k + 2acos\mathbf{B}) = a^2 \tag{5}$$

From the above we know that:-

$$b + c = 13 \tag{6}$$

From the above, we obtain the matrix equation:-

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

reduced row echelon form of $\begin{pmatrix} 13 & -13 + \frac{\sqrt{2}(-7+7\sqrt{3})}{2} & 49 \\ 1 & 1 & 13 \end{pmatrix}$

Divide row1 by 13: R1 $= \frac{R1}{13}$

$$\begin{pmatrix} 1 & -\frac{-7\sqrt{6}+7\sqrt{2}+26)}{26} & \frac{49}{13} \\ 1 & 1 & 13 \end{pmatrix}$$

Subtract row 1 from row 2: R2 = R2 - R1

$$\begin{pmatrix} 1 & -\frac{-7\sqrt{6}+7\sqrt{2}+26)}{26} & \frac{49}{13} \\ 0 & -\frac{-7\sqrt{6}+7\sqrt{2}+52)}{26} & \frac{120}{13} \end{pmatrix}$$

Multiply row 2 by $\frac{26}{-7\sqrt{6}+7\sqrt{2}+52}$: R2$=\frac{26}{-7\sqrt{6}+7\sqrt{2}+52}$

Add row 2 multiplied by $\frac{-7\sqrt{6}+7\sqrt{2}+26}{26}$

$$\begin{pmatrix} 1 & 0 & -\frac{91\sqrt{6}+91\sqrt{2}+436)}{-7\sqrt{6}+7\sqrt{2}+52)} \\ 0 & 1 & \frac{240}{-7\sqrt{6}+7\sqrt{2}+52} \end{pmatrix}$$

$$\begin{pmatrix} b \\ c \end{pmatrix} = \begin{pmatrix} -\frac{91\sqrt{6}+91\sqrt{2}+436)}{-7\sqrt{6}+7\sqrt{2}+52)} \\ \frac{240}{-7\sqrt{6}+7\sqrt{2}+52} \end{pmatrix}$$

$$\mathbf{A} = c\begin{pmatrix} cos75 \\ sin75 \end{pmatrix} = \begin{pmatrix} 1.33 \\ 5.15 \end{pmatrix}$$

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

$$\mathbf{C} = \begin{pmatrix} 7 \\ 0 \end{pmatrix}$$

Below python code realizes the above construction :

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https://github.com/manasareddy442002/
fwc-moudle1/blob/matrix-lines/matrix.py
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0.3   Construction