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Sep 2022

## MATRIX ASSIGNMENT

### 0.1 Problem:

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

### 0.2 Solution:

#### Theory:

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

#### To Prove:

- Draw base  $BC = 8$  cm, and at point, B make an angle  $CBX$  of  $\angle B = 45^\circ$  using a protractor.
- With B as center and radius  $BD = 3.5$  cm, draw an arc to intersect ray  $BX$  at D.
- Join DC.
- Let's construct a perpendicular bisector of DC. With D and C as the center and radius greater than half of DC, draw arcs above and below the line DC to intersect ray  $BX$  at A.
- Join AC.

ABC is the required triangle.

#### Verification:

On measuring we see that,  $BC = 8$  cm,  $\angle B = 45^\circ$  and  $AB - AC = 3.5$  cm

### 0.3 TermuxCommands:

python3 matrix.py

#### To Prove:

Given BC length is  $a=8$  cm, so the coordinates of B are  $\begin{pmatrix} 0 \\ 0 \end{pmatrix}$

$X_1, Y_1$  respectively and the coordinates of C are,  $\begin{pmatrix} a \\ 0 \end{pmatrix}$

$X_3, Y_3$  respectively and also given the angle is  $B = 45^\circ$ , so by finding the coordinates of the other side we can form a required triangle.

### Calculating Other Coordinate:

Let the coordinates of A are  $X_2, Y_2$  respectively.

Let  $A = \begin{pmatrix} \sin\theta \\ \cos\theta \end{pmatrix}$  Using the Cosine formula in  $\triangle ABC$ ,

$$b^2 = a^2 + c^2 - 2accosB.$$

$$\Rightarrow (c+b)(c-b) + 8^2 - 2 \times 8 \times 0.707c$$

$$\Rightarrow (7-16 \times \sqrt{2}) + 7 = -128 \dots 1$$

Upon Simplification we get:-

$$c-b = \frac{1}{2} \dots 2$$

and the above 2 equations can be written as:-

$$\begin{pmatrix} 7-16\sqrt{2} & 7 \\ 1 & -1 \end{pmatrix} \begin{pmatrix} c \\ b \end{pmatrix} = \begin{pmatrix} -128 \\ \frac{7}{2} \end{pmatrix}$$

$$\text{from this, } \begin{pmatrix} c \\ b \end{pmatrix} = \begin{pmatrix} 11.99 \\ 8.49 \end{pmatrix}$$

Thus, the vertices of  $\triangle ABC$  are

$$A = 11.99 \begin{pmatrix} \cos 45^\circ \\ \sin 45^\circ \end{pmatrix}, B = \begin{pmatrix} 0 \\ 0 \end{pmatrix}, C = \begin{pmatrix} 8 \\ 0 \end{pmatrix}$$

The below python code realizes the above construction:

<https://github.com/kedareshwari200/fwc-module1/blob/main/triangle.py>

### 0.4 Construction

