PRML - Assignment 1

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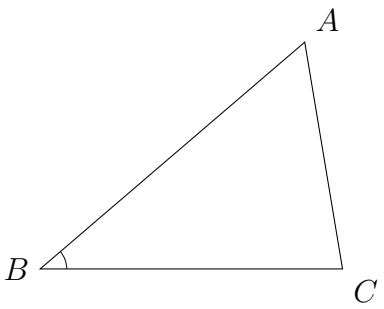
1 Problem Statement

Construct a triangle, given its base, a base angle and sum of other two sides.

Given the base BC, a base angle, say B and the sum AB + AC of the other two sides of a triangle ABC, you are required to construct it.



2 Solution

Using the cosine formula in $\triangle ABC$,

$$b^2 = a^2 + c^2 - 2acCosB \tag{1}$$

$$(b+c)(b-c) = a^2 - 2acCosB \tag{2}$$

$$or, K(b-c) = a^2 - 2acCosB \tag{3}$$

$$\text{where } K = b + c \tag{4}$$

$$Kb + c(2aCosB - K) = a^2 \tag{5}$$

Writing (3.4) and (3.5) into matrix form

$$\begin{pmatrix} 1 & 1 \\ K & 2aCosB - K \end{pmatrix} \begin{pmatrix} b \\ c \end{pmatrix} = \begin{pmatrix} K \\ a^2 \end{pmatrix} \tag{6}$$

Solve matrix (3.6) for 'c'

The coordinates of $\triangle ABC$ can then be expressed as

$$\vec{A} = c\begin{pmatrix} cosB \\ sinB \end{pmatrix}, \vec{B} = \begin{pmatrix} 0 \\ 0 \end{pmatrix}, \vec{C} = \begin{pmatrix} a \\ 0 \end{pmatrix} \tag{7}$$

3 Code

https://github.com/1ROH1TH/PRML/blob/main/PRML_Assignment1.py

4 Plot

The above code plots Fig.1.

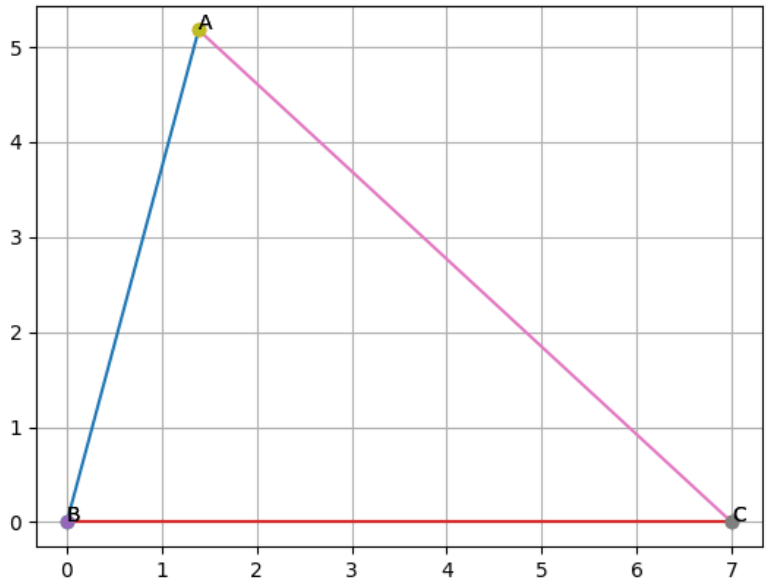


Figure 1: Triangle with BC=7; ∠B = 75°; AB + BC = 13