Assignment 1

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Download all python codes from

https://github.com/grajanarsavva/Matrix−theory/codes

and latex-tikz codes from

https://github.com/grajanarsavva/Matrix−theory

1 Question No. 2.9

Draw a $\triangle ABC$ in which $\angle C = 90^{\circ}, \angle B = 30^{\circ} and$a+b+c=11

2 Explanation

Given,

$$\angle A = 60^{\circ}; \angle B = 30^{\circ}; \angle C = 90^{\circ} \tag{2.0.1}$$

and we know $a + b + c = 11$
By using Sin Rule:

$$\frac{\sin A}{a} = \frac{\sin B}{b} = \frac{\sin C}{c} \tag{2.0.2}$$

$$\implies b \sin C = c \sin B \tag{2.0.3}$$

$$b \sin 90 = c sin 30 \tag{2.0.4}$$

$$\implies c = 2b \tag{2.0.5}$$

$$a \sin B = b \sin A \tag{2.0.6}$$

$$a \sin 30 = b \sin 60 \tag{2.0.7}$$

$$\implies a = \sqrt{3}b \tag{2.0.8}$$

Substitute a,b values in a+b+c=11
Then,

$$a = \left(\frac{11\sqrt{3}}{3 + \sqrt{3}}\right); b = \left(\frac{11}{3 + \sqrt{3}}\right); c = \left(\frac{22}{3 + \sqrt{3}}\right) \tag{2.0.9}$$

$$\implies a = 4.02; \tag{2.0.10}$$

$$\implies b = 2.32; \tag{2.0.11}$$

$$\implies c = 4.64 \tag{2.0.12}$$

The Vertices of $\triangle ABC$ are

$$\mathbf{A} = \begin{pmatrix} 0 \\ c \end{pmatrix} = \begin{pmatrix} 0 \\ 4.64 \end{pmatrix}; \mathbf{B} = \begin{pmatrix} 0 \\ 0 \end{pmatrix}; \mathbf{C} = \begin{pmatrix} a \\ 0 \end{pmatrix} = \begin{pmatrix} 4.02 \\ 0 \end{pmatrix} and \mathbf{D} = \begin{pmatrix} p \\ 0 \end{pmatrix} = \Bigg(\tag{2.0.13}$$

Now,

$$AB = \|\mathbf{A} - \mathbf{B}\|^2 = \|\mathbf{A}\|^2 = c^2 = 21.61 \tag{2.0.14}$$

$$BC = \|\mathbf{C} - \mathbf{B}\|^2 = \|\mathbf{C}\|^2 = a^2 = 16.21 \tag{2.0.15}$$

$$AC = \|\mathbf{A} - \mathbf{C}\|^2 = b^2 = 5.4 \tag{2.0.16}$$

from AC
b$^2 = \|\mathbf{A} - \mathbf{C}\|^2 = (\mathbf{A} - \mathbf{C})^T(\mathbf{A} - \mathbf{C})$
$= \mathbf{A}^T\mathbf{A} + \mathbf{C}^T\mathbf{C} - \mathbf{A}^T\mathbf{C} - \mathbf{C}^T\mathbf{A}$
$= \|\mathbf{A}\|^2 + \|\mathbf{C}\|^2 - 2\mathbf{A}^T\mathbf{C}$
$= a^2 + b^2 - 2ap$
yielding
$p = \left(\frac{a^2+c^2-b^2}{2a}\right) = 4.026;$
$\|\mathbf{A}\|^2 = c^2 = p^2 + q^2$
$\implies q = \pm\sqrt{c^2 - p^2} = \pm 2.324$

The $\triangle ABC$ is as follows:

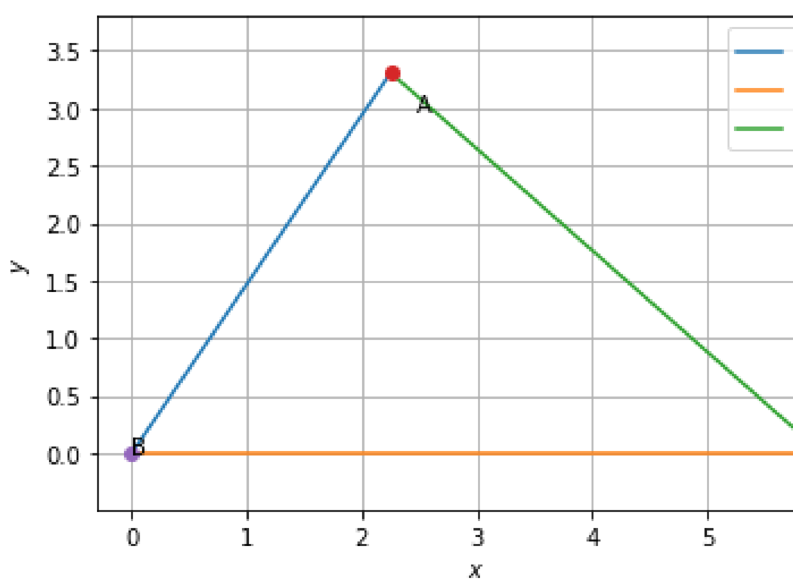

Fig. 0: $\triangle ABC$