# ASSIGNMENT-2

UNNATI GUPTA

Download all python codes from

https://github.com/unnatigupta2320/Assignment−2/tree/master/codes

and latex-tikz codes from

https://github.com/unnatigupta2320/Assignment−2/tree/master

## 1 Question No. 2.36

Construct a quadrilateral MIST where $MI = 3.5, IS = 6.5, \angle M = 75°, \angle I = 105°$ and $\angle S = 120°$.

## 2 SOLUTION

For this quadrilateral MIST we have,

$$\angle M + \angle I = 75° + 105° = 180°, \tag{2.0.1}$$

$\implies MT \parallel IS$ ($\because$ MI being the transversal)
As, sum of adjacent angle on same side is 180° only when lines are parallel.

1) Now, considering ST as another transversal on parallel lines MT and IS then$\angle S$ and $\angle T$being on same side of transversal, we get

$$\implies \angle S + \angle T = 180°, \tag{2.0.2}$$

$$\implies \angle T = 60° \tag{2.0.3}$$

2) Now taking sum of all the angles given and (2.0.3) we get

$$\angle M + \angle I + \angle S + \angle T = 360° \tag{2.0.4}$$

So construction of given quadrilateral is possible as sum of all the angles is equal to 360°.

3) Now,Using cosine formula in $\triangle MIS$ we can find SM:

$$\implies \|\mathbf{S}-\mathbf{M}\|^2 = \|\mathbf{M}-\mathbf{I}\|^2 + \|\mathbf{I}-\mathbf{S}\|^2 - 2\times\|\mathbf{M}-\mathbf{I}\|\times\|\mathbf{I}-\mathbf{S}\|\cos I \tag{2.0.5}$$

$$\implies SM = 8.14 \tag{2.0.6}$$

4) Also in $\triangle MIS$, Let $\angle$ IMS $=\theta$, $\angle$ MIS $=\beta$, $\angle$ ISM $=\gamma$.Now using sine formula in $\triangle MIS$ we have

$$\frac{\sin\theta}{IS} = \frac{\sin\beta}{SM} = \frac{\sin\gamma}{MI} \tag{2.0.7}$$

$$\theta = \sin^{-1} 0.7713; \tag{2.0.8}$$

$$\theta = \angle IMS = 50.47°; \tag{2.0.9}$$

5) Now, polar coordinates of vertex **S** of $\triangle MIS$ be

$$\mathbf{S} = SM\begin{pmatrix}\cos\theta\\ \sin\theta\end{pmatrix} \tag{2.0.10}$$

$$\mathbf{S} = 8.14\begin{pmatrix}\cos 50.47\\ \sin 50.47\end{pmatrix} \tag{2.0.11}$$

$$\implies \mathbf{S} = \begin{pmatrix}5.18\\ 6.27\end{pmatrix}, \tag{2.0.12}$$

6) Also in $\triangle MTS$, Let $\angle$ TSM $=\phi$, $\angle$ TMS $=\alpha 1$, $\angle$ MTS $=\alpha 2$, Now using sine formula in $\triangle MTS$ we have

$$\frac{\sin\phi}{MT} = \frac{\sin\alpha 1}{ST} = \frac{\sin\alpha 2}{SM} \tag{2.0.13}$$

$$\frac{\sin 95.47°}{MT} = \frac{\sin 60°}{8.14} \tag{2.0.14}$$

$$\implies MT = 9.35 \tag{2.0.15}$$

7) Now, the polar coordinates of **T** of $\triangle MTS$ can be calculated using vector MT and angle $\angle TMI$.
8) Let $\angle TMI = \omega$ =75°.The polar coordinates of **T** are:

$$\implies \mathbf{T} = MT\begin{pmatrix}\cos\omega\\ \sin\omega\end{pmatrix} \tag{2.0.16}$$

$$\implies \mathbf{T} = \begin{pmatrix}2.42\\ 9.63\end{pmatrix} \tag{2.0.17}$$

9) Now,the vertices of given Quadrilateral MIST

can be written as,

$$\mathbf{M} = \begin{pmatrix} 0 \\ 0 \end{pmatrix}, \mathbf{I} = \begin{pmatrix} 3.5 \\ 0 \end{pmatrix}, \mathbf{S} = \begin{pmatrix} 5.18 \\ 6.27 \end{pmatrix}, \mathbf{T} = \begin{pmatrix} 2.42 \\ 9.63 \end{pmatrix} \tag{2.0.18}$$

10) On constructing the given quadrilateral we, get:

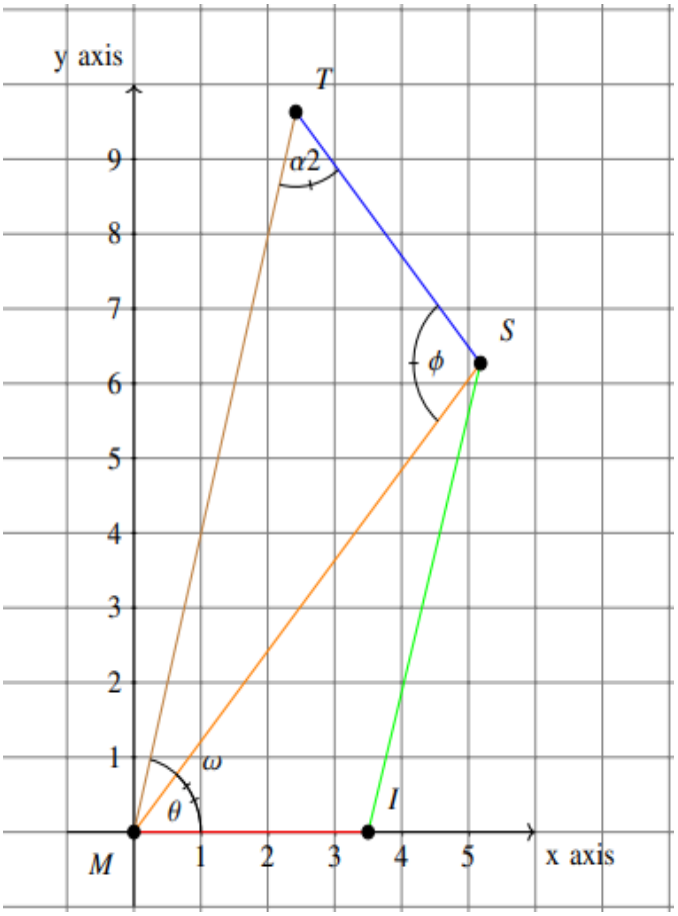


Fig. 2.1: Quadrilateral MIST