

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 $MI = 3.5$, $IS = 6.5$, $\angle M = 75^\circ$, $\angle I = 105^\circ$ and $\angle S = 120^\circ$.

2 SOLUTION

For this quadrilateral MIST we have,

$$\angle M + \angle I = 75^\circ + 105^\circ = 180^\circ, \quad (2.0.1)$$

$\Rightarrow MT \parallel IS$ (\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

$$\Rightarrow \angle S + \angle T = 180^\circ, \quad (2.0.2)$$

$$\Rightarrow \angle T = 60^\circ \quad (2.0.3)$$

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

$$\angle M + \angle I + \angle S + \angle T = 360^\circ \quad (2.0.4)$$

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:

$$\Rightarrow \|\mathbf{S} - \mathbf{M}\|^2 =$$

$$\|\mathbf{M} - \mathbf{I}\|^2 + \|\mathbf{I} - \mathbf{S}\|^2 - 2 \times \|\mathbf{M} - \mathbf{I}\| \times \|\mathbf{I} - \mathbf{S}\| \cos I \quad (2.0.5)$$

$$\Rightarrow SM = 8.14 \quad (2.0.6)$$

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

$$\frac{\sin \theta}{IS} = \frac{\sin \beta}{SM} = \frac{\sin \gamma}{MI} \quad (2.0.7)$$

$$\theta = \sin^{-1} 0.7713; \quad (2.0.8)$$

$$\theta = \angle IMS = 50.47^\circ; \quad (2.0.9)$$

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

$$\mathbf{S} = SM \begin{pmatrix} \cos \theta \\ \sin \theta \end{pmatrix} \quad (2.0.10)$$

$$\mathbf{S} = 8.14 \begin{pmatrix} \cos 50.47^\circ \\ \sin 50.47^\circ \end{pmatrix} \quad (2.0.11)$$

$$\Rightarrow \mathbf{S} = \begin{pmatrix} 5.18 \\ 6.27 \end{pmatrix}, \quad (2.0.12)$$

- 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

$$\frac{\sin \phi}{MT} = \frac{\sin \alpha_1}{ST} = \frac{\sin \alpha_2}{SM} \quad (2.0.13)$$

$$\phi = \angle MST = 95.47^\circ \quad (2.0.14)$$

- 7) Now, the polar coordinates of T of $\triangle MTS$ be

$$\mathbf{T} = SM \begin{pmatrix} \cos \phi \\ \sin \phi \end{pmatrix}$$

$$\mathbf{T} = \begin{pmatrix} 2.78 \\ 7.65 \end{pmatrix} \quad (2.0.15)$$

- 8) Now, the Vertices of given Quadrilateral MIST can be written as,

$$\mathbf{M} = \begin{pmatrix} 0 \\ 0 \end{pmatrix}, \mathbf{I} = \begin{pmatrix} 3.5 \\ 0 \end{pmatrix}, \mathbf{S} = \begin{pmatrix} 5.18 \\ 6.27 \end{pmatrix}, \mathbf{T} = \begin{pmatrix} 2.78 \\ 7.65 \end{pmatrix} \quad (2.0.16)$$

- 9) On constructing the given quadrilateral we, get:

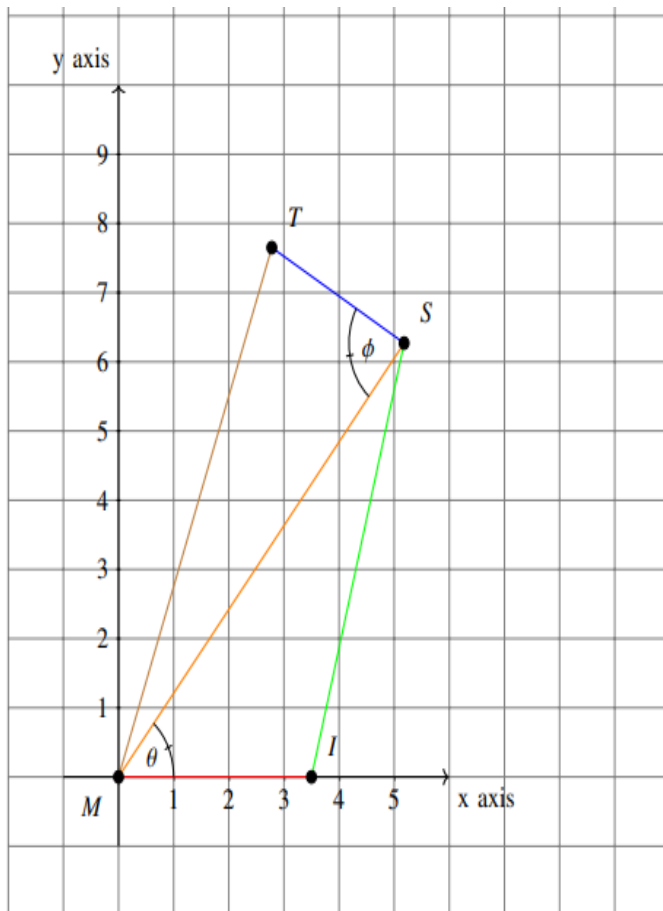


Fig. 2.1: Quadrilateral MIST