

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:

$$\begin{aligned} \Rightarrow \|S - M\|^2 &= \\ \|M - I\|^2 + \|I - S\|^2 - 2 \times \|M - I\| \times \|I - S\| \cos I & \quad (2.0.5) \end{aligned}$$

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

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

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

$$\angle \theta = \arcsin 0.7713; \quad (2.0.8)$$

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

- 5) Now, polar coordinates of vertex S of $\triangle MIS$ be $(SM \cos \theta, SM \sin \theta)$, we get

$$S(8.14 \times \cos 50.47, 8.14 \times \sin 50.47) \quad (2.0.10)$$

$$\Rightarrow S(5.18, 6.27) \quad (2.0.11)$$

- 6) Using sine formula in $\triangle MTS$, we get

$$\angle TMS = 24.53^\circ \quad (2.0.12)$$

- 7) Considering the polar coordinates of T of $\triangle MTS$ and solving we get,

$$T(2.42, 9.03) \quad (2.0.13)$$

- 8) Now, we have the coordinate of vertices M, I, S, T as M(0,0); I(3.5,0); S(5.18,6.27); T(2.42,9.03);

- 9) We can construct the quadrilateral. On constructing the given quadrilateral we, get:

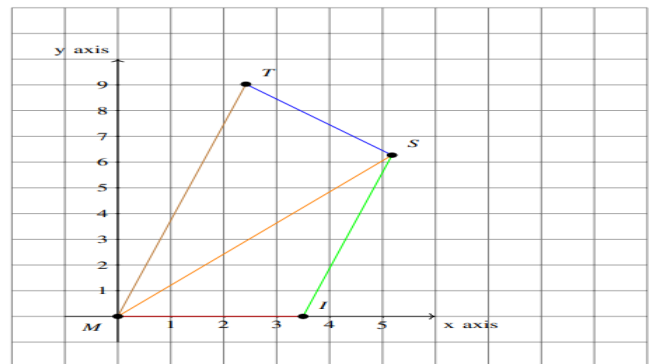


Fig. 2.1: Quadrilateral MIST