

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

$$MI = 3.5, \quad (2.0.1)$$

$$IS = 6.5 \quad (2.0.2)$$

$$\angle M = 75^\circ, \quad (2.0.3)$$

$$\angle I = 105^\circ \quad (2.0.4)$$

$$\angle S = 120^\circ. \quad (2.0.5)$$

$$\text{where } \angle M + \angle I = 75^\circ + 105^\circ = 180^\circ, \quad (2.0.6)$$

$\Rightarrow MT \parallel IS$ (\because MI being the transversal)

As, sum of adjacent angle on same side is 180° only when lines are parallel. 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

$$\Rightarrow \angle S + \angle T = 180^\circ, \quad (2.0.7)$$

$$\Rightarrow 120^\circ + \angle T = 180^\circ; \quad (2.0.8)$$

$$\Rightarrow \angle T = 180^\circ - 120^\circ; \quad (2.0.9)$$

$$\Rightarrow \angle T = 60^\circ \quad (2.0.10)$$

Now taking sum of all the angles given and (2.0.10) we get

$$\angle M + \angle I + \angle S + \angle T = 75^\circ + 105^\circ + 120^\circ + 60^\circ \quad (2.0.11)$$

$$= 360^\circ \quad (2.0.12)$$

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

Now, Using cosine formula we can find SM:

$$\|S - M\|^2 = \|M - I\|^2 + \|I - S\|^2 - 2 \times \|M - I\| \times \|I - S\| \cos I \quad (2.0.13)$$

$$\Rightarrow SM^2 = 3.5^2 + 6.5^2 - 2 \times 3.5 \times 6.5 \times \cos 105^\circ \quad (2.0.14)$$

$$\Rightarrow SM^2 = 8.14 * 8.14 \quad (2.0.15)$$

$$\Rightarrow SM = 8.14 \quad (2.0.16)$$

Also, using sine formula in $\triangle MIS$, we have

$$\frac{\sin M}{m} = \frac{\sin I}{i} = \frac{\sin S}{s} \quad (2.0.17)$$

$$\frac{\sin 105}{8.14} = \frac{\sin M}{6.5}; \quad (2.0.18)$$

$$\sin M = 0.7713; \quad (2.0.19)$$

$$\angle M = \arcsin 0.7713; \quad (2.0.20)$$

$$\angle M = 50.47^\circ; \quad (2.0.21)$$

Now, polar coordinates of vertex S of $\triangle MIS$ be $(SM \cos M, SM \sin M)$

$$\text{we get, } S(5.18, 6.27) \quad (2.0.22)$$

Similarly, we can get vertex T of $\triangle MTS$ as

$$T(2.42, 9.03) \quad (2.0.23)$$

- 1) 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);
- 2) We can construct the quadrilateral. On constructing the given quadrilateral we, get:

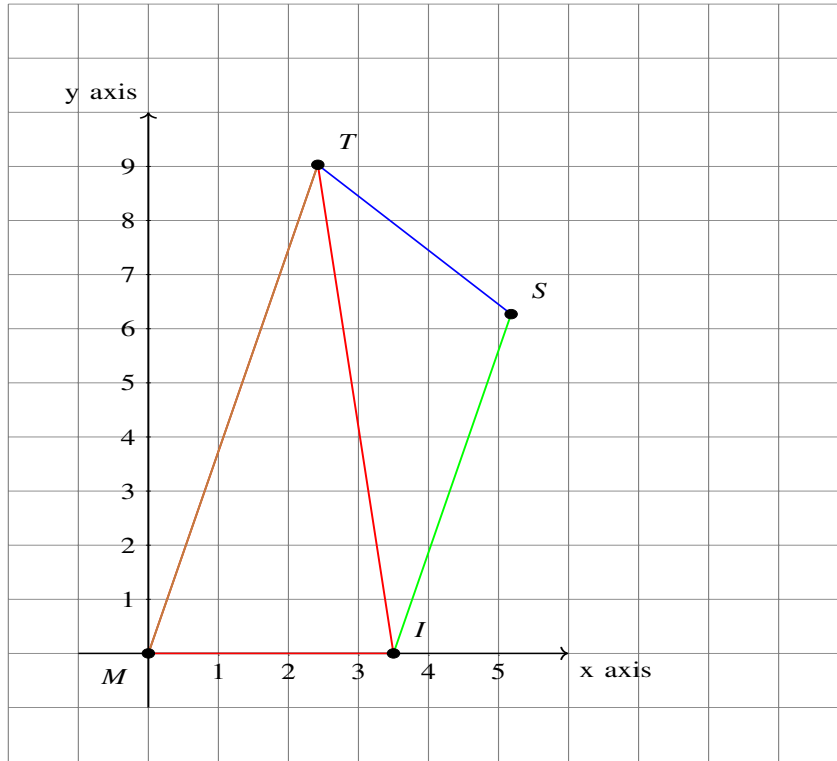


Fig. 2.1: Quadrilateral MIST