ASSIGNMENT-2

UNNATI GUPTA

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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

$$MI = 3.5, \quad (2.0.1)$$
$$IS = 6.5 \quad (2.0.2)$$
$$\angle M = 75°, \quad (2.0.3)$$
$$\angle I = 105° \quad (2.0.4)$$
$$\angle S = 120°. \quad (2.0.5)$$
$$\text{where} \angle M + \angle I = 75° + 105° = 180°, \quad (2.0.6)$$

$\implies MT \parallel IS$ ($\because$ 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

$$\implies \angle S + \angle T = 180°, \quad (2.0.7)$$
$$\implies 120° + \angle T = 180°; \quad (2.0.8)$$
$$\implies \angle T = 180° − 120°; \quad (2.0.9)$$
$$\implies \angle T = 60° \quad (2.0.10)$$

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

$$\angle M + \angle I + \angle S + \angle T = 75° + 105° + 120° + 60° \quad (2.0.11)$$
$$= 360° \quad (2.0.12)$$

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:

$$\|\mathbf{S} − \mathbf{M}\|^2 = \|\mathbf{M} − \mathbf{I}\|^2 + \|\mathbf{I} − \mathbf{S}\|^2 − 2 \times \|\mathbf{M} − \mathbf{I}\| \times \|\mathbf{I} − \mathbf{S}\| \cos I \quad (2.0.13)$$

$$\implies SM^2 = 3.5^2 + 6.5^2 − 2 \times 3.5 \times 6.5 \times \cos 105° \quad (2.0.14)$$

$$\implies SM^2 = 8.14 * 8.14 \quad (2.0.15)$$
$$\implies SM = 8.14 \quad (2.0.16)$$

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

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

$$\frac{\sin 105}{8.14} = \frac{\sin M}{6.5}; \quad (2.0.18)$$
$$\sin M = 0.7713; \quad (2.0.19)$$
$$\angle M = \arcsin 0.7713; \quad (2.0.20)$$
$$\angle M = 50.47°; \quad (2.0.21)$$

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

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

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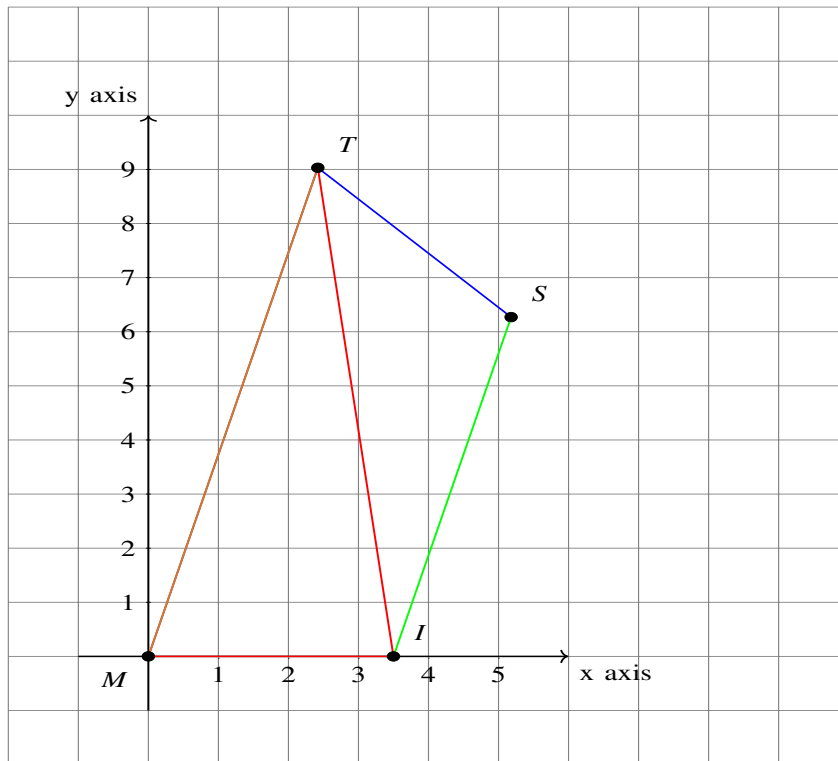2) We can construct the quadrilateral. On constructing the given quadrilateral we, get:

Fig. 2.1: Quadrilateral MIST