Assignment 2

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Download all python codes from

https://github.com/ka−raja−babu/Matrix−Theory/tree/main/Assignment2/Codes

and latex-tikz codes from

https://github.com/ka−raja−babu/Matrix−Theory/tree/main/Assignment2

1 Question No. 32

Can you construct a quadrilateral $PQRS$ with $PQ = 3, RS = 3, PS = 7.5, PR = 8$ and $SQ = 4$?

2 Solution

1) Assume vertices of given quadrilateral:-
Let the vertices of quadrilateral $PQRS$ be $\mathbf{P}$,$\mathbf{Q}$,$\mathbf{R}$ and $\mathbf{S}$.
2) List out given data in form of vectors:-
According to given data:

$$\|\mathbf{P}-\mathbf{Q}\| = 3 \tag{2.0.1}$$
$$\|\mathbf{R}-\mathbf{S}\| = 3 \tag{2.0.2}$$
$$\|\mathbf{P}-\mathbf{S}\| = 7.5 \tag{2.0.3}$$
$$\|\mathbf{P}-\mathbf{R}\| = 8 \tag{2.0.4}$$
$$\|\mathbf{S}-\mathbf{Q}\| = 4 \tag{2.0.5}$$

3) Find out two triangles of given quadrilateral having same base
Quadrilateral $PQRS$ is made up of two triangles $\triangle PSQ$ and $\triangle PSR$ placed on base PS .
4) Verify that construction of both triangles,is possible or not by using the fact that "sum of any two sides of a triangle is greater than third side":-
Now,in $\triangle PSR$:-

$$\|\mathbf{P}-\mathbf{S}\| + \|\mathbf{R}-\mathbf{S}\| = 7.5 + 3 = 10.5 > \|\mathbf{P}-\mathbf{R}\| \tag{2.0.6}$$
$$\|\mathbf{P}-\mathbf{R}\| + \|\mathbf{R}-\mathbf{S}\| = 8 + 3 = 11 > \|\mathbf{P}-\mathbf{S}\| \tag{2.0.7}$$
$$\|\mathbf{P}-\mathbf{S}\| + \|\mathbf{P}-\mathbf{R}\| = 7.5 + 8 = 15.5 > \|\mathbf{R}-\mathbf{S}\| \tag{2.0.8}$$

$\because$ Sum of any two sides is greater than third side in $\triangle PSR$.
$\therefore$ Construction of $\triangle PSR$ is possible.
Now,in $\triangle PSQ$:-

$$\|\mathbf{P}-\mathbf{S}\| + \|\mathbf{S}-\mathbf{Q}\| = 7.5 + 4 = 11.5 > \|\mathbf{P}-\mathbf{Q}\| \tag{2.0.9}$$
$$\|\mathbf{P}-\mathbf{S}\| + \|\mathbf{P}-\mathbf{Q}\| = 7.5 + 3 = 10.5 > \|\mathbf{S}-\mathbf{Q}\| \tag{2.0.10}$$
$$\|\mathbf{P}-\mathbf{Q}\| + \|\mathbf{S}-\mathbf{Q}\| = 3 + 4 = 7 < \|\mathbf{P}-\mathbf{S}\| \tag{2.0.11}$$

$\because$ Sum of two sides PQ and SQ is less than third side PS in $\triangle PSQ$.
$\therefore$ Construction of $\triangle PSQ$ is not possible.

5) Conclude that construction of quadrilateral is possible if both triangles can be constructed otherwise not possible:-
Without $\triangle PSQ$, quadrilateral $PQRS$ cannot be constructed.Hence,construction of quadrilateral $PQRS$ is not possible with the given values.
6) Perform construction of quadrilateral to know why it cannot be constructed:-
In fig. 2.1,two arcs with centre P and S and radius 3 cm and 4 cm respectively , will never intersect each other at any point.So,point Q will never be formed and hence,quadrilateral $PQRS$ will never be constructed.

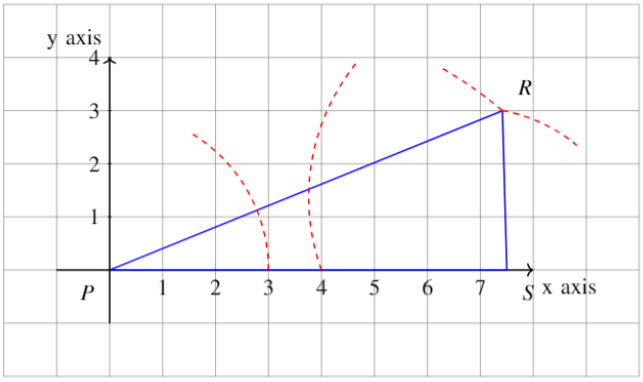

Fig. 2.1: Construction of quadrilateral $PQRS$

7) Plot approximate figure of quadrilateral by using assumptions:-
Ordinate of Q vertex comes imaginary.To plot approximate figure,we assume only real value of ordinate (i.e. zero) disregarding its imaginary part.Due to this assumption,P,Q and S appear collinear in fig. 2.2 although they are actually neither collinear nor non-collinear as point Q does not exist.

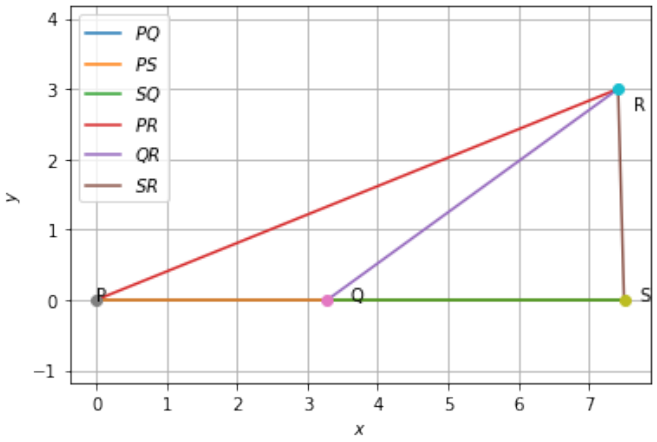

Fig. 2.2: Approximate quadrilateral $PQRS$