

# EE5600 Assignment 1

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**Abstract**—This document contains the solution to a Lines and planes problem.

Download all python codes from

<https://github.com/abhishekt711/EE5600/codes>

$$[P - R] = [-6, 0]$$

$$[Q - S] = [0, 5]$$

If adjacent side of parallelogram are equal then it is a rhombus.

## 1 PROBLEM

Quad 1) ABCD is a rectangle formed by the points A(-1,-1), B(-1,4), C(5,4), D(5,-1), P,Q,R,S are the midpoints of AB, BC, CD, DA respectively. Is the Quadrilateral PQRS a

- A) Square?
- B) Rectangle?
- C) Rhombus?

$$(P - R)^T(Q - S) = \begin{pmatrix} -6 & 0 \end{pmatrix} \begin{pmatrix} 0 \\ 5 \end{pmatrix}$$

$$(P - R)^T(Q - S) = [(-6 \times 0) + (0 \times 5)] = [0] \quad (2.0.3)$$

Diagonal bisect orthogonally. Therefore, it may be a rhombus or square.

Thus, PQRS is a rhombus.

## 2 SOLUTION

**Step1:** we will find the midpoint P, Q, R, S

$$\begin{aligned} P &= \frac{(A + B)}{2} = (-1, 1.5) \\ Q &= \frac{(B + C)}{2} = (2, 4) \\ R &= \frac{(C + D)}{2} = (5, 1.5) \\ S &= \frac{(A + D)}{2} = (2, -1) \end{aligned} \quad (2.0.1)$$

Join P, Q, R, S to form a quadrilateral

**Step2:** We will check whether quadrilateral PQRS is parallelogram or not.

**Diagonal Bisect Rule:**

If,

$$\frac{(P + R)}{2} = \frac{(Q + S)}{2} = (2, 1.5) \quad (2.0.2)$$

Then, Quadrilateral PQRS is a parallelogram

**Step3:** We will check whether Parallelogram is rhombus or not.

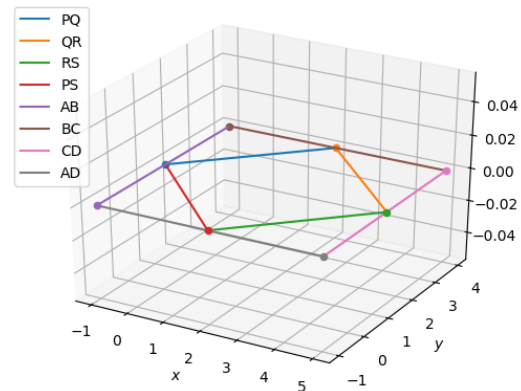


Fig. 0: Simulation of midpoint of ABCD forms PQRS.

**Step4:** We will check whether Parallelogram PQRS is Square or not.

$$[P - Q] = [-3, -2.5]$$

$$[P - S] = [-3, 2.5]$$

If adjacent side of parallelogram are orthogonal to each other then PQRS is a Square.

$$(P - Q)^T(P - S) = \begin{pmatrix} -3 & -2.5 \end{pmatrix} \begin{pmatrix} -3 \\ -2.5 \end{pmatrix}$$

$$(P - Q)^T(P - S) = [(-3 \times -3) + (-2.5 \times 2.5)]$$

$$(P - Q)^T(P - S) = [9 - 6.25] = [2.75] \quad (2.0.4)$$

Here the angle between adjacent side is not  $90^\circ$

Hence, PQRS is not a Square.

**Step 5:** We will check whether PQRS is rectangle or not.

If adjacent side of parallelogram and diagonal obeys pythagoras rule then only it is a rectangle.

$$(P - Q)^T(P - S) = 2.75 \quad (2.0.5)$$

Rectangle condition not satisfying in this question.

**Conclusion:** PQRS is only a Rhombus. It is not a square and rectangle.