# Project Findings

## Knowledge Graph creation:

From the given problem generate the knowledge graph with associated shape and theorems applicable to solve the problem.

Example:

Shape:

**Node details**

**Shape**

| Key | Value |
|---|---|
| **<id>** | 4:c7b8bff6-552e-4766-9381-3774d934ba5f:1 |
| **occurrence_count** | 1 |
| **updated_at** | 2025-09-28T21:57:52.351000000Z |
| **name** | "parallelogram" |
| **created_at** | 2025-09-28T21:57:52.351000000Z |
| **shape_type** | "quadrilateral" |
| **constraints** | ["sum of angles = 360°"] |
| **properties** | ["4 sides", "4 angles", "4 vertices", "angle sum = 360°"] |

Theorem:

**Node details**

**Theorem**

| Key | Value |
|---|---|
| **<id>** | 4:c7b8bff6-552e-4766-9381-3774d934ba5f:0 |
| **mathematical_form** | "If ABCD is a parallelogram, then AB = DC and BC = AD" |
| **usage_count** | 1 |
| **updated_at** | 2025-09-28T21:30:32.930000000Z |
| **confidence** | 1.0 |
| **conclusions** | [] |
| **theorem_id** | "8ca9556bd756" |
| **name** | "Opposite sides of a parallelogram are equal" |
| **created_at** | 2025-09-28T21:30:32.930000000Z |

List(0)

Relationships:

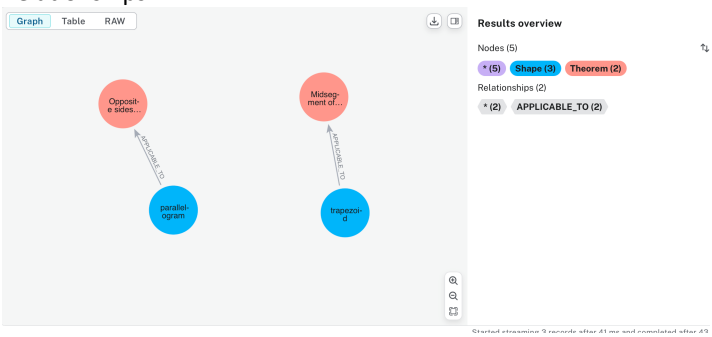
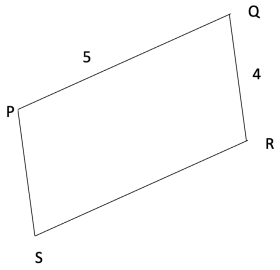


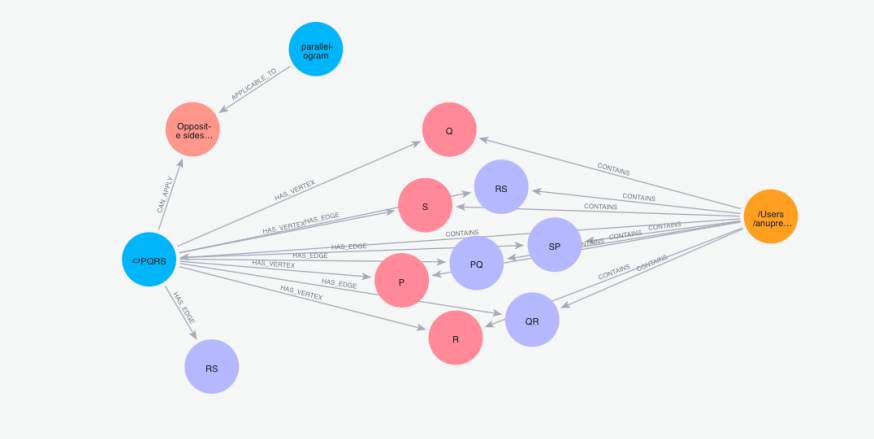

Image to Graph Builder:

Prompt LLM to extract points, lines, angles and shapes in the given image and store this in Neo4j graph

Geometric Image:




Generated Graph:




Solve the problem using graph:

Problem Description: `Given parallelogram PQRS. Find length of RS`

Retrieved Graph Structure {'shapes_by_type': {'parallelogram': [{'shape_id': 'parallelogram_PQRS', 'shape_type': 'parallelogram', 'properties': {'side_lengths': [5, 4, 5, 4], 'parallel_sides': [['PQ', 'RS'], ['QR', 'SP']]}, 'confidence': 0.85}]}, 'shapes_by_id': {'parallelogram_PQRS': {'shape_id': 'parallelogram_PQRS', 'shape_type': 'parallelogram', 'properties': {'side_lengths': [5, 4, 5, 4], 'parallel_sides': [['PQ', 'RS'], ['QR', 'SP']]}, 'confidence': 0.85}}, 'relationships': [], 'points': [{'point_id': 'S', 'x': 0.1, 'y': 0.7, 'label': 'S'}, {'point_id': 'R', 'x': 0.9, 'y': 0.7, 'label': 'R'}, {'point_id': 'Q', 'x': 0.9, 'y': 0.3, 'label': 'Q'}, {'point_id': 'P', 'x': 0.1, 'y': 0.3, 'label': 'P'}], 'lines': [{'line_id': 'SP', 'length': 4.0, 'angle': None}, {'line_id': 'RS', 'length': 5.0, 'angle': None}, {'line_id': 'QR', 'length': 4.0, 'angle': None}, {'line_id': 'PQ', 'length': 5.0, 'angle': None}]}

Retrieved Available Theorems [{'theorem_id': '8ca9556bd756', 'theorem_name': 'Opposite sides of a parallelogram are equal', 'description': 'In a parallelogram, the opposite sides are equal in length.', 'mathematical_form': 'If ABCD is a parallelogram, then AB = DC and BC = AD', 'conditions': ['The shape must be a parallelogram'], 'conclusions': [], 'applicable_shapes': [], 'score': 0.7}]
INFO:httpx:HTTP Request: POST https://api.openai.com/v1/chat/completions "HTTP/1.1 200 OK"
INFO:__main__:Problem Analysis {'known_variables': {'side_SP_length': {'value': 4.0, 'type': 'length', 'entity_id': 'Line SP', 'units': 'units', 'confidence': 1.0}, 'side_RS_length': {'value': 5.0, 'type': 'length', 'entity_id': 'Line RS', 'units': 'units', 'confidence': 1.0}, 'side_QR_length': {'value': 4.0, 'type': 'length', 'entity_id': 'Line QR', 'units': 'units', 'confidence': 1.0}, 'side_PQ_length': {'value': 5.0, 'type': 'length', 'entity_id': 'Line PQ', 'units': 'units', 'confidence': 1.0}}, 'target_variables': ['side_RS_length'], 'problem_type': 'length_finding', 'key_relationships': ['In a parallelogram, opposite sides are equal in length']}

Solution using Graph and reasoning:

problem solving completed. Success: True, Completion: 100.00%
Complex Problem Result:

Success: True
Completion Rate: 100.00%
Steps taken: 0
Explanation: EXPLANATION:

1. What was found:

The length of the side RS in the given parallelogram PQRS was found to be 5 units.

2. Reasoning steps:

In a parallelogram, opposite sides are equal in length