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:

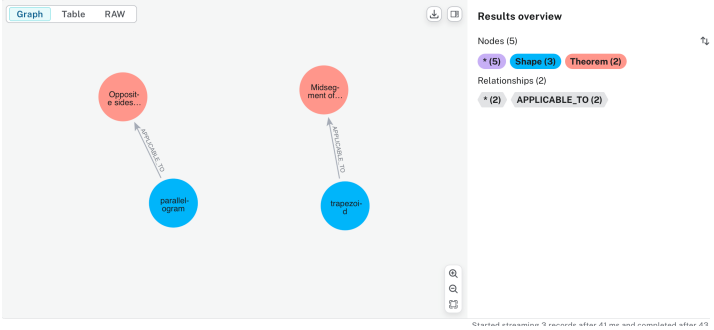
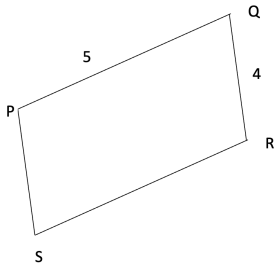


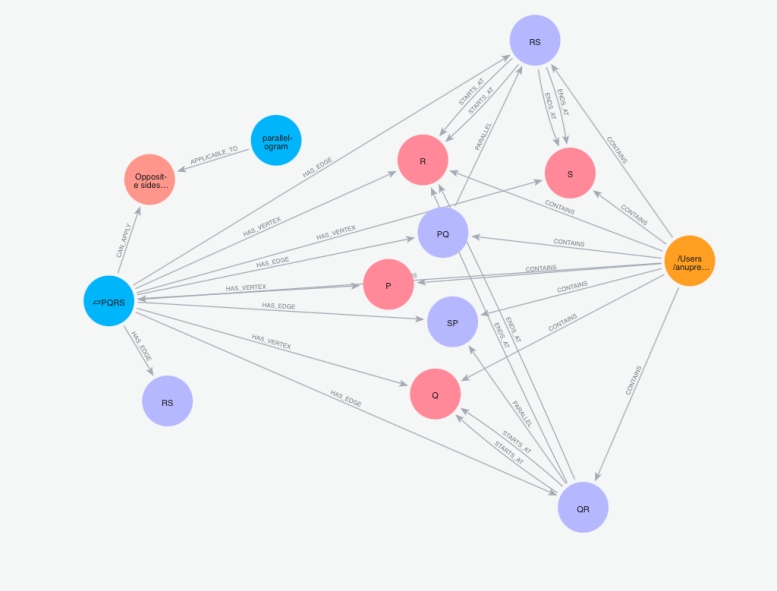
Image to Graph Builder:

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}]

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

Findings:

1. Generating knowledge graph.
2. Able to create graph and solve the simple problem with simple theorem application, need to extend to reason and solve complex problems where multiple theorems can be applied.