MATHEMATICS WORKING MODEL

# PYTHAGORAS THEOREM

Complete Illustrated Guide • Construction • Demonstration • Working • Real-Life Applications

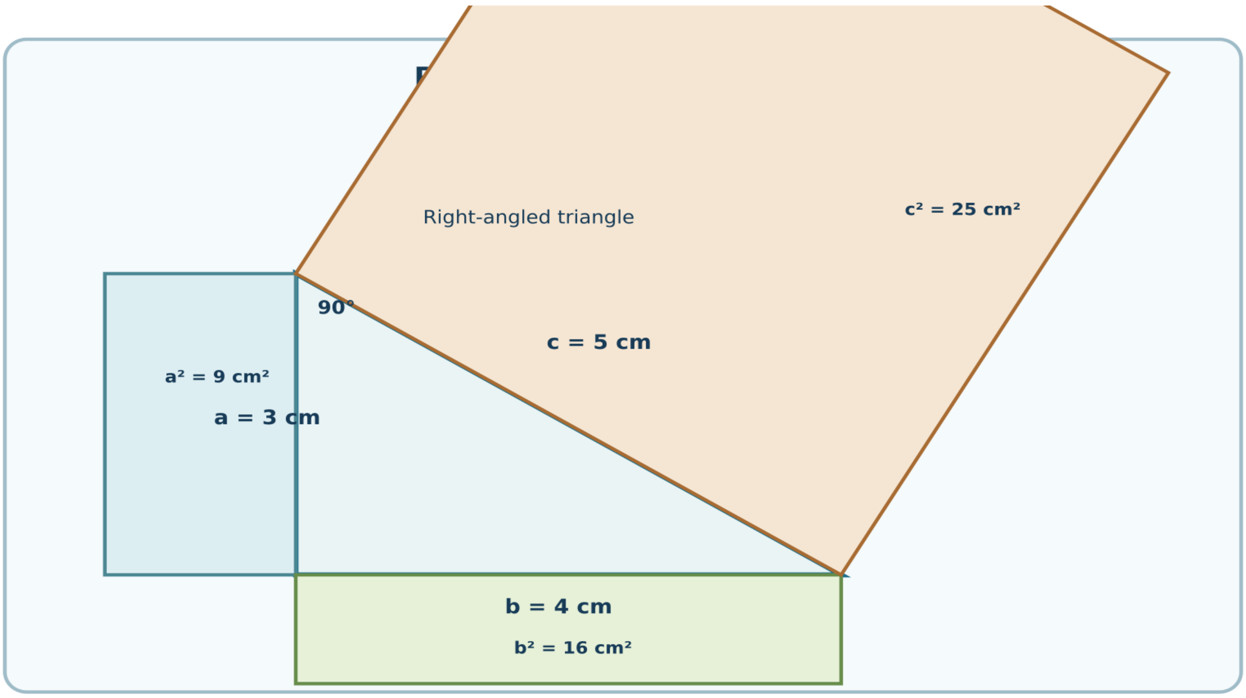



Figure 1 — Complete working-model layout: right-angled triangle with squares constructed on all three sides.

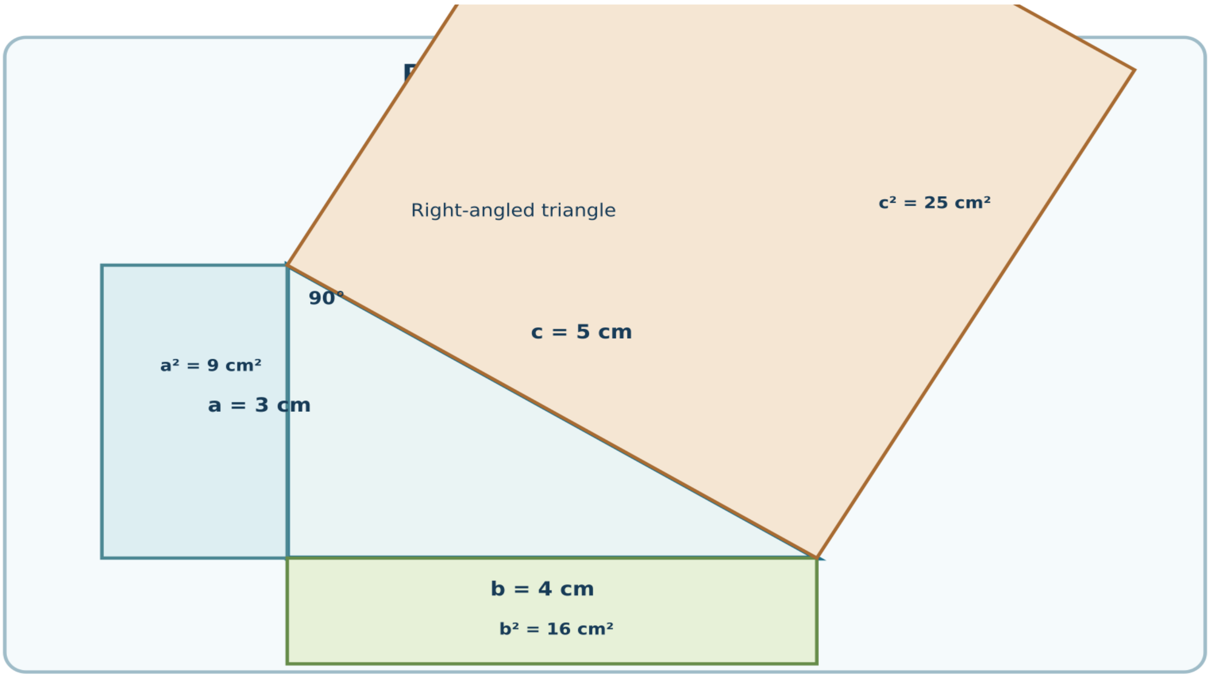
## CORE FORMULA

$$a^2 + b^2 = c^2$$

Best suited for school mathematics exhibitions and Classes 7–10.

# 1. Theme & Main Idea

Theme: “Mathematics You Can See.” This model turns Pythagoras Theorem from a formula into a physical demonstration. A right-angled triangle is placed in the centre, and a square is constructed on each side. The areas of the two smaller squares are shown to be equal to the area of the largest square.




The three squares represent $a^2$, $b^2$ and $c^2$ as actual areas.

For the model we use a 3–4–5 triangle. This gives an easy numerical demonstration:

$$3^2 + 4^2 = 5^2 \rightarrow 9 + 16 = 25$$

# 2. Materials Required

• A3 cardboard or foam board

• Coloured chart paper / craft paper

• Ruler, pencil, protractor and set square

• Scissors and glue

• Marker pens and labels

• Small paper tiles / beads / coins for the interactive area demonstration

• Optional: transparent sheet or Velcro pieces to make the pieces movable

# 3. Model Parts

| Part | Purpose |
|---|---|
| 3–4–5 triangle | The main mathematical object |
| Square on 3 cm side | Shows $3^2 = 9\ \text{cm}^2$ |
| Square on 4 cm side | Shows $4^2 = 16\ \text{cm}^2$ |
| Square on 5 cm side | Shows $5^2 = 25\ \text{cm}^2$ |

| | |
|---|---|
| Area tiles | Let visitors physically compare 9 + 16 with 25 |
| Explanation panel | Shows formula, calculations and applications |

# 4. Step-by-Step Construction

Step 1 — Draw an accurate right-angled triangle. Use a ruler and protractor. Make the sides 3 cm, 4 cm and 5 cm. Clearly mark the 90° angle.

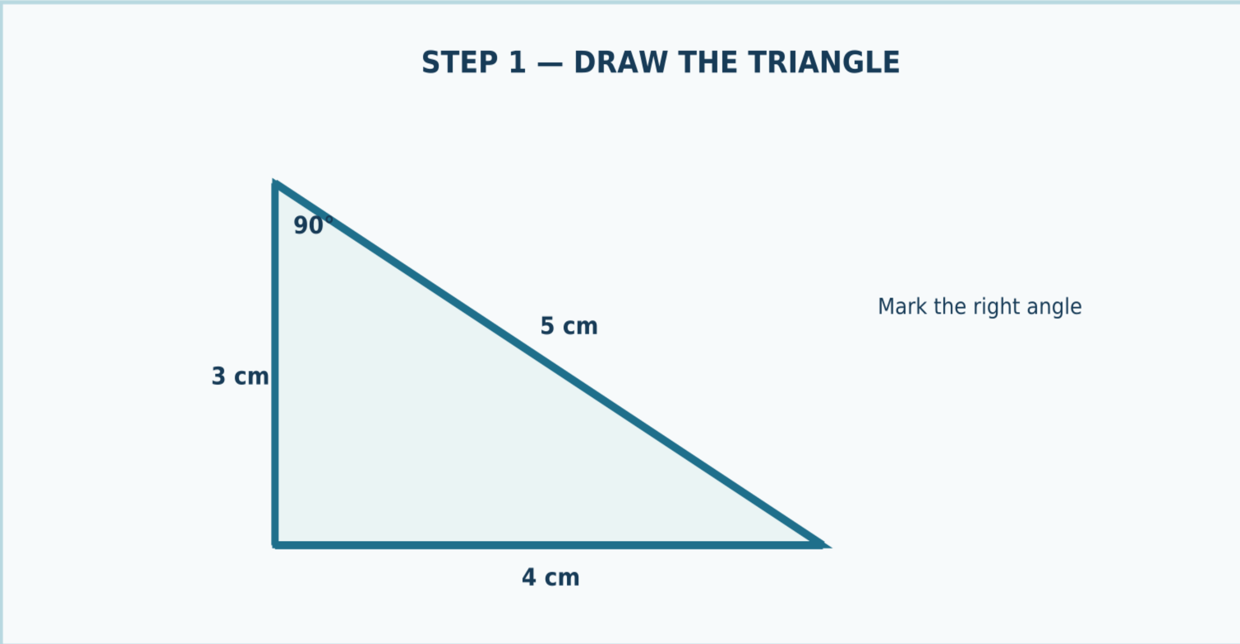



Figure 2 — Draw and label the 3–4–5 right-angled triangle.

Step 2 — Construct a square on every side. Each square must have the corresponding triangle side as one of its sides. Keep all square corners at 90°.

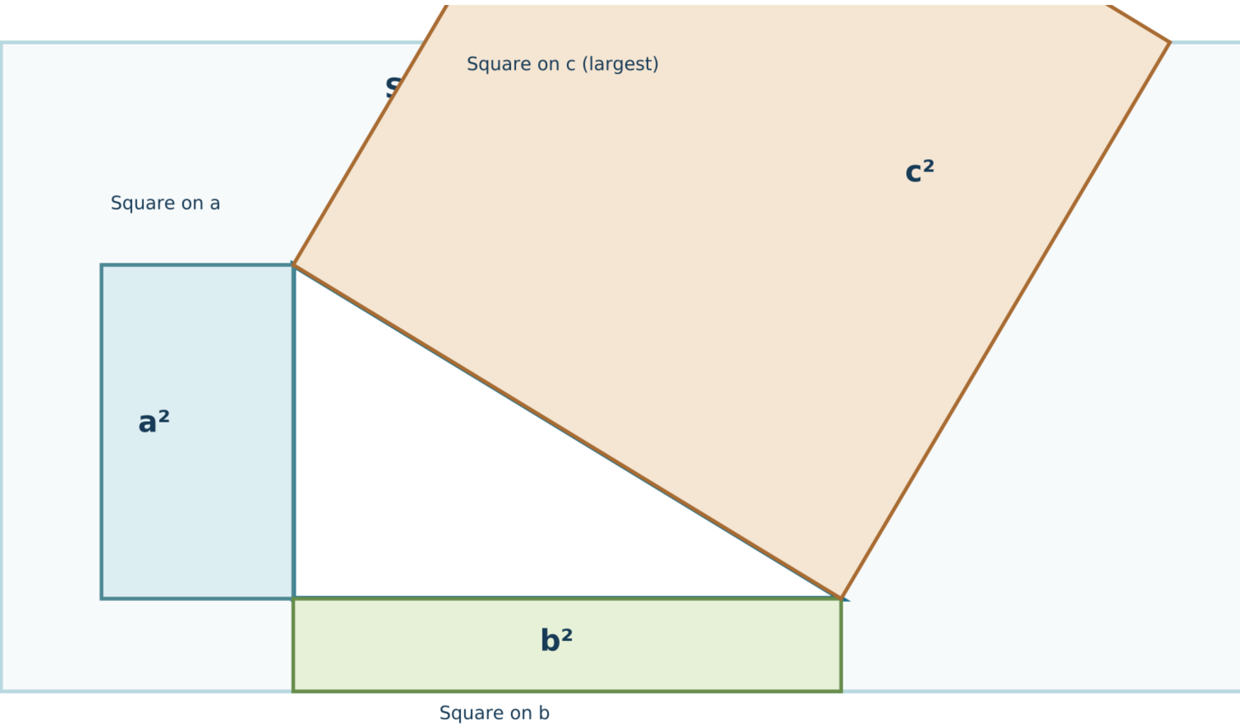



Figure 3 — Three squares are constructed on the three sides.

Step 3 — Add area labels. Since area of a square = side × side, the three areas are 9 cm², 16 cm² and 25 cm².

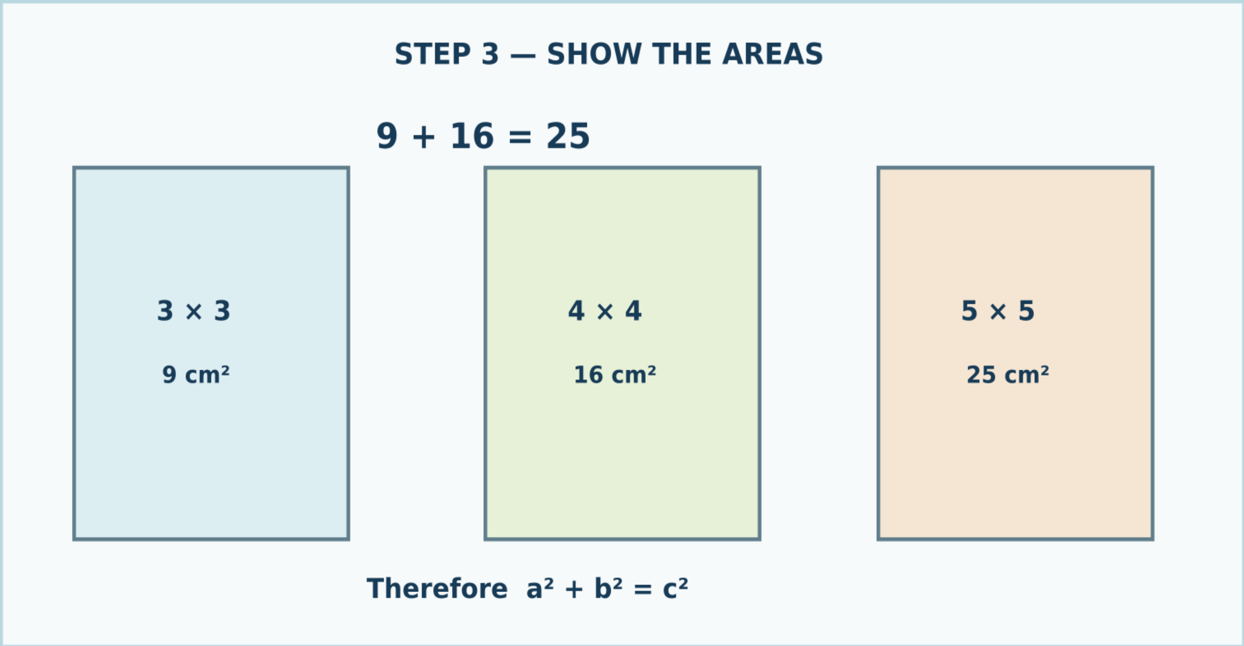



Figure 4 — The numerical area proof.

# 5. Proper Demonstration — How the Model Works

The most important part of the project is not simply displaying the model. The student should demonstrate it to the visitor.

1. Point to the 90° angle and say: “This is a right-angled triangle.”

2. Point to the longest side and say: “The side opposite 90° is the hypotenuse, c.”

3. Point to the two smaller squares and explain that their areas are $a^2$ and $b^2$.

4. For 3 cm and 4 cm, calculate $3^2 = 9$ and $4^2 = 16$.

5. Ask the visitor to add the two areas: $9 + 16 = 25$.

6. Point to the largest square and show that $5^2 = 25$.

7. Conclude: “Therefore, the area represented by $a^2 + b^2$ is exactly equal to $c^2$.”

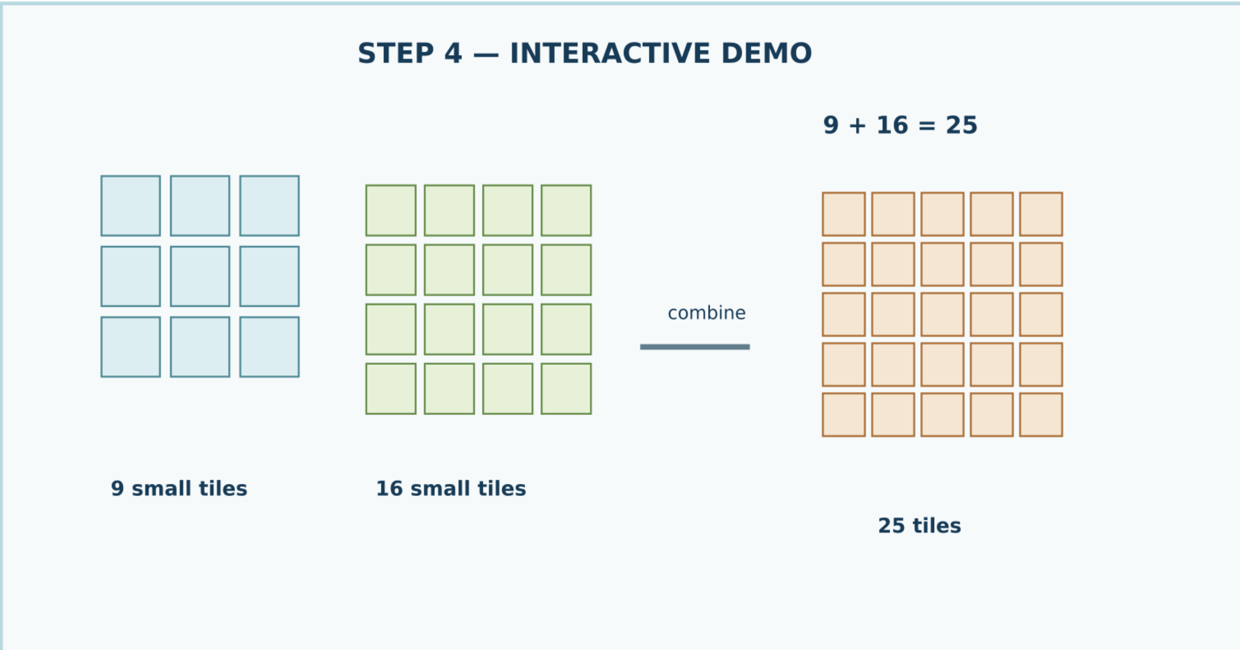



Figure 5 — Interactive demonstration using small equal tiles.

Interactive idea: Use 25 equal paper tiles. Keep 9 tiles in the 3×3 group and 16 tiles in the 4×4 group. Combine them and compare with the 5×5 group. This makes the equality visible and memorable.

# 6. Mathematical Working

For a right-angled triangle:

$$a^2 + b^2 = c^2$$

For the model:

$$3^2 + 4^2 = 5^2$$

$$9 + 16 = 25 \checkmark$$

If a side is unknown, rearrange the formula. For example, if c = 13 cm and a = 5 cm:

$$b = \sqrt{(13^2 - 5^2)} = \sqrt{144} = 12 \text{ cm}$$

# 7. Practical Implementation in Real Life

Pythagoras Theorem is useful whenever two perpendicular measurements form a right triangle and we want to find the direct distance.

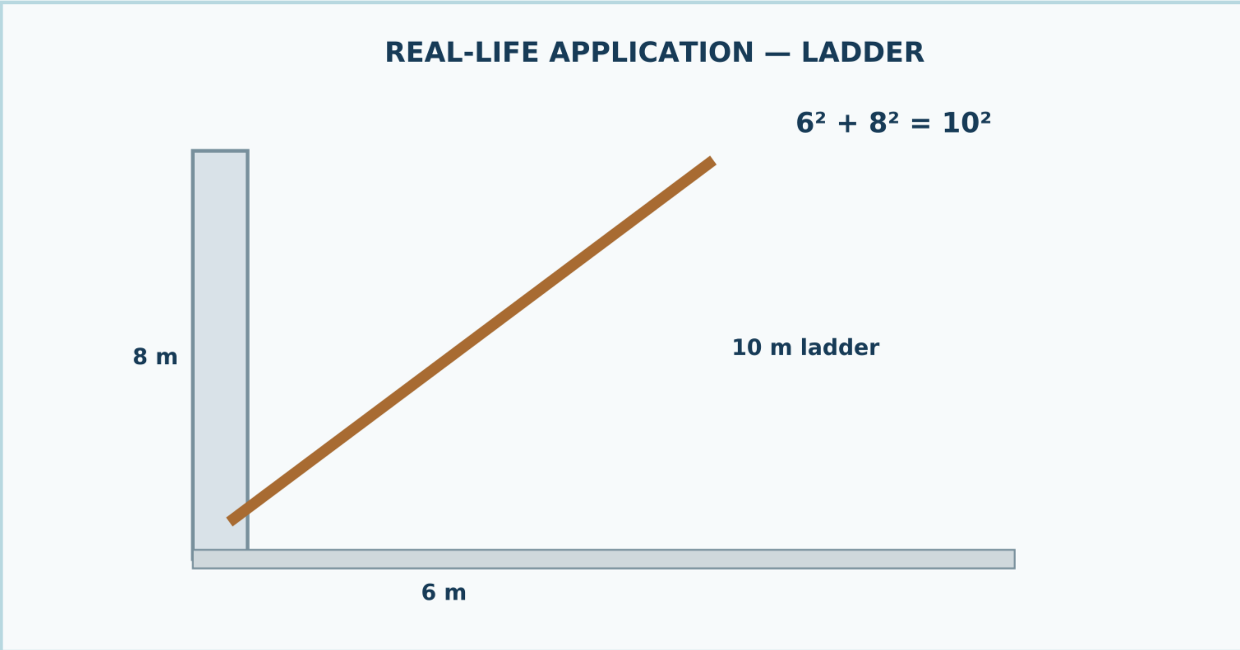



Figure 6 — Ladder application: 6 m from the wall and 8 m high gives a 10 m ladder.

Ladder example: $c^2 = 6^2 + 8^2 = 36 + 64 = 100$, so $c = 10$ m.

Construction: Checking right angles, diagonals and sloping structures.

Surveying: Finding distances that are difficult to measure directly.

Ramps: Calculating the sloping length from height and horizontal distance.

Sports grounds: Finding the diagonal of a rectangular field.

Architecture: Working with diagonals, roof slopes and structural measurements.

Navigation & maps: Finding straight-line distance from perpendicular movements.

# 8. Exhibition Demonstration Script

A student can present the model in about 60–90 seconds:

"Good morning. My model demonstrates Pythagoras Theorem. Here we have a right-angled triangle with sides 3 cm, 4 cm and 5 cm. I have constructed a square on each side. The area of the first square is $3^2 = 9$ cm², and the second is $4^2 = 16$ cm². When we add them, $9 + 16 = 25$ cm². The largest square has side 5 cm, so its area is $5^2 = 25$ cm². Therefore, $a^2 + b^2 = c^2$. This theorem is useful in construction, surveying, ladders, ramps and finding diagonals. Thank you."

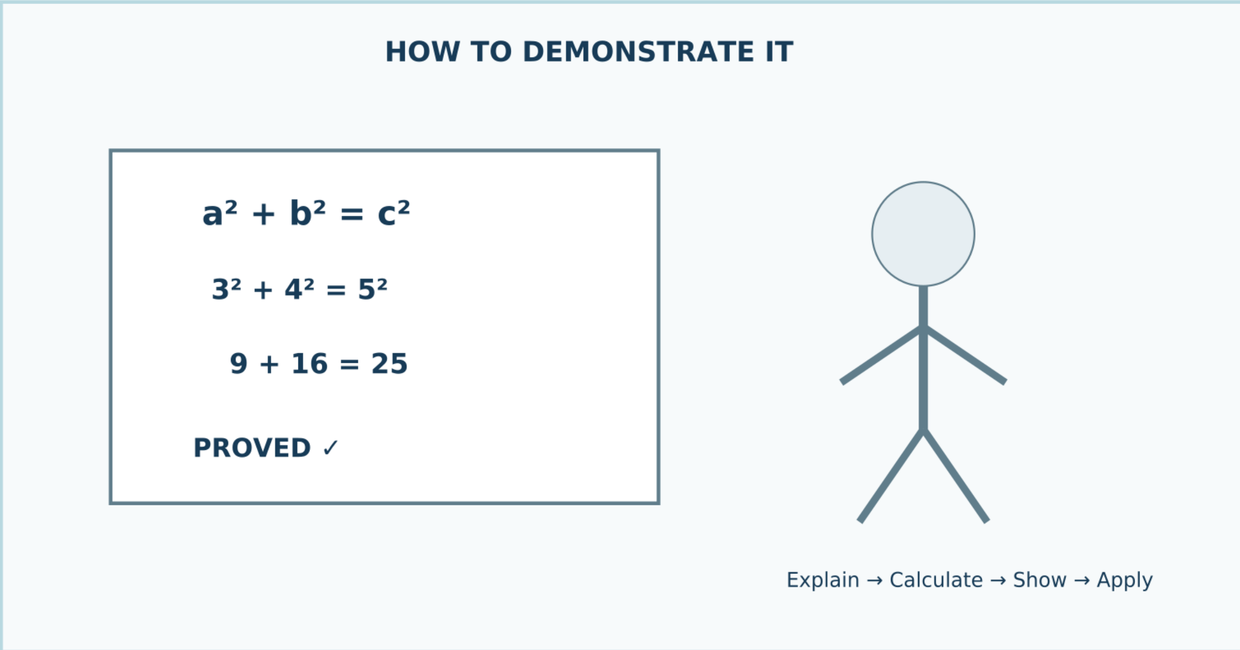



Figure 7 — Suggested presentation flow for the school exhibition.

## 9. Viva Questions

| Question | Answer |
|---|---|
| What is Pythagoras Theorem? | In a right-angled triangle, the square of the hypotenuse equals the sum of the squares of the other two sides. |
| What is the hypotenuse? | The side opposite the 90° angle; it is the longest side. |
| Why are squares used in this model? | Because $a^2$, $b^2$ and $c^2$ can be represented as the areas of squares built on the sides. |
| Can it be used for every triangle? | The standard Pythagoras Theorem applies to right-angled triangles. |
| Where is it used? | Construction, surveying, architecture, ramps, ladders, maps and diagonal measurements. |

## 10. Final Model Checklist

☐ Triangle is accurately drawn with a clearly marked 90° angle.

☐ Hypotenuse is correctly identified.

☐ Three squares are constructed on the three sides.

☐ Areas 9 $cm^2$, 16 $cm^2$ and 25 $cm^2$ are clearly displayed.

☐ The 9 + 16 = 25 demonstration can be performed physically.

☐ At least two real-life applications are shown.

☐ Student can explain the model without reading the board.

☐ Model is neat, strong and safe for repeated demonstrations.