The Pythagorean Theorem

Find any missing side in 2D and 3D

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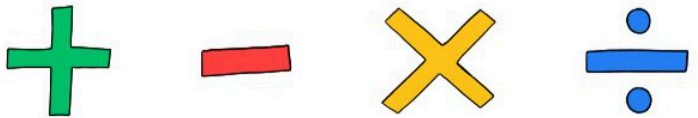
Today we will...

WE ARE LEARNING TO

- Use $a^2 + b^2 = c^2$ for right triangles
- Find unknown sides in real-world problems
- Use two steps for 3D diagonals

SUCCESS LOOKS LIKE

- ✓ I can spot the hypotenuse correctly
- ✓ I can solve for any missing side
- ✓ I can find length, width, height diagonals



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

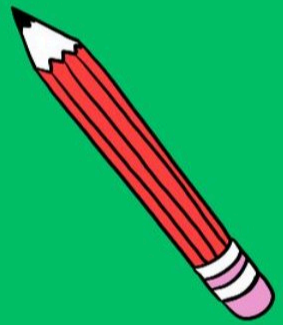
Hypotenuse vs. Missing Leg

Finding Hypotenuse c

- c is longest, opposite right angle
- Add squares: $a^2 + b^2 = c^2$
- Square root answer to get c

Finding a Leg a or b

- Leg is one side of right angle
- Subtract: $a^2 = c^2 - b^2$
- Square root answer to get leg



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Where Right Triangles Hide

Ladders

Ladder, wall, and ground make a right triangle.

Boxes

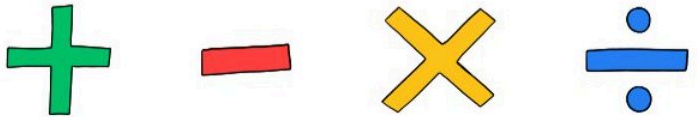
Base diagonal plus height makes a space diagonal.

Maps

East and north distances make a shortcut path.

Screens

Width and height make the diagonal size.



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

What could this be?

Three squares grow from one triangle. What rule links their areas?

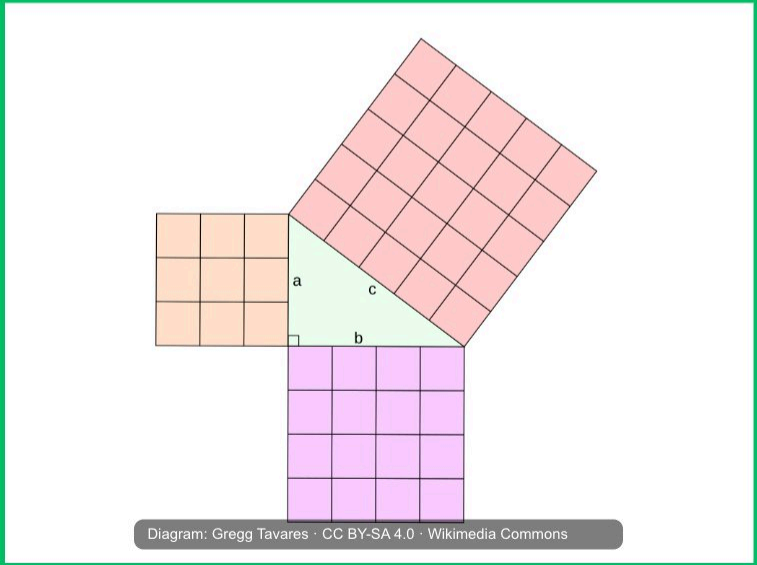


Diagram: Gregg Tavares · CC BY-SA 4.0 · Wikimedia Commons



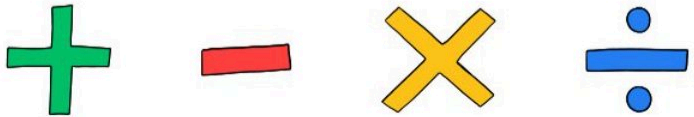
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Watch: Finding the Hypotenuse



▶ 0:00 – 4:55

- Listen for which side is called c
- Spot when to square, add, square root

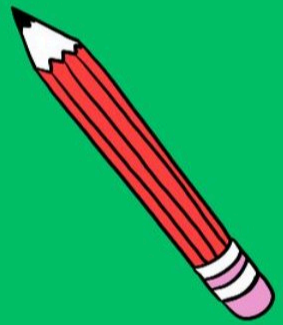


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$a^2+b^2=c^2$

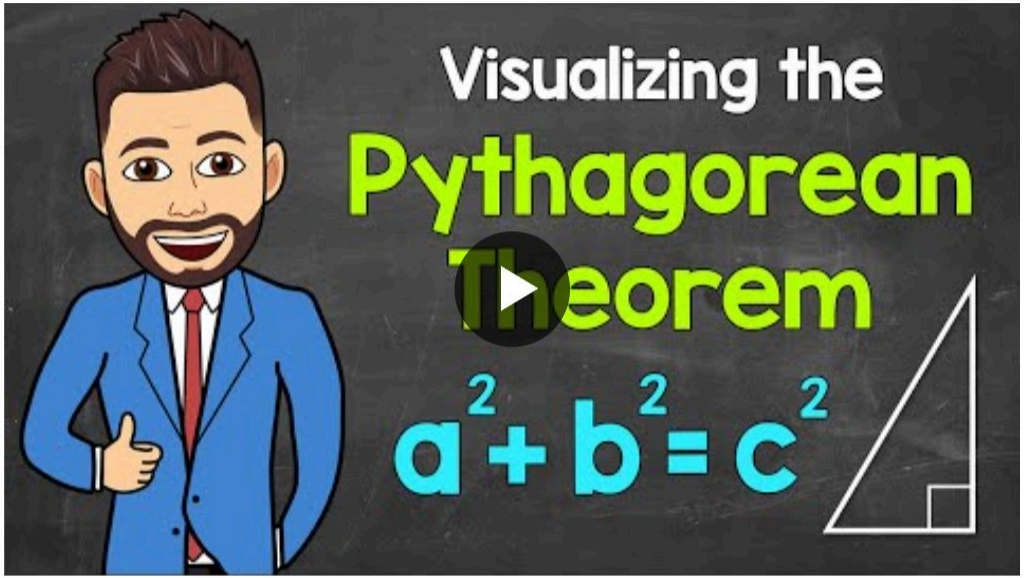
Solve Any Right Triangle

1. Mark right angle, label c opposite
2. Write $a^2 + b^2 = c^2$
3. Plug in the two known sides
4. Add or subtract, then square root
5. Check: c must be longest



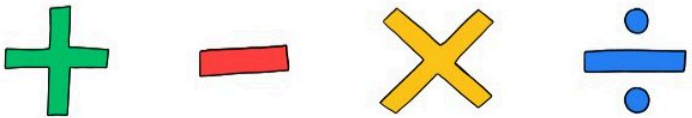
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See It: Why Squares Matter



▶ 0:00 – 4:51

- Watch how small squares fill big square
- Connect picture to the formula



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

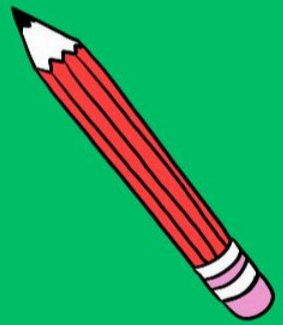
Your task

In pairs, solve three missing-side challenges: 10-foot ladder 6 feet out, 6 in. by 8 in. screen, and 6 in. by 8 in. box 5 in. tall.

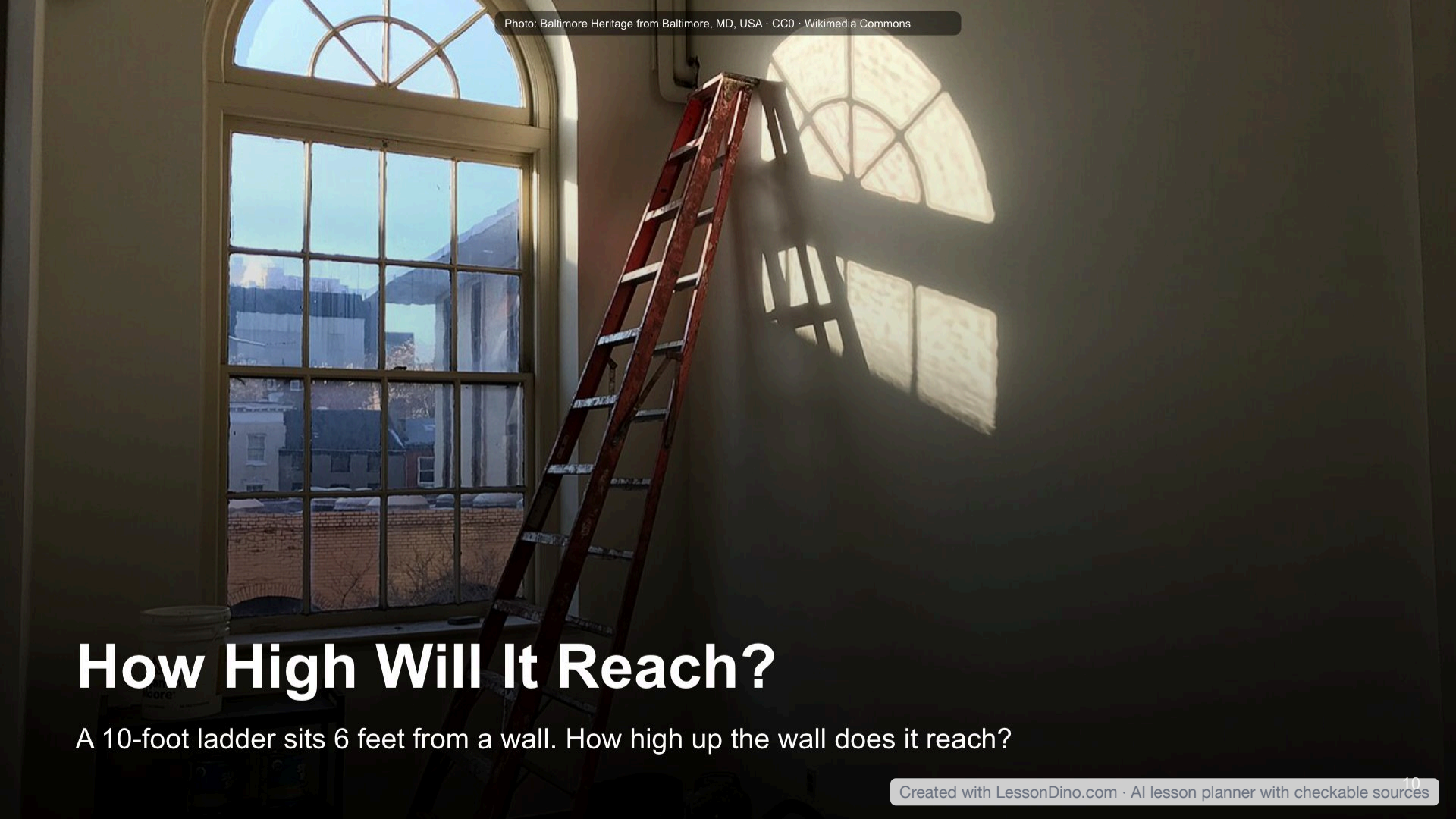
1. Draw the right triangle inside each picture
2. Label legs and hypotenuse c
3. Calculate and check reasonableness

10 min

In pairs



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How High Will It Reach?

A 10-foot ladder sits 6 feet from a wall. How high up the wall does it reach?

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

Think, pair, share

A box is 6 in. by 8 in. with height 5 in. What is the longest pencil that fits inside?





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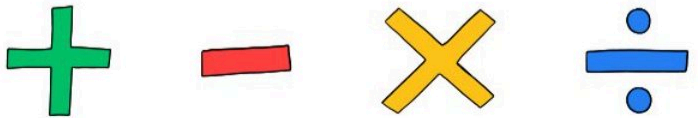
True or false?

In $a^2 + b^2 = c^2$, c is always the hypotenuse.

The theorem finds a missing side in any triangle.

A 3D diagonal can need the theorem twice.

If c = 13 and a = 5, then b = 12.



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