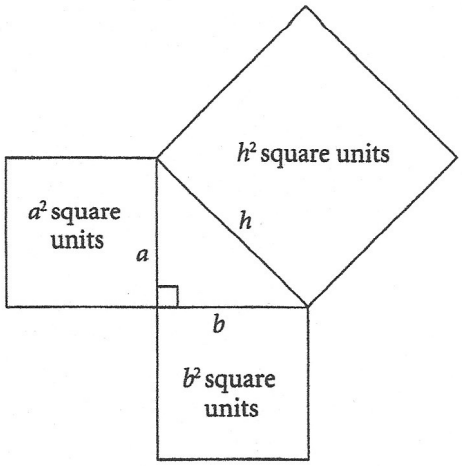
1.7 Applying the Pythagorean Theorem

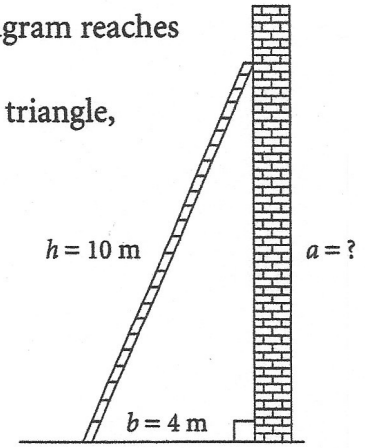
Quick Review

- The Pythagorean Theorem applies to right triangles.
- An algebraic equation for the Pythagorean Theorem is $h^2 = a^2 + b^2$, where h is the length of the hypotenuse and a and b are the lengths of the legs.



- You can apply the Pythagorean Theorem to problems involving right triangles.

You can calculate how high up the wall the ladder in the diagram reaches using the formula $h^2 = a^2 + b^2$
Since the length of the ladder is the hypotenuse of the right triangle, we label it h. The lengths of the two legs of this triangle are labelled a and b.



Substitute $b = 4$ and $h = 10$ into $h^2 = a^2 + b^2$

$10^2 = a^2 + 4^2$
$100 = a^2 + 16$
$100 - 16 = a^2 + 16 - 16$
$84 = a^2$
$\sqrt{84} = a$
$9.2 \doteq a$

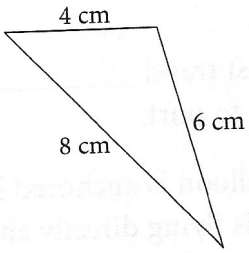
a is approximately 9.2 m. The ladder reaches approximately 9.2 m up the wall.

Tip

*It does not matter which leg is labelled a and which leg is labelled b, so long as a and b label the **legs** and h labels the **hypotenuse**.*

Practice

1. Use the Pythagorean Theorem to check if this is a right triangle.



Substitute $a =$ ____, $b =$ ____, and $h =$ ____
into the formula $h^2 = a^2 + b^2$

$h^2 =$ _____ $a^2 + b^2 =$ _____

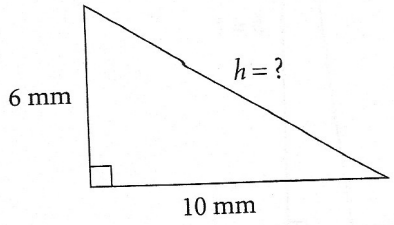
Circle the choices that make the sentence true.

Since h^2 *equals / does not equal* $a^2 + b^2$, the triangle *is / is not* a right triangle.

For questions 2 to 5, give each length to 1 decimal place.

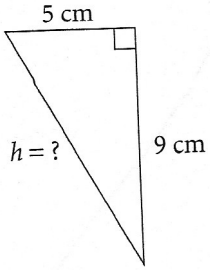
2. Use the equation $h^2 = a^2 + b^2$ to find the length of the unknown side.

a)



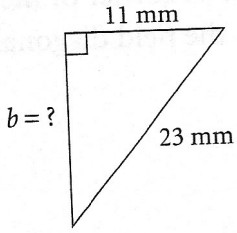
$h \doteq$ _____

b)



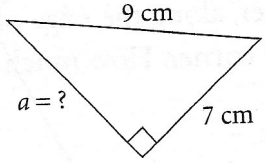
$h \doteq$ _____

c)



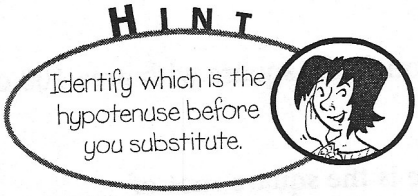
$b \doteq$ _____

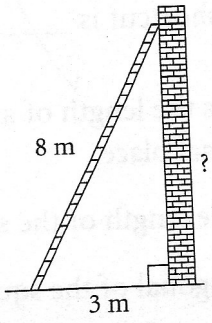
d)



$a \doteq$ _____

3. An 8-m ladder leans against a wall. How far up the wall does the ladder reach if the foot of the ladder is 3 m from the base of the wall? Show your work.

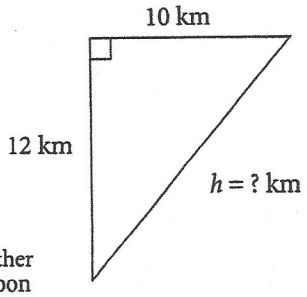




$b \doteq$ _____

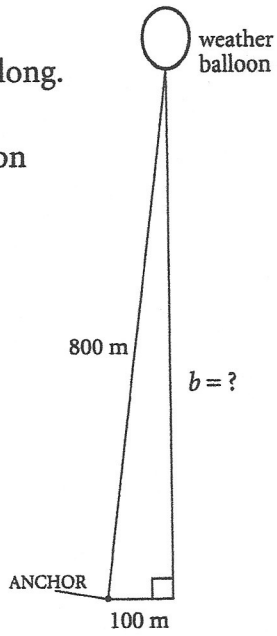
The ladder can reach a height of _____, to 1 decimal place.

4. A ship leaves port and travels 12 km due north. It then changes direction and travels due east for 10 km. How far must it travel to go directly back to port? Sketch a diagram to explain.



The ship must travel _____, to 1 decimal place, to go directly back to port.

5. A weather balloon is anchored by a cable 800 m long. The balloon is flying directly above a point that is 100 m from the anchor. How high is the balloon flying? Give your answer to the nearest metre.



The balloon is flying at a height of _____, to the nearest metre.

6. A rectangular field is 40 m long and 30 m wide. Carl walks from one corner of the field to the opposite corner, along the edge of the field. Jade walks across the field diagonally to arrive at the same corner. How much shorter is Jade's shortcut?

> **Tip**
> *Sketch a diagram first.*

The diagonal of the field measures _____.
Jade walks _____.
Carl walks _____ + _____ = _____
Jade's shortcut is _____ − _____ = _____ shorter.

7. What is the length of a diagonal of a square with area 100 cm²? Give your answer to 1 decimal place.

The side length of the square is the square root of _____, or _____ cm.

The diagonal of the square is the _____ of the right triangle with sides _____ and _____.

The length of the diagonal of the square is _____, to 1 decimal place.