Applying Pythagoras' theorem

Year 9 Mathematics
Mainstream

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Learning Objectives

By the end of the lesson I hope that you understand and can apply the following to a range of questions from the Year 9 Mathematics course.

- To know how to apply Pythagoras's Theorem to more complex problems.
- Know how to apply Pythagoras' Theorem to real world problems where we have to find right angled triangles and hence find missing side lengths

RECAP

In a previous lesson we looked at how, for right angled triangles, there is a relationship between the sum of the areas of the two shortest sides of a right angled triangle and the area of the hypotenuse.

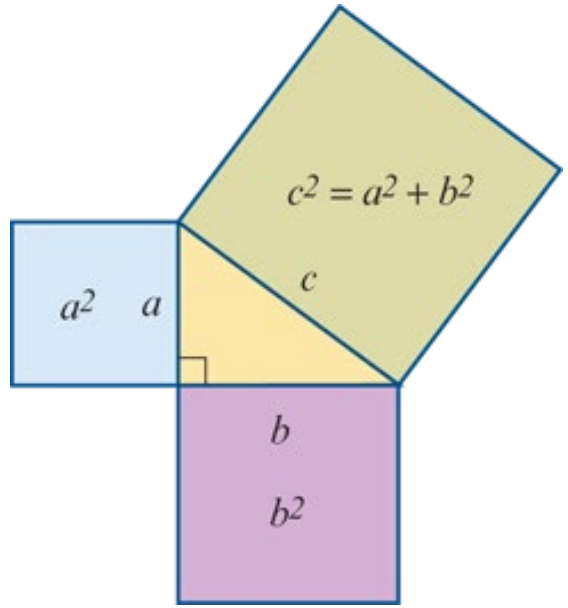
This is **only true** for right angled triangles.

The relationship is more formally known as:

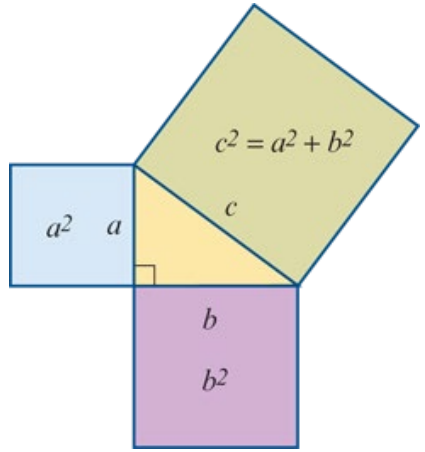
$$c^2 = a^2 + b^2$$

In the previous lessons we looked at how to find any missing side length of a right angled triangle **so long as we have two other sides given to me**.

Let's see how we can apply them to more complex problems.



Triangles are everywhere



No matter where you look, I can guarantee that there are triangles everywhere.

In fact, they are one of the most important shapes used in construction of houses, buildings, garden decks etc.

This guy, in the picture, is using a **Pythagorean Triple** to make sure the joists are perpendicular to the bottom of the building.

Where we can find right angled triangles, we can use Pythagoras' Theorem to find missing side lengths.

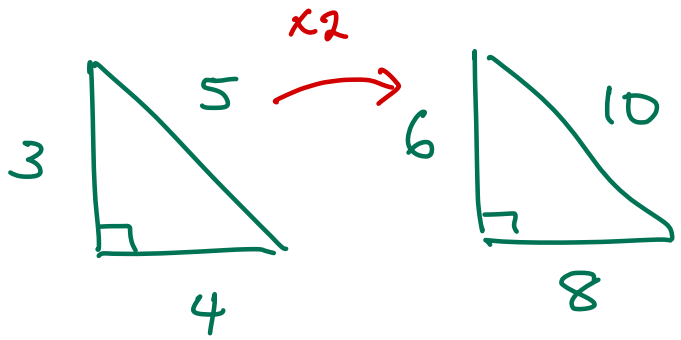
Side note: Pythagorean Triples

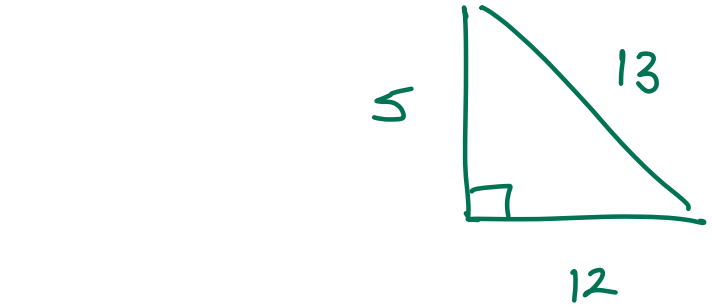
There are certain triangles which we have labelled as Pythagorean Triples. There are generally triangles where the side lengths are whole numbers.

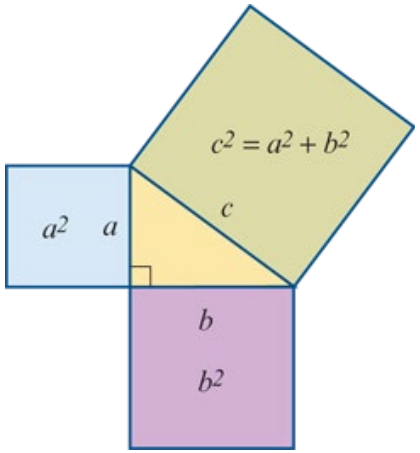
The most used ones are:

3, 4, 5
5, 12, 13
7, 24, 25
9, 40, 41

You can check (in your own time!) to see if they are right angled triangles …

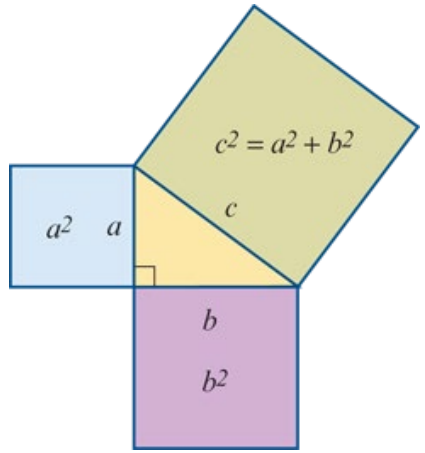


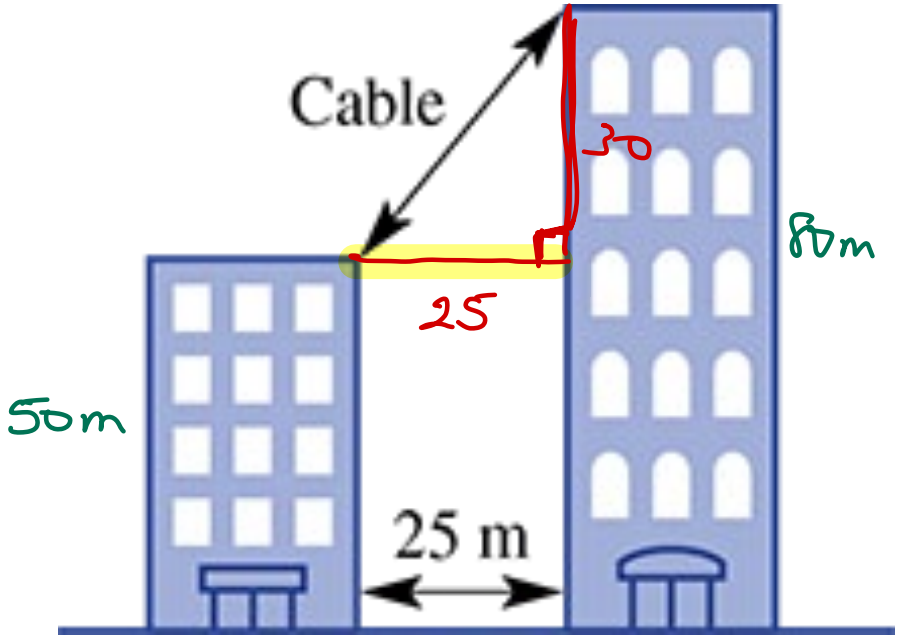


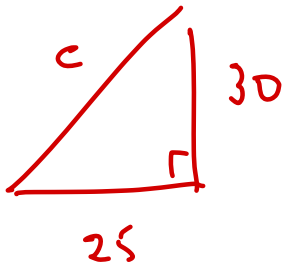


A real world example

Two skyscrapers are located 25 m apart and a cable links the tops of the two buildings. Find the length of the cable if the buildings are 50 m and 80 m in height. Give your answer correct to two decimal places.







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

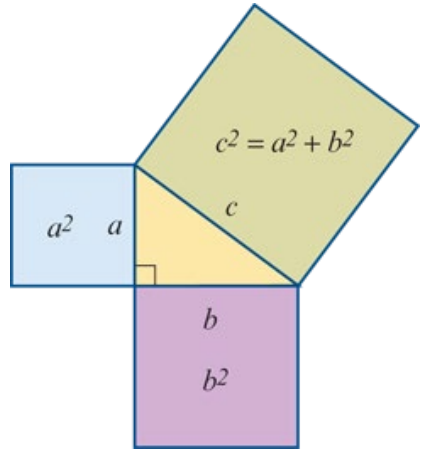
$c^2 = 25^2 + 30^2$

$c^2 = 1525$

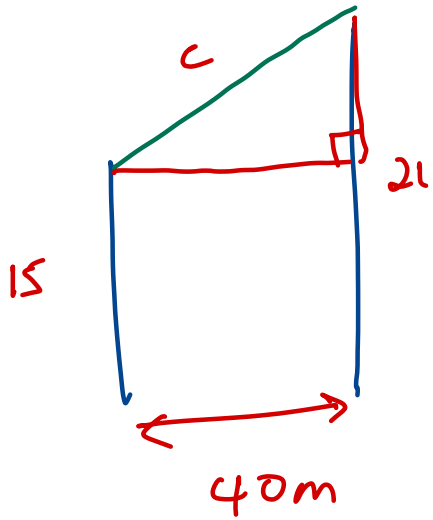
$c = \sqrt{1525}$

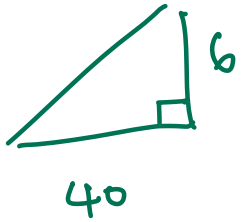
$c = 39.05\text{ m}$

Example 2



Two poles are located 40 m apart and a rope links the tops of the two poles. Find the length of the rope if the poles are 15 m and 21 m in height. Give your answer correct to two decimal places.





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

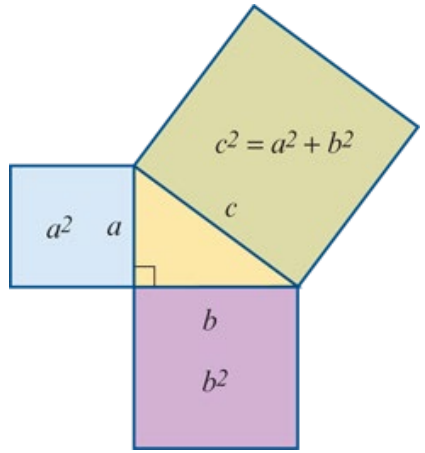
$c^2 = 40^2 + 6^2$

$c^2 \approx 1636$

$c = \sqrt{1636}$

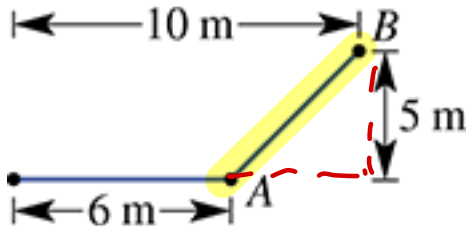
$c = 40.45\text{ m}$

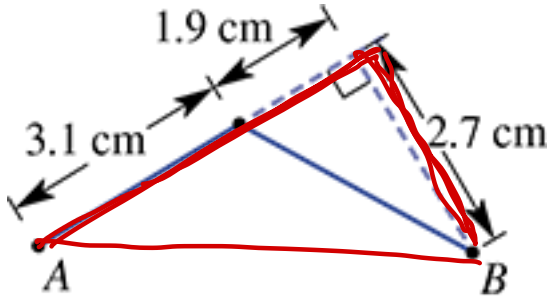
Thinking about the question

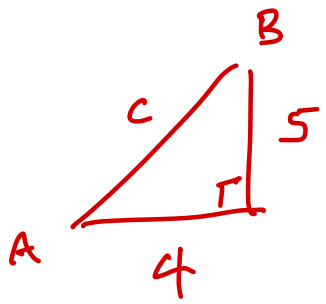


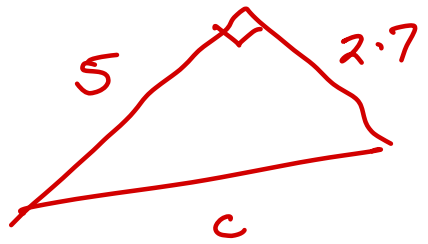
It's really important to understand what the question is asking, but to also be able to find right angled triangles. When you know where the right angled triangle is … you then need to find the side lengths and **put it into the context of the question**.

How would you find the distance between A and B in each of the following.

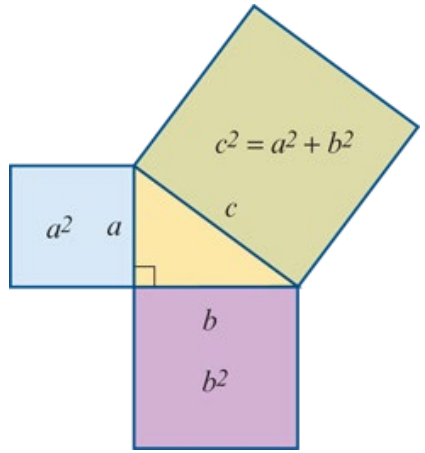








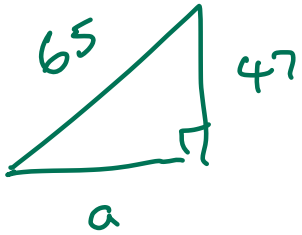
Thinking about the question

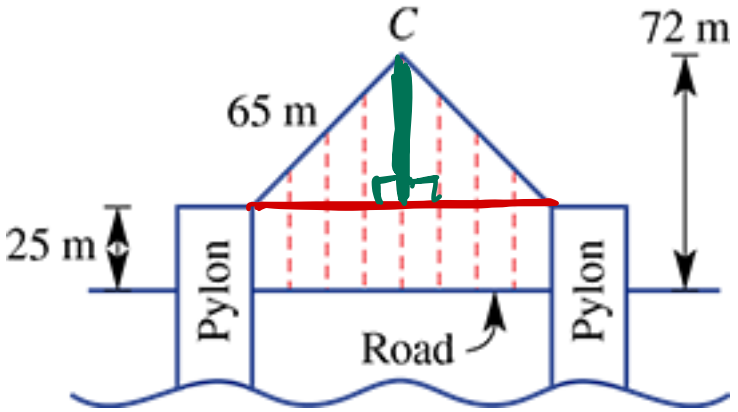


It's really important to understand what the question is asking, but to also be able to find right angled triangles. When you know where the right angled triangle is … you then need to find the side lengths and **put it into the context of the question**.

How would you find the distance between the two pylons in the following diagram.

Note: You may need to do more than one calculation to be able to complete the question.





Questions to complete:

The questions I would like you to complete for this lesson are:

Exercise 3C: Applying Pythagoras' Theorem
Questions: 1, 3, 5ab, 6, 8, 9

Extension Questions (optional)
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