Pythagoras Puzzle

Objectives:

- To investigate Pythagoras' Theorem.

Learning Outcomes:

I can follow a series of instructions. I can measure accurately.

I can calculate areas of triangles and squares.

I understand visually, how Pythagoras' Theorem works.

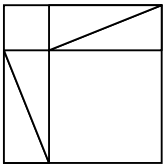
Method: A series of challenges which involve making and then measuring a puzzle.

What you need: Rulers, pupil worksheets, A4 and A5 coloured paper.

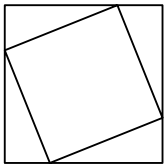
The Activity

Tell the pupils that you are going to give them some practical challenges. They will have to read and follow instructions carefully, measure accurately, cut accurately and solve a puzzle. There will then be some more measuring and thinking to do. Discuss potential sources of error when measuring, drawing lines and cutting and talk about how to minimise them. Issue the sheets and set the pupils to the task. As the pupils complete the challenges, discuss the solutions:

Challenge 1:



Challenge 2:



Challenges 3 & 4: Area of small triangle = $\frac{1}{2}$ base x height = $\frac{1}{2}$ x 6 x 8 = 24 cm^2

Area of smallest square = 6 x 6 = 36 cm^2

Area of medium sized square = 8 x 8 = 64 cm^2

Area of large square = 10 x 10 = 100 cm^2

Challenges 5 & 6: Sum of the smaller squares = the larger square. (The reason is that the underlying square is still the same size and the four triangles take up the same amount of space.)

This works for any right-angled triangle. As an extension activity, set the challenge of creating similar puzzle with right-angled triangles of a different size and shape. (longer & thinner, shorter & fatter.)

This will lead on naturally to an investigation of Pythagoras' Theorem: The sum of the squares on two sides = the square on the third side.

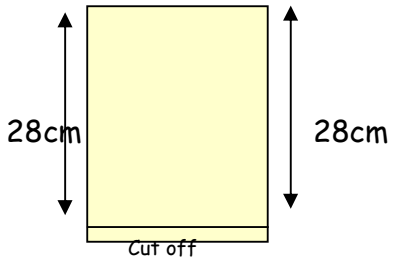
Pythagoras Puzzle

You are going to make a puzzle.

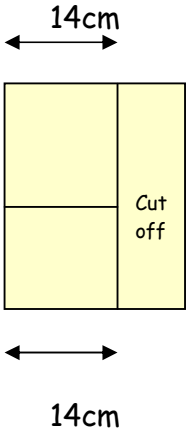
You will need:
One coloured sheet of A4 paper.
One different coloured sheet of A5 paper.
A 30cm ruler
Scissors
Pritt stick

Follow these instructions to make TWO EQUAL SQUARES and EIGHT EQUAL TRIANGLES. Make sure all your measuring and cutting is done EXACTLY.

Step 1 Making the two squares



Measure down *both* sides of the A4 sheet and put a mark at 28cm.
Draw a line across the page.
Cut off the narrow strip and recycle it.

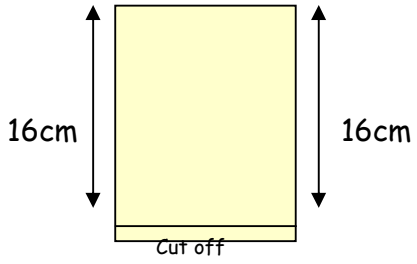


Measure along the top and bottom edges of the remaining sheet and put marks at 14cm.
Draw a line down the page.
Cut off the strip down the edge and recycle it.

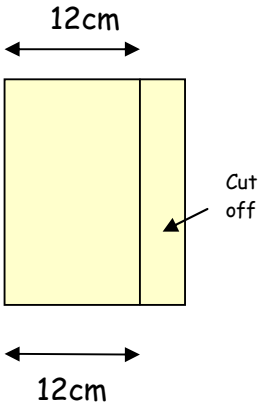
Measure and *cut* the remaining rectangle into two squares *exactly* 14cm by 14cm.

Keep them safe!

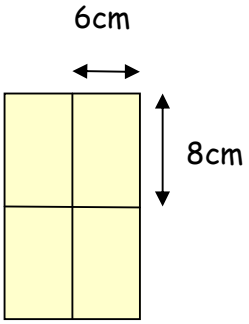
Step 2 Making the eight triangles



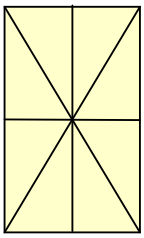
Measure down both sides of the *A5* sheet and put a mark at 16cm.
Draw a line across the page.
Cut off the narrow strip and recycle it.



Measure along the top and bottom edges of the remaining sheet and put marks at 12cm.
Draw a line down the page.
Cut off the strip down the edge and recycle it.



Measure and *draw* lines to divide the remaining rectangle into four rectangles *exactly* 6cm by 8cm.



Draw *diagonal* lines, corner to corner, to make eight equal triangles.
Each triangle should be *exactly* 8cm tall and 6cm wide. If you have measured accurately, the long side of each triangle (the hypotenuse) will also be an *exact* number of centimetres.
If your triangles are accurate, *cut* them out.

Challenge 1

Use *one* of your squares and *four* triangles.

Arrange four triangles to *cover up* some of the big square and *leave* **two smaller squares of different sizes in the background colour**.

The triangles must be fully on the big square (not sticking off the edge).

There must be no little gaps anywhere.

Get your teacher to check and then stick the puzzle in your book.

Challenge 2

Use your *other* square and the *other* four triangles.

Arrange the four triangles on *cover up* some of the big square and *leave* **one smaller squares in the background colour**.

Same rules as before!

Get your teacher to check and then stick the puzzle in your book.

Challenge 3

Measure the *sides* and calculate the *areas* of ***each triangle and square***.

Write them on both diagrams.

Challenge 4

Look at the *lengths of the sides* of the *triangles*.

Look at the *areas* of the *squares* you made in challenge 1 and challenge 2.

What is the connection?

Challenge 5

Add together the areas of the two smaller squares from challenge 1. Compare with the area of the larger square you made in challenge 2. What do you notice? Why does this work?