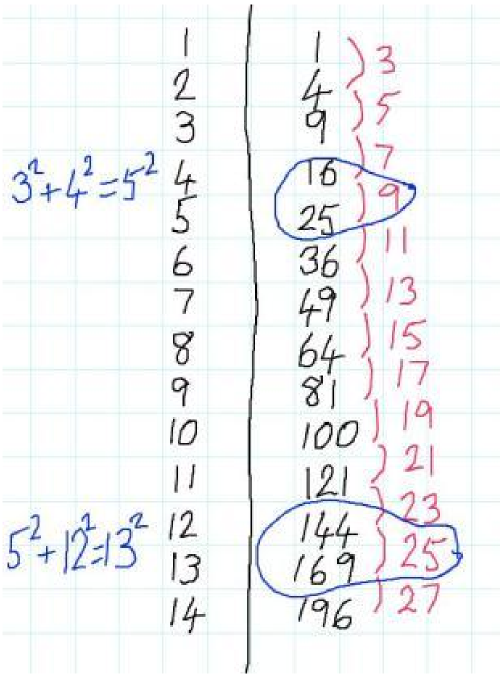
# Generating Triples

Charlie has been investigating square numbers. He decided to organise his work in a table:




Charlie noticed some special relationships between certain square numbers:

$$3^2 + 4^2 = 5^2 \qquad 5^2 + 12^2 = 13^2$$

Sets of integers like 3, 4, 5 and 5, 12, 13 are called **Pythagorean Triples**, because they could be the lengths of the sides of a right-angled triangle.

He wondered whether he could find any more...

Can you extend Charlie's table to find any more sets of Pythagorean Triples where the hypotenuse is 1 unit longer than one of the other sides?
Do you notice any patterns?
Can you make any predictions?

**Can you find a formula that generates Pythagorean Triples like Charlie's?**
**Can you prove that your formula works?**

Alison has been working on Pythagorean Triples where the hypotenuse is 2 units longer than one of the other sides.
So far, she has found these:

$$4^2 + 3^2 = 5^2 \qquad 6^2 + 8^2 = 10^2 \qquad 8^2 + 15^2 = 17^2$$

Some of these are just scaled-up versions of Charlie's triples, but some of them are new and can't be divided by a common factor (these are called **primitive triples**).

Can you find more Pythagorean Triples like Alison's?

**Can you find a formula for generating Pythagorean Triples like Alison's?**
**Can you prove that your formula works?**