

## Fermat's Last Theorem

Consider the following proposition 'it is **impossible** to find three non-zero integers  $a$ ,  $b$  and  $c$  such that

$$a^n + b^n = c^n \text{ where } n \geq 3'$$

This proposition is the famous Fermat's Last Theorem. Fermat was a French Lawyer and did mathematics in his spare time. The reason why Fermat's last theorem is popular is because Fermat stated this theorem around 1630 and added that "I have discovered a proof but the margin is too small to write the proof".



Pierre de Fermat



Andrew Wiles

However for over 350 years no one could find a proof for this theorem. Eventually in 1993 Andrew Wiles a British mathematician working in Princeton USA provided a proof at Cambridge. Initially this proof had a flaw but that was resolved in 1994.

Fermat's last theorem states that the equation

$$a^n + b^n = c^n \quad \text{for } n \geq 3$$

has **no** integer solutions. *What does this mean?*

We know there are integer solutions for  $n = 2$  because it often crops up in Pythagoras's theorem:

$$3^2 + 4^2 = 5^2, \quad 5^2 + 12^2 = 13^2, \quad 8^2 + 15^2 = 17^2, \dots$$

However when  $n \geq 3$  we **cannot** find integer solutions to the above equation. This means there are no integers  $a$ ,  $b$  and  $c$  such that

$$a^3 + b^3 = c^3, \quad a^4 + b^4 = c^4, \quad a^5 + b^5 = c^5, \dots$$