Fermat's Last Theorem

Fermat’s Last Theorem: There are no natural numbers (1, 2, 3, …) a, b, and c such that $a^n + b^n = c^n$, in which n is a natural number greater than 2.

Proof

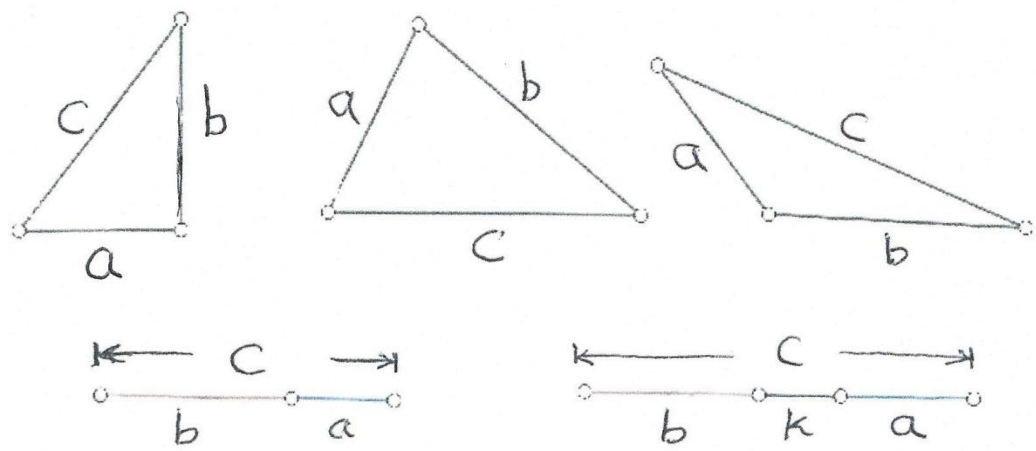
$1 - Taha's\ Logic\ Equations\ Fact$

$a = b\ (True\ or\ False)\ \&\ c = d\ (True) \Rightarrow (a - c = b - d)\ Fulse \Leftrightarrow a = b\ (\ False)$

$2 -\ Taha's\ Coefficient\ Fact$: *[a + b = c ⇒ ax + by= cz] ⇔ x = y = z*

3- Taha’s (N_+) & $Three\ Sided\ Geometric$ Shapes Fact below:

$N_+ = \text{(RTs)} \cup \text{(ATs)} \cup \text{(OTs)} \cup (\text{Seqments c} = a + b) \cup (\text{Seqments c} > a + b)$



In all shapes

$1st)\ if\ a = b\ in\ all\ above\ five\ geometric\ shapes$

$$is\ a^n + b^n = c^n?$$

$$let\ a^n + b^n = c^n$$

$$a^n + a^n = c^n$$

$$2a^n = c^n$$

$$\therefore c = \sqrt[n]{2}\ a \notin N_+$$

$$\therefore a^n + b^n \neq c^n$$

$2nd)\ if\ a = b = c\ in\ Acute\ Triangle$

$$is\ a^n + b^n = c^n?$$

$$let\ a^n + b^n = c^n$$

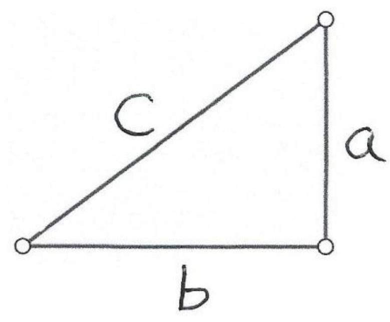
$$\therefore a^n + a^n = a^n$$

$$a^n = 0 \Rightarrow a = 0 \ldots Contradiction\ to\ a \in N_+$$

$$\therefore a^n + b^n \neq c^n$$

$3rd)\ if\ a < b < c\ in\ all\ above\ five\ geometric\ shapes$

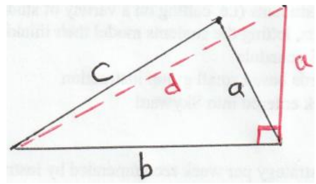
$Shape1$: $Right\ Triangle$



$A)\ is\ a^n + b^n = c^n?\ a < b < c$
$let\ a^n + b^n = c^n \dots eq1$
$\because\ a^2 + b^2 = c^2 \dots eq2$
$\therefore a^n - a^2 + b^n - b^2 = c^n - c^2\ (by\ subtraction)$
$a^n\ (1\text{-}\ a^{2-n}) + b^n\ (1\text{-}\ b^{2-n}) = c^n(1 - c^{2-n}) \dots eq3$
$Taha's\ Coefficient\ Fact\ in\ eq3$: $1\text{-}\ a^{2-n} = 1 - b^{2-n} = 1 - c^{2-n} \Leftrightarrow a^n + b^n = c^n$
$\therefore 1 - a^{2-n} = 1 - b^{2-n} \Rightarrow a = b \dots contradiction\ to\ a < b$
$\therefore a^n + b^n \neq c^n$

$B)\ is\ a^n + c^n = b^n?\ a < b < c$
$let\ a^n + c^n = b^n$
$\therefore c^n < b^n \dots (subtracted\ a^n\ from\ 1st\ side)$
$\therefore c < b \dots Contradiction\ to\ c > b$
$\therefore a^n + c^n \neq b^n$

$Shape2: Acute\ Triangle$



$A) is\ a^n + b^n = c^n ?\ when\ a < b < c$

$let\ a^n + b^n = c^n \ldots eq1$

$\because a^2 + b^2 = d^2 \ldots eq2$

$\therefore a^n - a^2 + b^n - b^2 = c^n - d^2\ \ldots by\ subtraction\ (eq1 - eq2)$

$a^n\ (1\text{-}\ a^{2-n}) + b^n\ (1\text{-}\ b^{2-n}) = c^n \left(1 - \frac{d^2}{c^n}\right) \ldots eq3$

$Taha's\ Coefficient\ Fact\ in\ eq3$:1- $a^{2-n} = 1 - b^{2-n} = 1 - \frac{d^2}{c^n} \Leftrightarrow a^n + b^n = c^n$

$\therefore 1 - a^{2-n} = 1 - b^{2-n} \Rightarrow a = b \ldots contradictio\ to\ a < b$

$\therefore a^n + b^n \neq c^n$

$B) is\ a^n = b^n + c^n ? when\ a < b < c$

$let\ a^n = b^n + c^n$

$\therefore a^n > c^n \ldots subtracted\ b^n\ from\ 2nd\ side$

$\therefore a > c \ldots contradiction\ to\ a < b < c$

$\therefore a^n \neq b^n + c^n$

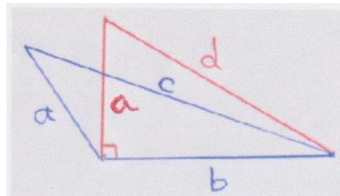
$C) is\ a^n = b^n + c^n ?\ when\ a = b = c$

$Proof$:

$let\ a^n = b^n + c^n \Rightarrow a^n = a^n + a^n \Rightarrow 1 = 2\ false$

$\therefore a^n \neq b^n + c^n$

$Shape3$: $Obtuse\ Triangle$



$A)\ is\ a^n + b^n = c^n?\ when\ a < b < c.$

$let\ a^n + b^n = c^n \dots eq1$

$\because a^2 + b^2 = d^2 \dots eq2$

$\therefore a^n - a^2 + b^n - b^2 = c^n - d^2$

$\therefore a^n(1 - a^{2-n}) + b^n(1 - b^{2-n}) = c^n\left(1 - \frac{d^2}{c^n}\right) \dots eq3$

$Taha's\ Coefficient\ Fact\ in\ eq3$: 1- $a^{2-n} = 1 - b^{2-n} = 1 - \frac{d^2}{c^n} \Leftrightarrow a^n + b^n = c^n$

$\therefore 1 - a^{2-n} = 1 - b^{2-n} \Rightarrow a = b \dots contradiction\ to\ a < b$

$\therefore\ a^n + b^n \neq c^n$

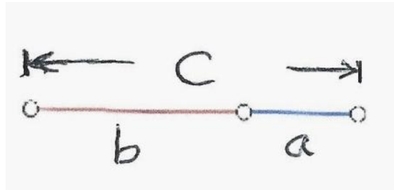
$B)\ is\ c^n + b^n = a^n?\ When\ a < b < c.$

$let\ c^n + b^n = a^n$

$\therefore c^n < a^n \Rightarrow c < a \dots Contradiction\ to\ a < b < c$

$\therefore\ c^n + b^n \neq a^n\ the\ same\ way\ for\ c^n + a^n \neq b^n$

$\boldsymbol{Shape\ 4: c = a + b}$



$is\ a^n + b^n = c^n?\ When\ c = a + b$

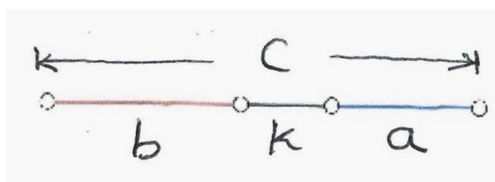
$\because c = a + b$

$\therefore c^n = (a + b\ )^n$

$\therefore c^n > a^n + b^n$

$\therefore c^n \neq a^n + b^n$

$\boldsymbol{Shape\ 5: c} > a + b$



$is\ a^n + b^n = c^n?\ When\ c > a + b$

$\because c > a + b$

$\therefore c^n > (a + b)^n$

$\therefore c^n > a^n + b^n$

$\therefore c^n \neq a^n + b^n$