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An Elementary Proof for Fermat's Last Theorem using Three Distinct Odd Primes *F*, *E* and *R*

P. N. Seetharaman

***Abstract:** In number theory, Fermat's Last Theorem states that no three positive integers a, b and c satisfy the equation $a^n + b^n = c^n$ where n is any integer > 2. Fermat and Euler had already proved that there are no integral solutions to the equations $x^3 + y^3 = z^3$ and $x^4 + y^4 = z^4$. Hence it would suffice to prove the theorem for the index n = p, where p is any prime > 3. In this proof, we have hypothesized that r, s and t are positive integers in the equation $r^p + s^p = t^p$ where p is any prime >3 and prove the theorem using the method of contradiction. We have used an Auxiliary equations $x^3 + y^3 = z^3$ along with the main equation $r^p + s^p = t^p$, which are connected by means of transformation equation through the parameters. Solving the through transformation equations we get the result rst = 0, showing that only a trivial solution exists in the main equation.*

***Keywords:** Transformation Equations Two Fermat's Equations. 2010 Mathematics Subject Classification 2010: 11A–XX.*

Abbreviations:
LHS: Left Hand Side
RHS: Right Hand Side

I. INTRODUCTION

During 1637, the French mathematician Pierre de Fermat conjectured in the margin of a book that the equation $x^n + y^n = z^n$ has no integral solutions for *x*, *y* and *z*, where $n > 2$ [1]. He mentioned therein that he himself had found a marvelous solution to $x^n + y^n = z^n$, with $n > 2$, but the margin was too narrow to contain it. However his proof is available only for $x^4 + y^4 = z^4$ using infinite decent method [2]. Subsequently Euler and others proved the theorem for $x^3 + y^3 = z^3$. Later on Sophie Germain proved the theorem for a general case, and subsequently E.E [3]. Kummer proved the theorem for regular primes [4]. Many mathematicians worked on this theorem by which number theory developed leaps and bounds [5]. Mathematicians found a close relationship between Fermat's Last theorem and Elliptic curve [6]. Finally in 1995 Andrew Wiles proved the theorem completely [7]. Many mathematicians have analysed and explained the theorem in all aspects [8]. In this paper we are trying for an alternative elementary proof for Fermat's Last theorem [9].

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*Correspondence Author(s)
P.N Seetharaman*, Retired Executive Engineer, Energy Conservation Cell), Tamil Nadu State Electricity Board, Anna Salai, Chennai (Tamil Nadu), India. Email ID: palamadaiseetharaman@gmail.com, ORCID ID: 0000-0002-4615-1280

II. ASSUMPTIONS

A. We initially hypothesize that all r, s and t are non-zero integers satisfying the equation $r^p + s^p = t^p$ *where p is any prime > 3, and establish a contradiction in this proof. We can have gcd(r, s, t) = 1*

B. We employ the Auxiliary equation $x^3 + y^3 = z^3$; along with the main equation $r^p + s^p = t^p$ Since we are proving the theorem only in the main equation, we have the choice of assigning suitable numerical values for x, y and z^3. Without loss of generality we can have x and y as positive integers; z^3 a positive integer; both z and z^2 irrational. In this proof we have assigned the values as x =53; y = 11; $z^3 = 53^3 + 11^3 = 8^2 \times 2347$. We have created transformation equations to the above two equations and linked them through parameters called a, b, c, d, e and f.

C. F, E and R are distinct odd primes; each coprime to x, y, z^3, r. s and t.

Proof. By random trials, we have created the following equations,

$$\left(a\sqrt{t^p}+b\sqrt{11E^{1/3}}\right)^2+\left(c\sqrt{2347}+d\sqrt{F}\right)^2=\left(e\sqrt{E^{5/3}}+f\sqrt{53}\right)^2 \quad (1)(i)$$

and

$$\left(a\sqrt{F}-b\sqrt{E}\right)^2+\left(c\sqrt{r^p}-d\sqrt{R^{5/3}}\right)^2=\left(e\sqrt{s^p}-f\sqrt{R^{1/3}}\right)^2 \quad (1)(ii)$$

as the transformation equations of $x^3 + y^3 = z^3$ and $r^p + s^p = t^p$ respectively, through the parameters called *a*, *b*, *c*, *d*, *e* and *f*. Here $x = 53$; $y = 11$; and $z^3 = \underline{x}^3 + y^3 = 53^3 + 11^3 = 8^2 \times 2347$. *F*, *E* and *R* are distinct odd primes, each coprimes, each coprime to *x*, *y*, z^3, *r*, *s* and *t*.

From equation (1-i) and (1-ii, we get

$$a\sqrt{t^p} + b\sqrt{11E^{1/3}} = \sqrt{x^3} \quad (2)$$

$$a\sqrt{F} - b\sqrt{E} = \sqrt{r^p} \quad (3)$$

$$c\sqrt{2347} + d\sqrt{F} = \sqrt{y^3} \quad (4)$$

$$c\sqrt{r^p} - d\sqrt{R^{5/3}} = \sqrt{s^p} \quad (5)$$

$$e\sqrt{E^{5/3}} + f\sqrt{53} = \sqrt{z^3} \quad (6)$$

and $$e\sqrt{s^p} - f\sqrt{R^{1/3}} = \sqrt{t^p} \quad (7)$$

Solving simultaneously (2) and (3), (4) and (5), (6) and (7), we get

$$a = \left(\sqrt{Ex^3} + \sqrt{11E^{1/3}r^p}\right) \Big/ \left(\sqrt{Et^p} + \sqrt{11FE^{1/3}}\right)$$

$$b=\left(\sqrt{Fx^3}-\sqrt{r^pt^p}\right)\Big/\left(\sqrt{Et^p}+\sqrt{11FE^{1/3}}\right)$$
$$c=\left(\sqrt{R^{5/3}y^3}+\sqrt{Fs^p}\right)\Big/\left(\sqrt{Fr^p}+\sqrt{2347R^{5/3}}\right)$$
$$d=\left(\sqrt{r^py^3}-\sqrt{2347s^p}\right)\Big/\left(\sqrt{Fr^p}+\sqrt{2347R^{5/3}}\right)$$
$$e=\left(\sqrt{R^{1/3}z^3}+\sqrt{53t^p}\right)\Big/\left(\sqrt{53s^p}+\sqrt{E^{5/3}R^{1/3}}\right)$$
and $$f=\left(\sqrt{z^3s^p}-\sqrt{E^{5/3}t^p}\right)\Big/\left(\sqrt{53s^p}+\sqrt{E^{5/3}R^{1/3}}\right)$$

From (3) & (5), we have
$$\sqrt{r^p}\times\sqrt{r^p}=\left(a\sqrt{F}-b\sqrt{E}\right)\left(\sqrt{s^p}+d\sqrt{R^{5/3}}\right)\Big/(c)$$
i.e., $$r^p=\left\{(a)\sqrt{Fs^p}+(ad)\sqrt{FR^{5/3}}-(b)\sqrt{Es^p}-(bd)\sqrt{ER^{5/3}}\right\}\Big/(c)$$

From (5) & (7), we get
$$\sqrt{s^p}\times\sqrt{s^p}=\left(c\sqrt{r^p}-d\sqrt{R^{5/3}}\right)\left(\sqrt{t^p}+f\sqrt{R^{1/3}}\right)\Big/(e)$$
i.e., $$s^p=\left\{(c)\sqrt{r^pt^p}+(cf)\sqrt{R^{1/3}r^p}-(d)\sqrt{R^{5/3}t^p}-(df)R\right\}\Big/(e)$$

From (2) & (7), we get
$$\sqrt{t^p}\times\sqrt{t^p}=\left(\sqrt{x^3}-b\sqrt{11E^{1/3}}\right)\left(e\sqrt{s^p}-f\sqrt{R^{1/3}}\right)\Big/(a)$$
i.e., $$t^p=\left\{(e)\sqrt{x^3s^p}-(f)\sqrt{R^{1/3}x^3}-(be)\sqrt{11E^{1/3}s^p}+(bf)\sqrt{11E^{1/3}R^{1/3}}\right\}\Big/(a)$$

On substituting the above equivalent values of r^p, s^p and t^p in the Fermat's equation $t^p = r^p + s^p$ after multiplying both sides by $\{(ace)\}$, we get

$$\{(ce)\}\left\{(e)\sqrt{x^3s^p}-(f)\sqrt{R^{1/3}x^3}-(be)\sqrt{11E^{1/3}s^p}+(bf)\sqrt{11E^{1/3}R^{1/3}}\right\}$$
$$=\{ae\}\left\{(a)\sqrt{Fs^p}+(ad)\sqrt{FR^{5/3}}-(b)\sqrt{Es^p}-(bd)\sqrt{ER^{5/3}}\right\}$$
$$+\{(ac)\}\left\{(c)\sqrt{r^pt^p}+(cf)\sqrt{R^{1/3}r^p}-(d)\sqrt{R^{5/3}t^p}-(df)R\right\}\quad(8)$$

Our purpose is to compute all rational terms in equation (8) and equate them an both sides, after multiplying both sides by
$$\left(\sqrt{Et^p}+\sqrt{11FE^{1/3}}\right)^2\left(\sqrt{Fr^p}+\sqrt{2347R^{5/3}}\right)^2\left(\sqrt{53s^p}+\sqrt{E^{5/3}R^{1/3}}\right)^2$$
for freeing from denominators on the parameters *a*, *b*, *c*, *d*, *e* and *f* , and again multiplying both sides by $\left(E^{1/3}\sqrt{y}\right)$ for obtaining some rational terms, as worked out hereunder term by term.

I term in LHS of equation (8), after multiplying by the respective terms and substituting for $\{ce^2\}$
$$=\sqrt{x^3s^p}\left\{\left(Et^p\right)+\left(11FE^{1/3}\right)+2E^{2/3}\sqrt{11Ft^p}\right\}\left(\sqrt{Fr^p}+\sqrt{2347R^{5/3}}\right)$$
$$\times\left(E^{1/3}\sqrt{y}\right)\left(\sqrt{R^{5/3}y^3}+\sqrt{Fs^p}\right)\left\{\left(R^{1/3}z^3\right)+\left(53t^p\right)+2\sqrt{R^{1/3}z^3}\sqrt{53t^p}\right\}$$

On multiplying by
$$\left\{\sqrt{x^3s^p}\left(2E^{2/3}\sqrt{11Ft^p}\right)\sqrt{2347R^{5/3}}\left(E^{1/3}\sqrt{y}\right)\sqrt{Fs^p}\left(2\sqrt{R^{1/3}z^3}\sqrt{53t^p}\right)\right\}$$

We get
$$\left\{\left(4FERs^pt^p\right)\sqrt{53x^3}\sqrt{11y}\sqrt{2347z^3}\right\}$$

II term in LHS of equation (8), after multiplying by the respective terms and substituting for $\{c(ef)\}$
$$=\left(-\sqrt{R^{1/3}x^3}\right)\left\{\left(Et^p\right)+\left(11FE^{1/3}\right)+2E^{2/3}\sqrt{11Ft^p}\right\}\left(\sqrt{Fr^p}+\sqrt{2347R^{5/3}}\right)$$
$$\times\left(E^{1/3}\sqrt{y}\right)\left(\sqrt{R^{5/3}y^3}+\sqrt{Fs^p}\right)\left(\sqrt{R^{1/3}z^3}+\sqrt{53t^p}\right)\left(\sqrt{z^3s^p}-\sqrt{E^{5/3}t^p}\right)$$

Rational part in this term
$$=\left\{\left(-\sqrt{R^{1/3}x^3}\right)\left(2E^{2/3}\sqrt{11Ft^p}\right)\sqrt{2347R^{5/3}}\left(E^{1/3}\sqrt{y}\right)\sqrt{Fs^p}\sqrt{53t^p}\sqrt{z^3s^p}\right\}$$
$$=\left\{-\left(2FERs^pt^p\right)\sqrt{53x^3}\sqrt{11y}\sqrt{2347z^3}\right\}$$

III term in LHS of equation (8), after multiplying by the respective terms and substituting for $\{bce^2\}$

$$=\left(-\sqrt{11E^{1/3}s^p}\right)\left(\sqrt{Et^p}+\sqrt{11FE^{1/3}}\right)\left(\sqrt{Fr^p}+\sqrt{2347R^{5/3}}\right)\left(\sqrt{Fx^3}-\sqrt{r^pt^p}\right)$$
$$\times\left(E^{1/3}\sqrt{y}\right)\left(\sqrt{R^{5/3}y^3}+\sqrt{Fs^p}\right)\left\{\left(R^{1/3}z^3\right)+\left(53t^p\right)+2\sqrt{R^{1/3}z^3}\sqrt{53t^p}\right\}$$

Rational part in this term

$$=\left\{\left(-\sqrt{11E^{1/3}s^p}\right)\sqrt{Et^p}\sqrt{2347R^{5/3}}\sqrt{Fx^3}\left(E^{1/3}\sqrt{y}\right)\sqrt{Fs^p}\left(2\sqrt{R^{1/3}z^3}\sqrt{53t^p}\right)\right\}$$
$$=\left\{-\left(2FERs^pt^p\right)\sqrt{53x^3}\sqrt{11y}\sqrt{2347z^3}\right\}$$

IV term in LHS of equation (8), after multiplying by the respective terms and substituting for $\{bc(ef)\}$

$$=\left(\sqrt{11E^{1/3}R^{1/3}}\right)\left(\sqrt{Et^p}+\sqrt{11FE^{1/3}}\right)\left(\sqrt{Fr^p}+\sqrt{2347R^{5/3}}\right)\left(\sqrt{Fx^3}-\sqrt{r^pt^p}\right)$$
$$\times\left(E^{1/3}\sqrt{y}\right)\left(\sqrt{R^{5/3}y^3}+\sqrt{Fs^p}\right)\left(\sqrt{R^{1/3}z^3}+\sqrt{53t^p}\right)\left(\sqrt{z^3s^p}-\sqrt{E^{5/3}t^p}\right)$$

Rational part in this term

$$=\left\{\sqrt{11E^{1/3}R^{1/3}}\sqrt{Et^p}\sqrt{2347R^{5/3}}\sqrt{Fx^3}\left(E^{1/3}\sqrt{y}\right)\sqrt{Fs^p}\sqrt{53t^p}\sqrt{z^3s^p}\right\}$$
$$=\left\{\left(FERs^pt^p\right)\sqrt{53x^3}\sqrt{11y}\sqrt{2347z^3}\right\}$$

I term in RHS of equation (8), after multiplying by the respective terms and substituting for $\{a^2e\}$

$$=\sqrt{Fs^p}\left\{\left(2347R^{5/3}\right)+\left(Fr^p\right)+2\sqrt{2347R^{5/3}}\sqrt{Fr^p}\right\}\left(\sqrt{E^{5/3}R^{1/3}}+\sqrt{53s^p}\right)$$
$$\times\left(E^{1/3}\sqrt{y}\right)\left(\sqrt{R^{1/3}z^3}+\sqrt{53t^p}\right)\left\{\left(Ex^3\right)+\left(11E^{1/3}r^p\right)+2E^{2/3}\sqrt{11x^3r^p}\right\}$$

Rational part in this term

$$=\left\{\sqrt{Fs^p}\left(2\sqrt{2347R^{5/3}}\sqrt{Fr^p}\right)\sqrt{53s^p}\left(E^{1/3}\sqrt{y}\right)\sqrt{R^{1/3}z^3}\left(2E^{2/3}\sqrt{11x^3r^p}\right)\right\}$$
$$=\left\{\left(4FERr^ps^p\right)\sqrt{53x^3}\sqrt{11y}\sqrt{2347z^3}\right\}$$

II term in RHS of equation (8), after multiplying by the respective terms and substituting for $\{(a^2de\}$

$$=\sqrt{FR^{5/3}}\left(\sqrt{2347R^{5/3}}+\sqrt{Fr^p}\right)\left(\sqrt{E^{5/3}R^{1/3}}+\sqrt{53s^p}\right)\left(E^{1/3}\sqrt{y}\right)$$
$$\times\left\{\left(Ex^3\right)+\left(11E^{1/3}r^p\right)+2E^{2/3}\sqrt{11x^3r^p}\right\}\left(\sqrt{r^py^3}-\sqrt{2347s^p}\right)\left(\sqrt{R^{1/3}z^3}+\sqrt{53t^p}\right)$$

Rational part in this term

$$=\left\{\sqrt{FR^{5/3}}\sqrt{Fr^p}\sqrt{53s^p}\left(E^{1/3}\sqrt{y}\right)\left(2E^{2/3}\sqrt{11x^3r^p}\right)\left(-\sqrt{2347s^p}\right)\sqrt{R^{1/3}z^3}\right\}$$

We get

$$\left\{-\left(2FERr^ps^p\right)\sqrt{53x^3}\sqrt{11y}\sqrt{2347z^3}\right\}$$

III term in RHS of equation (8), after multiplying by the respective terms and substituting for $\{(ab)e\}$

$$=\left(-\sqrt{Es^p}\right)\left\{\left(2347R^{5/3}\right)+\left(Fr^p\right)+2\sqrt{2347R^{5/3}}\sqrt{Fr^p}\right\}\left(\sqrt{E^{5/3}R^{1/3}}+\sqrt{53s^p}\right)$$
$$\times\left(E^{1/3}\sqrt{y}\right)\left(\sqrt{R^{1/3}z^3}+\sqrt{53t^p}\right)\left(\sqrt{Ex^3}+\sqrt{11E^{1/3}r^p}\right)\left(\sqrt{Fx^3}-\sqrt{r^pt^p}\right)$$

Rational part in this term

$$=\left\{\left(-\sqrt{Es^p}\right)\left(2\sqrt{2347R^{5/3}}\sqrt{Fr^p}\right)\sqrt{53s^p}\left(E^{1/3}\sqrt{y}\right)\sqrt{R^{1/3}z^3}\sqrt{11E^{1/3}r^p}\sqrt{Fx^3}\right\}$$
$$=\left\{-\left(2FERr^ps^p\right)\sqrt{53x^3}\sqrt{11y}\sqrt{2347z^3}\right\}$$

IV term in RHS of equation (8), after multiplying by the respective terms and substituting for $\{(ab)de\}$

$$=\left(-\sqrt{ER^{5/3}}\right)\left(\sqrt{2347R^{5/3}}+\sqrt{Fr^p}\right)\left(\sqrt{E^{5/3}R^{1/3}}+\sqrt{53s^p}\right)\left(E^{1/3}\sqrt{y}\right)$$
$$\times\left(\sqrt{Ex^3}+\sqrt{11E^{1/3}r^p}\right)\left(\sqrt{Fx^3}-\sqrt{r^pt^p}\right)\left(\sqrt{r^py^3}-\sqrt{2347s^p}\right)\left(\sqrt{R^{1/3}z^3}+\sqrt{53t^p}\right)$$

Rational part in this term

$$=\left\{\left(-\sqrt{ER^{5/3}}\right)\sqrt{Fr^p}\sqrt{53s^p}\left(E^{1/3}\sqrt{y}\right)\sqrt{11E^{1/3}r^p}\sqrt{Fx^3}\left(-\sqrt{2347s^p}\right)\sqrt{R^{1/3}z^3}\right\}$$

$$=\left\{\left(FERr^{p}s^{p}\right)\sqrt{53x^{3}}\sqrt{11y}\sqrt{2347z^{3}}\right\}$$

V term in RHS of equation (8), after multiplying by the respective terms and substituting for $\{ac^2\}$

$$=\sqrt{r^{p}t^{p}}\left(\sqrt{Et^{p}}+\sqrt{11FE^{1/3}}\right)\left\{\left(E^{5/3}R^{1/3}\right)+\left(53s^{p}\right)+2\sqrt{E^{5/3}R^{1/3}}\sqrt{53s^{p}}\right\}$$
$$\times\left(E^{1/3}\sqrt{y}\right)\left(\sqrt{Ex^{3}}+\sqrt{11E^{1/3}r^{p}}\right)\left\{\left(R^{5/3}y^{3}\right)+\left(Fs^{p}\right)+2\sqrt{R^{5/3}y^{3}}\sqrt{Fs^{p}}\right\}$$

(i) Rational part in this term

$$=\left\{\sqrt{r^{p}t^{p}}\sqrt{Et^{p}}\left(53s^{p}\right)\left(E^{1/3}\sqrt{y}\right)\sqrt{11E^{1/3}r^{p}}\left(Fs^{p}\right)\right\}$$
$$=\left\{\left(53\times FEr^{p}s^{2p}t^{p}\right)\sqrt{11y}\right\}$$

(ii) Further on multiplying by

$$=\left\{\sqrt{r^{p}t^{p}}\sqrt{Et^{p}}\left(E^{5/3}R^{1/3}\right)\left(E^{1/3}\sqrt{y}\right)\sqrt{Ex^{3}}\left(R^{5/3}y^{3}\right)\right\}$$
$$=\left\{\left(E^{3}R^{2}xy^{3}t^{p}\right)\sqrt{r^{p}xy}\right\}$$

Which will be irrational if r is coprime to $x = 53$ and $y = 11$; if not, we have the choice of assigning alternative values for x and y such that $x = 17$; $y = 47$, $z^3 = 17^3 + 47 = 8^2 \times 1699$, such that r is coprime to 17 and 47.

VI term in RHS of equation (8), after multiplying by the respective terms and substituting for $\{ac^2f\}$ is

$$=\sqrt{R^{1/3}r^{p}}\left(\sqrt{Et^{p}}+\sqrt{11EF^{1/3}}\right)\left(\sqrt{E^{5/3}R^{1/3}}+\sqrt{53s^{p}}\right)\left(E^{1/3}\sqrt{y}\right)$$
$$\times\left(\sqrt{Ex^{3}}+\sqrt{11E^{1/3}r^{p}}\right)\left\{\left(R^{5/3}y^{3}\right)+\left(Fs^{p}\right)+2\sqrt{R^{5/3}y^{3}}\sqrt{Fs^{p}}\right\}\left(\sqrt{z^{3}s^{p}}-\sqrt{E^{5/3}t^{p}}\right)$$

On multiplying by

$$\left\{\sqrt{R^{1/3}r^{p}}\sqrt{Et^{p}}\sqrt{E^{5/3}R^{1/3}}\left(E^{1/3}\sqrt{y}\right)\sqrt{11E^{1/3}r^{p}}\left(R^{5/3}y^{3}\right)\left(-\sqrt{E^{5/3}t^{p}}\right)\right\}$$

We get

$$\left\{-\left(E^{8/3}R^{2}y^{3}r^{p}t^{p}\right)\sqrt{11y}\right\}$$

Which will be irrational since E is an odd prime.

VII term in RHS of equation (8), after multiplying by the respective terms and substituting for $\{a(cd)\}$ is

$$=\left(-\sqrt{R^{5/3}t^{p}}\right)\left(\sqrt{Et^{p}}+\sqrt{11FE^{1/3}}\right)\left\{\left(E^{5/3}R^{1/3}\right)+\left(53s^{p}\right)++2\sqrt{E^{5/3}R^{1/3}}\sqrt{53s^{p}}\right\}\left(E^{1/3}\sqrt{y}\right)$$
$$\times\left(\sqrt{Ex^{3}}+\sqrt{11E^{1/3}r^{p}}\right)\left(\sqrt{R^{5/3}y^{3}}+\sqrt{Fs^{p}}\right)\left(\sqrt{y^{3}r^{p}}-\sqrt{2347s^{p}}\right)$$

On multiplying by

$$\left\{\left(-\sqrt{R^{5/3}t^{p}}\right)\sqrt{Et^{p}}\left(E^{5/3}R^{1/3}\right)\left(E^{1/3}\sqrt{y}\right)\sqrt{11E^{1/3}r^{p}}\sqrt{R^{5/3}y^{3}}\sqrt{y^{3}r^{p}}\right\}$$

We get

$$\left\{-\left(E^{8/3}R^{2}y^{3}r^{p}t^{p}\right)\sqrt{11y}\right\}$$

Which is irrational.

VIII term in RHS of equation (8), after multiplying by the respective terms and substituting for $\{a(cd)f\}$ is

$$=(-R)\left(\sqrt{Et^{p}}+\sqrt{11FE^{1/3}}\right)\left(\sqrt{E^{5/3}R^{1/3}}+\sqrt{53s^{p}}\right)\left(E^{1/3}\sqrt{y}\right)$$
$$\times\left(\sqrt{Ex^{3}}+\sqrt{11E^{1/3}r^{p}}\right)\left(\sqrt{R^{5/3}y^{3}}+\sqrt{Fs^{p}}\right)\left(\sqrt{y^{3}r^{p}}-\sqrt{2347s^{p}}\right)\left(\sqrt{z^{3}s^{p}}-\sqrt{E^{5/3}t^{p}}\right)$$

On multiplying by

$$=\left\{(-R)\sqrt{11FE^{1/3}}\sqrt{53s^{p}}\left(E^{1/3}\sqrt{y}\right)\sqrt{Ex^{3}}\sqrt{Fs^{p}}\left(-\sqrt{2347s^{p}}\right)\sqrt{z^{3}s^{p}}\right\}$$
$$=\left\{\left(FERs^{2p}\right)\sqrt{53x^{3}}\sqrt{11y}\sqrt{2347z^{3}}\right\}$$

Sum of all rational terms on LHS of equation (8)

$$=\left\{\left(FERs^{p}t^{p}\right)\sqrt{53x^{3}}\sqrt{11y}\sqrt{2347z^{3}}\right\}$$

Sum of all rational terms on RHS of equation (8)

$$=\left\{\left(FERr^{p}s^{p}\right)\sqrt{53x^{3}}\sqrt{11y}\sqrt{2347z^{3}}\right\} \qquad \text{(combining I to IV terms)}$$
$$+\left\{\left(53FEr^{p}s^{2p}t^{p}\right)\sqrt{11y}\right\} \qquad \text{(vide V term)}$$

$$+\left\{\left(FERs^{2p}\right)\sqrt{53x^3}\sqrt{11y}\sqrt{2347z^3}\right\} \quad \text{(vide VI term)}$$

$$=\left\{\left(FERs^{p}\right)\sqrt{53x^3}\sqrt{11y}\sqrt{2347z^3}\right\}\left(r^p+s^p\right)$$

$$+\left\{\left(53FEr^p s^{2p} t^p\right)\sqrt{11y}\right\}$$

$$=\left\{\left(FERs^{p}t^p\right)\sqrt{53x^3}\sqrt{11y}\sqrt{2347z^3}\right\} \qquad \left(\because r^p+s^p=t^p\right)$$

$$+\left\{\left(53FEr^p s^{2p} t^p\right)\sqrt{11y}\right\}$$

Equating the rational terms on both sides of equation (8), we get

$$\left\{\left(53FEr^p s^{2p} t^p\right)\sqrt{11y}\right\}=0$$

Dividing both sides by

$$\left(53FE\right)\sqrt{11y}$$

We get

$$\left(r^p s^{2p} t^p\right)=0$$

That is, either $r = 0$; or $s = 0$; or $t = 0$.

This contradicts our hypothesis that all r, s and t are non-zero integers in the equation $r^p + s^p = t^p$, with p any prime > 3, thus proving that only a trivial solution exists in the equation.

III. CONCLUSION

In this proof equation (8) has been obtained from the two transformation equations for $x^3 + y^3 = z^3$ and $r^p + s^p = t^p$. by using the equivalent values of r^p, s^p & t^p, which are substituted in the equation $r^p + s^p = t^p$. Hence the result $rst = 0$, that we get from equation (8) proves that there is no non-zero integer solutions exists in the equation $r^p + s^p = t^p$.

DECLARATION STATEMENT

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REFERENCES

1. Hardy G. H. and Wright E. M., *An introduction to the theory of numbers*, 6th ed. Oxford University Press, 2008, pp. 261-586. DOI: https://doi.org/10.1080/00107510903184414
2. Lawrence C. Washington, *Elliptic Curves, Number Theory and Cryptography*, 2nd ed. 2003, pp. 445-448. DOI: https://doi.org/10.1201/9781420071474
3. Andrew Wiles, Modular *Elliptic Curves and Fermat's Last Theorem*, Annals of Mathematics, 1995; 141(3); pp.443-551. DOI: https://doi.org/10.2307/2118559
4. 13 Lectures on Fermat's Last Theorem by Paulo Ribenboim, Publisher: Springer , New York , originally published in 1979, pages 159. DOI: https://doi.org/10.1007/978-1-4684-9342-9
5. P. N Seetharaman. (2024). An Elementary Proof for Fermat's Last Theorem using Ramanujan-Nagell Equation. In Indian Journal of Advanced Mathematics (Vol. 4, Issue 2, pp. 10–15). DOI: https://doi.org/10.54105/ijam.b1180.04021024
6. Chithra, P. L., & Sathya, K. (2020). A Novel Encryption Algorithm by Fusion of Modified Blowfish Algorithm and Fermat's Little Theorem for Data Security. In International Journal of Innovative Technology and Exploring Engineering (Vol. 9, Issue 4, pp. 1188–1192). DOI: https://doi.org/10.35940/ijitee.c8684.029420
7. Bashir, S. (2023). Pedagogy of Mathematics. In International Journal of Basic Sciences and Applied Computing (Vol. 10, Issue 2, pp. 1–8). DOI: https://doi.org/10.35940/ijbsac.b1159.1010223
8. Selvarathi, M. (2019). Algebraic Properties of Implication-Based Anti-Fuzzy Subgroup over a Finite Group. In International Journal of Engineering and Advanced Technology (Vol. 9, Issue 1s4, pp. 1116–1120). DOI: https://doi.org/10.35940/ijeat.a1208.1291s419
9. Peter, M. U. (2024). An Exploration of Some Special Functions and their Applications. In International Journal of Advanced Engineering and Nano Technology (Vol. 11, Issue 5, pp. 1–11). DOI: https://doi.org/10.35940/ijaent.b4329.11050524

AUTHOR'S PROFILE

P.N. Seetharaman, B.Sc (Mathematics); B.E (Electrical Engineering) is a retired Executive Engineer from Tamil Nadu Electricity Board. He had served in Mettur Tunnel Hydro Power Station for ten years, and finally worked in Research and Development wing, Energy Conservation Cell, at Chennai. He retired from service in 2002.After retirement, he studied Number Theory, especially Fermat's Last Theorem and worked for finding and elementary proof for the Theorem.