Using a Proof Assistant for Non-Trivial Theorems.

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Contents

1 Abstract:

PER previous documents, our duty is now to write proof statements in Lean.
Lean is a formidable proof assistant. We could use it to prove smaller theorems to then prove bigger theorems. Or, practice using it (Lean) to learn our craft.

2 Synopsis:

2.1 Theorems and Proofs:

LET the following theorem for $x, y, z \in \mathbb{Z}$. The following theorem per FLT (Fermat's Last Theorem) admits an identity for the following:

Theorem 2.1. *There exists no solutions for p^n in $\mathbb{Z}$. If and only If:*

$$x^n + y^n + z^n = p^n, \quad \forall n, c, x, y, z, p \neq 0, n \geq 2.$$

For all variables of $n, x, y, z, p \in \mathbb{Z}$. We could go by induction per Fermat Last Theorem that $x^n + y^n + z^n$ equals to:

$$x^n + y^n + z^n = p^n.$$

For $\forall x^n + y^n + z^n \in \mathbb{Z}$.:

$$x^n + y^n + z^n = a^n + b^n.$$

If and only If for $\forall x^n + y^n + z^n \in \mathbb{Z}$.:

$$x^n + y^n + z^n \neq 0, \quad x^n + y^n + z^n \geq 2, \quad \forall x^n + y^n + z^n \in \mathbb{Z}.$$

Thus we can induce the following for $\forall x^n + y^n + z^n \in \mathbb{Z}$.:

$$x^n + y^n + z^n - a^n = b^n, \quad x^n + y^n + z^n - b^n = a^n.$$

If and only If for $\forall x^n + y^n + z^n \in \mathbb{Z}$.:

$$x^n + y^n + z^n - a^n - b^n = 0, \quad x^n + y^n + z^n \neq 0.$$

Remark 2.2. There is a possibility that $x^n + y^n + z^n \geq 2$, may be replaced under some circumstances with $x^n + y^n + z^n \geq \mathbb{P}_0$. Where $\mathbb{P}$ is a sequence of pair numbers greater than one.

2.2 Notes on Theorem 1.1:

Remark 2.3. One method for proving Theorem 1.1 is using proofs by direct and/or induction of the FLT by Wiles.

3 Remarks:

PROOF sources have been distributed with the repository, one exercise would be for the reader to implement such non-trivial proof in Lean.
However usage of Lean may not be warranted for every proof writing.

4 Going Forward:

4.1 Conclusion:

WHILE a short note, the purpose is for the development of methodology on using proof assistants for non-trivial conjectures and theorems of Pure Mathematics.

References

[1] Avigad, J., De Moura, L., and Kong, S. Theorem proving in lean.

[2] Hardy, G. *A Course of Pure Mathematics*. Cambridge Mathematical Library. Cambridge University Press, 2002.

[3] Weil, A., and Weil, A. *Basic number theory*, vol. 1974. Springer, 1967.

[4] Wiles, A. Modular elliptic curves and fermat's last theorem. *Annals of mathematics 141*, 3 (1995), 443–551.