MTH-260: Transition to Higher Mathematics
Spring Semester 2018

Prof. Rall

Portfolio Essay

You may submit, in your Box folder, a write up of your portfolio essay one time for review following the directions written in the Guidelines for the Portfolio Project document. In addition, please feel free to come talk with me about it leading up to your first submission and also after I have reviewed it. Your second submission of the essay will be considered the final submission and will be the one that is graded. Your score for the portfolio essay will be assigned based only on the final submission.

- The deadline for discussion and submission of a draft of the essay for review is April 13, 2018.
- The last day to submit the essay for a grade is April 20, 2018.

Resources

For your paper, you need to read and cite at least two sources about Fermat's Last Theorem. At least one of these sources must be a book. Since online sources like Wikipedia are collaborative efforts open to anyone who cares to edit, the information found there is not necessarily accurate. If you use information from these types of online sources, then you must cite the source but you must also corroborate the information with more traditional sources that you also cite. The most common way available now to find mathematical sources other than books is a search tool called MathSciNet®. To get access to MathSciNet go to the homepage of the James B. Duke library and follow the following sequence of links: "Research by Subject", "Mathematics", "Math Sci Net". We will talk about searching in MathSciNet one day in class.

Make sure that you cite your sources appropriately and completely. To see an acceptable style of citation enter "Rall" in the Author field in MathSciNet, choose one of the articles that are found and click on the link beginning with 'MR' followed by a seven digit number at the front of that article. Look at the list of references included. (This list of references is taken directly from the article as it was published.) I will be showing you how to use the `\bibliography` environment to create a list of references and how to cite them in your work.

Content

Your essay can contain any information about Fermat's Last Theorem that you find interesting or want to include, but it must include the following items.

1. A precise statement of Fermat's Last Theorem.
2. How is it related to Pythagorean triples?
3. A brief description of the history of Fermat's Last Theorem. Include such information as
   - Who was Fermat?
   - What was the assertion that makes up what has come to be called Fermat's Last Theorem and what was the somewhat unusual way that it appeared?

- A summary of at least some of the initial progress that was made by mathematicians in trying to prove the assertion. Has the theorem been proved, and if so by whom?
- Why should it have been called a conjecture instead of a theorem? Is it correct to call it a theorem now? If so, why?

4. A proof of Proposition 1 that is stated below.

5. A proof of Proposition 2 stated below, which is a very special case of Fermat's Last Theorem. (As a hint, I suggest that you do a proof by contradiction in which you have cases based on whether a and b are even or odd.)

Let $Q = \{x \in \mathbb{N} : x \text{ is an odd prime}\}$ and let $K = \{x \in \mathbb{N} : x \text{ is odd and } x \geq 3\}$. In addition, for each natural number n, let $A(n)$ be the open sentence given by
$A(n)$: There do not exist natural numbers a, b and c such that $a^n + b^n = c^n$.

Proposition 1 *If $A(n)$ is true for every $n \in Q$, then $A(m)$ is true for every $m \in K$.*

Proposition 2 *There do not exist prime numbers a, b and c such that $a^3 + b^3 = c^3$.*