Math 108—Writing Assignment 05

*Due: Friday February 24—3:00*PM

Get the template for this assignment. Here's how to do it:

- **Team Member 1:** Go to https://www.sharelatex.com, and make sure you are logged in.
- **Team Member 1:** In a new window, go here:

  https://www.sharelatex.com/project/58aa58946bd8214e2cd1d40d

- **Team Member 1:** Click on the menu icon (upper-left corner - 3 horizontal lines); select "Copy Project"
- **Team Member 1:** When prompted for a name, choose something like "Math 108 - Assignment 04" and click "Copy"
- **Team Member 1:** When this completes you will be back in your own workspace (instead of mine).
- **Team Member 1:** Click on the share icon (upper-right - 5 headed beast). Enter your team member's email address, make sure they "can edit" it, and "Share."
- **Team Member 1 and 2:** After solving the problems (possibly by yourself), work together to make a beautiful write up.
- **Team Member 1 or 2:** Email me (or print and turn in) *one* copy of your final draft.

The problems are below.

1. Let $x, y \in \mathbb{Z}$. Prove that if 8 does not divide $x^2 - 1$, then x is even.

   Hint: try a proof by contraposition.

2. Prove that if p is a prime number and $p \neq 3$, then 3 divides $p^2 + 2$.

   Hint: when p is divided by 3, the remainder is either 0, 1, or 2; that is, for some $k \in \mathbb{Z}$, $p = 3k$ $p = 3k + 1$, or $p = 3k + 2$. Consider a proof by cases.

3. Let I_n be the $n \times n$ identity matrix. If $X = \{A \in M_{n\times n} : A^2 = I_n\}$ and $Y = \{A \in M_{n\times n} : \det(A) = \pm 1\}$, prove that $X \subseteq Y$.

   Hint: you may need to review properties of the determinant. If you can't find your linear algebra book, you can find the necessary ones here (#4 is key!):

   https://en.wikipedia.org/wiki/Determinant#Properties_of_the_determinant