**Math 6250 Presentation 2**

For the following presentations in class write up your presentation completely.

Remember when you are presenting that you are presenting to a class of peers. If you aren't certain of a definition or statement it is likely that neither are your classmates. State these definitions. You are teaching the class. Make the presentation so that you could follow it if you are in the class. That is, be clear and thorough. Include these notes in your write-ups. I will distribute your write-ups to the class as well.

1. Prove for $f : \mathbb{R} \to \mathbb{R}$ given by
$$f(x) = \frac{1}{x^2 + 1}$$
is neither injective nor surjective.

2. Prove for $f : [0, \infty) \to (0, 1)$ given by
$$f(x) = \frac{1}{x^2 + 1}$$
is injective and surjective.

3. Prove for $f : A \to B$ and $g : B \to C$ that
   (a) If $f$ and $g$ are injective then $g \circ f$ is injective.
   (b) If $f$ and $g$ are surjective then $g \circ f$ is surjective.

4. Write the definition of countable and uncountable, infinite and finite. Where do these overlap?

5. Show $A \sim \mathbb{N}$ where
$$A = \{1, 2, 3\} \times \mathbb{N}.$$

6. Show $\mathbb{Q} \sim \mathbb{N}$. You may wish to watch a video or read your book.

7. Show $\mathbb{R}$ is not countable! You may wish to watch a video or read your book. Now that you have competed Problem 6 and Problem 7 update Problem 4