Homework # 0, Math 412  
Due Friday, September 25, 2015

This homework set has seven (7) problems. Some of them are routine, others require more thought. You are encouraged to work with others and to ask questions of your instructor; however, you must write up your solutions independently. On this and all subsequent homework sets please write neatly and use complete sentences. Writing mathematics well is a craft, aim to hone it!

1. Draw a representation of the real number line, with the numbers 0, 5/4, $\sqrt{3}$ and $\pi$ in their relative locations.

2. What’s the biggest real number smaller than every rational number bigger than $\pi$?

3. Give an example of an infinite family
   \[ \{A_1, A_2, A_3, \ldots \} \]
   of infinite sets such that
   \[ \bigcap_{n=1}^{\infty} A_n = \{5/4\} . \]

4. Is $\sqrt{3}$ rational or irrational. Justify your assertion.

5. Determine which of the following statements is true in the universe of real numbers:
   \[ (\forall x)(\exists y)(x + y = 0) \quad \text{or} \quad (\exists y)(\forall x)(x + y = 0) . \]

6. Recall that given a set $A$, the power set of $A$ is $\mathcal{P}(A) = \{ B : B \subseteq A \}$. Determine $\mathcal{P}(\mathcal{P}(\emptyset))$.

7. Show that for each positive integer $n$, $7^n - 1$ is a multiple of 6.