MATH 174, LECTURE 5

1. Go over homework questions.

2. Homework: previous assignment plus
   pages 97–98, numbers 1, 2, 3(b), 5(b), 8(b), 13, 16

   Quiz: Thursday (09/13)

3. Finish previous lecture.

4. **Examples of Multiply Quantified Statements:** (1) $\forall n \in \mathbb{Z}, \exists k \in \mathbb{Z}$ such that $k > n$
   (2) $\exists$ a person A such that $\forall$ persons B, A is at least as nice as B
   (3) $\forall a \in \mathbb{Q}, \forall b \in \mathbb{Q}, \exists c \in \mathbb{Q}$ such that $a < c < b$
   (4) $\forall a \in \mathbb{Q}, \forall b \in \mathbb{Q}$ with $b > a, \exists c \in \mathbb{Q}$ such that $a < c < b$
   (5) $\exists a > 1$ such that $\forall$ positive integers $n, \underbrace{a^{\wedge}(a^{\wedge}(a^{\wedge}(a^{\wedge} \cdots)))}_{n \ a\text{'s}} < 2$

5. **Negations of Multiply Quantified Statements:**

   - The negation of $\forall x, \exists y$ such that $P(x, y)$ is $\exists x, \forall y$ such that $\sim P(x, y)$.

   - The negation of $\exists x$ such that $\forall y, P(x, y)$ is $\forall x, \exists y$ such that $\sim P(x, y)$.

6. **Example:** page 97, number 6

7. **Contrapositive, Converse, Inverse:** (of $\forall x \in D$, if $P(x)$ then $Q(x)$ and respectively)

   - $\forall x \in D$, if $\sim Q(x)$ then $\sim P(x)$

   - $\forall x \in D$, if $Q(x)$ then $P(x)$

   - $\forall x \in D$, if $\sim P(x)$ then $\sim Q(x)$

8. Give quiz.