Name: ..... Supervisor: .....

Class Teacher: .....

MA131 - Analysis 1
Workbook 1 Assignments

Due in 12th Oct

Assignment 1

1. Solve the inequality $1/x < x < 1$ by Case Analysis.
2. Consider the following argument:

$$\frac{1}{x} < x < 1 \qquad \therefore 1 < x^2 \qquad \therefore 1 < x.$$

But $x < 1$, therefore there are no solutions. How many mistakes can you find? Comment on this "solution" as though you were a teacher and it was written by one of your students.

Assignment 2 Is the following statement true for all x and y: "If $x < y$ then $x^2 < y^2$"? What about this statement: "If $x^2 < y^2$ then $x < y$"?

Assignment 3

1. Use induction to prove that if both x and y are positive then $x < y \implies x^n < y^n$.
2. Now try to prove the *converse*, that if both x and y are positive then $x^n < y^n \implies x < y$.

Assignment 4 Rewrite each of the following expressions without absolute value signs, treating various cases separately where necessary.

1. $a - |(a - |a|)|$. 2. $|(|x| - 2)|$.

Assignment 5 Solve the following inequalities:

1. $|x - 1| + |x - 2| \geq 5$; 2. $|x - 1| \cdot |x + 1| > 0$.

Assignment 6

1. Put a variety of numbers into the Triangle Inequality and convince yourself that it really works.
2. Write out the triangle inequality when you take $x = a - b$ and $y = b - c$.
3. Prove the Triangle Inequality.

Assignment 7

1. Show, for positive a and b, that $\frac{a+b}{2} - \sqrt{ab} = \frac{(\sqrt{a}-\sqrt{b})^2}{2}$.
2. Show that the arithmetic mean is always greater than or equal to the geometric mean. When can they be equal?