As there is no Tutorial for this Class Exercise I will discuss any problems you have in the lecture on Thursday 31st July.

Starred questions will not be marked and are not examinable. They are there as a challenge. Everyone should at least think about them. If you have problems or questions please come and see me or email me at michael.murray@adelaide.edu.au.

1. (a) Convert the following rational numbers to repeating or terminating decimals.
   
   \[
   \begin{align*}
   (i) & \quad \frac{41}{333} \\
   (ii) & \quad \frac{1}{13} \\
   (iii) & \quad \frac{37}{18}
   \end{align*}
   \]

   (b) Convert the following repeating or terminating decimal numbers to rational numbers.
   
   \[
   \begin{align*}
   (i) & \quad 0.124124\ldots \\
   (ii) & \quad 0.3434\ldots \\
   (iii) & \quad 13.512512\ldots
   \end{align*}
   \]

2. For each of the following sets state if they bounded above or below or not bounded above or below. When they are bounded above or below give an example of a bound. No justification is required for your answer.

   (a) \{x \in \mathbb{R} \mid -1.34 < x \leq 5.67\}
   
   (b) \((-5, 10] \cup (4, \infty)\)
   
   (c) \{n^2 \mid n = 1, 2, \ldots\}
   
   (d) \{1/k \mid k \in \mathbb{Z}\}.

3. For each of the following sets find the sup and inf. No justification is required for your answer.

   (a) \{x \in \mathbb{R} \mid -1.34 < x \leq 5.67\}
   
   (b) \((-5, 10] \cup (4, 16)\)
   
   (c) \{0, -1, -2.5, 3.4, 5, 1.6\}
   
   (d) \{x \in \mathbb{R} \mid x^2 - 9 < 0\}

4. Let \(S = (-\infty, 1]\). What is \(\sup S\)? Justify your answer: ie show that the number you have found is an upper bound and show that it is the least upper bound.

5. Let \(S \subset \mathbb{R}\) be non-empty and bounded above. Define \(T = \{5s \mid s \in S\}\). Show that \(T\) is non-empty and bounded above and that \(\sup T = 5 \sup S\).

6. (a) Let \(\epsilon > 0\). Find an \(N\) such that whenever \(n \geq N\) you must have
   
   \[
   \left| \frac{5 + 6n}{n + 2} - 6 \right| < \epsilon.
   \]

   (b) Now use (a) and the formal definition of limit to show that
   
   \[
   \lim_{n \to \infty} \frac{5 + 6n}{n + 2} = 6.
   \]

7*. Show that (strictly) between any pair of distinct real numbers there is a rational number and an irrational number.