1 State the formal definition of \( \lim_{n \to \infty} a_n = L \), where \(-\infty < L < \infty\).

2 State the famous *Monotone Sequence Theorem*.

3 Let \( a_n = \frac{5n - 8}{3n + 11} \). Find \( \lim_{n \to \infty} a_n \), and then show the scratch work for the \( N \)-recipe.
4. Find the area of the region bounded above and below by the curves $18x - y = -12$ and $y = 12x^2$ for and lying between the vertical lines $x = 0$ and $x = 3$. 
Let $R$ be the region enclosed by the graphs of $y = x^2$, $y = 9$ and $x = 1$ (note that $R$ does not touch the $y$-axis). Imagine the solid $S$ generated by revolving the region $R$ about the line $x = 3$. Set up the integrals $X$ and $Y$, where $X$ is a “$dx$” integral and $Y$ is a “$dy$” integral, both giving the volume of the solid $S$. Do not evaluate your integrals. Make sure the grader can easily make out which one’s $X$ and which one’s $Y$. 
6. For each of the following expressions, find its value, if it has a value (that is, if it converges). If it does not have a value, say so, and explain briefly.

(a) \( \lim_{n \to \infty} (n^3 + 1)^{-1} \)

(b) \( \lim_{n \to \infty} (3^n)^{-1} \)

(c) \( \sum_{n=0}^{\infty} (3^n)^{-1} \)

(d) \( \sum_{n=2}^{\infty} (3^n)^{-1} \)

7. For each of the following expressions, explain whether it converges.

(a) \( \sum_{n=1}^{\infty} (3n)^{-1} \)

(b) \( \lim_{n \to \infty} \left(-\frac{2}{3}\right)^{-n} \)

(c) \( \sum_{n=1}^{\infty} (3n^2)^{-1} \)
8 Show steps in finding the limit of the sequence $a_n = \left( 1 + \frac{1}{3n} \right)^n$. 