1. Consider a sequence $a_n = \frac{\sqrt{n}}{n+100}$.

   - Is this sequence monotone? Prove your claim.
   - Is this sequence bounded? Prove your claim.
   - Compute $\lim a_n$.

2. Consider a function $f = \frac{x^2}{x+1}$.

   - Find a set of all $x \in \mathbb{R}$ for which f is well defined.
   - Compute f' and f''.
   - Consider a function f restricted to a domain $[0, \infty)$. Is such function one-to-one? Prove your claim.
   - If the restriction from the previous answer is one-to-one, find an inverse f^{-1} to the restricted function.

3. Let the set M be given as

$$M = \{\langle x, y \rangle \in \mathbb{R}^2, \ x^2 < y \& y < x^2 + 6x + 9 \& y < x^2 - 4x + 3\}$$

   - Try to make a sketch of this set.
   - Write an integral which can be used to compute the volume of M.
   - Compute the volume of M.

4. Consider an equation

$$y'' + y' = \frac{1}{1 + e^x}$$

   (a) Find all solution to the appropriate homogeneous problem.
   (b) Use variation of constants to deduce one particular solution to the given problem.
   (c) Write all solutions to the given problem.
   (d) Find a particular solution fulfilling $y(0) = 1$, $y'(0) = -1$.