1. Evaluate the following limit:

$$\lim_{x\to\infty} \frac{x^6 + x^5 + 4x^7 + x^3 + 2}{x^7 + 5x^4 + 6x^2 + 3}$$

2. The unit-step function $\mu(x)$ is defined below:

$$\begin{cases} 0 & x < 0 \\ 1 & x > 0 \end{cases}$$

Evaluate the following limit:

$$\lim_{x\to 0} \mu(\mu(x^2))$$

3. The population of bunnies in Sharvaa's house can be modeled as a function of time as shown below:

$$P(t) = \frac{200}{1 + e^{-20t}}$$

As time goes on, this population approaches a certain size, L. Find L.

4. Evaluate: $\lim_{x\to\infty} \sqrt[3]{2x^3 + 6x^2 - x} - \sqrt[3]{2x^3 - 6x^2 - x}$

5. Evaluate: $\lim_{x\to -2.5} \lfloor x^3 \lfloor x^2 \lfloor x \rfloor \rfloor \rfloor$ where $\lfloor x \rfloor$ is the greatest integer less than or equal to x.

6. Evaluate: $\lim_{x\to 0} \frac{x^2}{\ln(\sin(x)/x)}$

7. Evaluate the following limit:

$$\lim_{n\to\infty} \binom{3n}{2n}^{1/n}$$

8. Let A_n denote the region bounded by $x^{2n} + y^{2n} = xy$ in the first quadrant. Find $\lim_{n\to\infty} A_n$.

9. (#30 2022 Feb Regional Calc Indiv) A sequence $\{a_n\}_{n=1}^{\infty}$ is defined by $a_1 = \sqrt{2}$ and $a_{n+1} = \sqrt{2 + a_n}$ for all $n \geq 1$. Evaluate:

$$\lim_{n\to\infty} 4^n(2 - a_n)$$

10. The Stolz-Cesaro theorem states that for two sequences $\{a_n\}_{n\geq 1}$ and $\{b_n\}_{n\geq 1}$, if $\{b_n\}$ is strictly montone and divergent and $\lim_{n\to\infty} \frac{a_{n+1} - a_n}{b_{n+1} - b_n} = L$, then $\lim_{n\to\infty} \frac{a_n}{b_n} = L$. Evalue the following limit in terms of k using the Stolz-Cesaro Theorem where k is an integer:

$$\lim_{n\to\infty} \frac{\sum_{j=1}^{n} j^k}{(n+1)^{k+1}}$$