1. Let $f(x) = x^2\sqrt{3 - 2x - x^2}$. Find the domain of $f(x)$. Plot $f(x)$.

2. Find all solutions to
$$x^2\sqrt{2 - x - x^2} = 6.$$

3. Find the length of the curve $y = \sin(x)$ between $x = 0$ and $x = \ln\pi$, both exactly and the the nearest thousandth.

4. Evaluate $\sum\limits_{n=2}^{M} \frac{1}{n(\log n)^{1/n}}$ for $M = 2, 4, 8, 16, 32, 64, 128, 256, 512, 1024$. Do you think this series converges or diverges?