1. (12 pts) Show that $\int_{1}^{\infty} \frac{dx}{\sqrt{x}}$ is convergent or divergent.

2. (17 pts) Set up (do not integrate) the following improper integral as a proper integral by using limits.
   $$\int_{0}^{1} \frac{dx}{\sqrt{x} \sqrt{x - 1}} =$$

3. (25 pts)
   a. Set up, ready for integration, the expression for the length of the sine curve $y = \sin x$ over $[0, \pi/2]$.
   $$L =$$

   b. Relate the curve $y = \sin x$ about the x-axis and set up the expression for the surface area of the 3-dimensional shape.
   $$S =$$