1. (10 pts each) Evaluate each of the following integrals:

(a) \( \int \frac{x}{x^2 - x - 2} \, dx \)
(b) \( \int \sqrt{1-x^2} \, dx \). \textbf{Hint:} Consider a substitution: \( x = \sin \theta \).
2. (10 pts each) Evaluate each of the following improper integrals:
   (Hint: A limit relationship?)
   
   (a) $\int_{1}^{\infty} x^2 \ln x \, dx$
(b) \[ \int_{0}^{1} \frac{1}{x^{1/2}} \, dx \]

3. (10pts) A force of 10 N is required to maintain a spring stretched from its natural length of 1m to a length of 2m. How much work is done in stretching the spring from 2m to 3m? (Hint: Hooke’s law: \( f(x) = kx \).)
4. (10 pts) Find the area bounded between the curves $y = \sqrt{x}$ and $y = x^2$.

5. (10 pts) Find the volume of the solid generated by rotating the region bounded by the curves $y = \sqrt{x}$ and $y = x^2$ about the $x$-axis.
6. (10 pts) Use the method of 
\textbf{cylindrical shells} to find the volume of the solid generated by rotating the region bounded by the curves \( y = \sqrt{x} \) and \( y = x^2 \) about the \( y \)-axis.

7. (10 pts) Find the length of the curve: \( y = \frac{2}{3} (x - 2)^{3/2} \), \( 3 \leq x \leq 4 \).