1. (Test problem) Determine if the following improper integral converges.
\[ \int_2^\infty \frac{-4}{x^2 + 2x - 3} \, dx \]
If it converges, find its limit.

Evaluate the following integrals or prove that they diverge.

2. \[ \int_3^\infty \sqrt[3]{e^{-x}} \, dx \]

3. \[ \int_0^1 \ln(x^2) \, dx \]

4. Find the volume of the region bounded by \( x^{-2} \) and the \( x \)-axis on the interval \([1, \infty)\) revolved around the \( x \)-axis.
5. What is wrong with this integral?
\[ \int_{-1}^{1} -2x^{-3} \, dx = x^{-2}\bigg|_{-1}^{1} = 1 - 1 = 0 \]

6. For what values of \( p \) does the integral
\[ \int_{1}^{\infty} \frac{1}{x^p} \, dx \]
exist and what is the value of the integral as a function of \( p \)?

7. (Test Question) Determine whether the following improper integral converges or diverges. If it converges, find its value.
\[ \int_{2}^{\infty} \frac{-2x + 6}{x(x^2 + 2x - 3)} \, dx. \]

8. (Test Question) Evaluate the improper integral or show that it diverges.
\[ \int_{1}^{\infty} x^{-6} \ln x \, dx \]