Section 8.8

1. a.) Use the midpoint rule with \( n = 5 \) to approximate \( \int_{1}^{6} \frac{1}{x^2} \, dx \). Draw the approximating rectangles.
   
   b.) What is the exact error in using this approximation?

2. a.) Use the Trapezoid rule with \( n = 4 \) to approximate \( \int_{0}^{1} e^{x^2} \, dx \). Draw the approximating trapezoids.
   
   b.) Find an upper bound for the error in this approximation.

3. How large do we need to choose \( n \) so that the approximation \( S_n \) to \( \int_{1}^{3} \ln x \, dx \) is accurate to within \( \frac{1}{1000} \)?

Section 8.9

4. Determine whether the following integrals converge or diverge. Evaluate those that converge.
   
   a.) \( \int_{-\infty}^{0} e^{3x} \, dx \)
   
   b.) \( \int_{-\infty}^{\infty} \frac{1}{x^2 + 1} \, dx \)
   
   c.) \( \int_{1}^{3} \frac{1}{(x - 1)^4} \, dx \)
   
   d.) \( \int_{-1}^{8} \frac{1}{\sqrt{x}} \, dx \)

5. For each of the following integrals, determine whether the integral converges or diverges using the comparison theorem.
   
   a.) \( \int_{1}^{\infty} \frac{1}{\sqrt{x^3 + 4}} \, dx \)
   
   b.) \( \int_{1}^{\infty} \frac{1 + e^{-x}}{x} \, dx \)