You must show all steps necessary to obtain your answer by hand. You may, however, use a calculator for basic arithmetic.

1. (10 points) Evaluate the following limit.

\[
\lim_{x \to 1} \frac{\sin(x - 1)}{x^2 + x - 2}
\]

2. (10 points) Evaluate the following limit.

\[
\lim_{x \to \infty} \frac{\sqrt{x}}{\ln x}
\]
3. (18 points) Evaluate the following integral.

\[ \int \frac{x + 15}{x^2 - 9} \, dx \]
4. (10 points) Evaluate the following integral.

\[ \int e^{-x} \sin x \, dx \]
5. (12 points) Evaluate the following improper integral.

\[ \int_{-2}^{0} \frac{-1}{(x + 2)^2} \, dx \]
6. (20 points) Evaluate the following improper integral.

$$\int_{2}^{\infty} 100e^{-2x} \, dx$$
7. (20 points) Determine which of the following series converge and which diverge. You must thoroughly justify your claim. For those series that converge, find their exact sums.

(a) \[ \sum_{k=1}^{\infty} \frac{5}{k} \]

(b) \[ \sum_{k=1}^{\infty} \left( \frac{1}{2^k} - \frac{1}{2^{k+1}} \right) \]
(c) \[ \sum_{k=1}^{\infty} \frac{3^k}{2(2k+1)} \]

(d) \[ \sum_{k=1}^{\infty} \frac{3k + 4}{k + 1} \]