

Name _____

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.

$$\lim_{x \rightarrow 1} \frac{\sin(x - 1)}{x^2 + x - 2}$$

2. (10 points) Evaluate the following limit.

$$\lim_{x \rightarrow \infty} \frac{\sqrt{x}}{\ln x}$$

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) $\sum_{k=1}^{\infty} \left(\frac{1}{2^k} - \frac{1}{2^{k+1}} \right)$

$$(c) \sum_{k=1}^{\infty} \frac{3^k}{2(2k+1)}$$

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