

Name: \_\_\_\_\_

Group #: \_\_\_\_\_

Evaluate the following limits using appropriate methods:

1.  $\lim_{x \rightarrow 0^+} \tan^{-1}(\ln x)$

2.  $\lim_{x \rightarrow \infty} \frac{1 + e^x}{1 - e^x}$

3.  $\lim_{x \rightarrow 0} \frac{2 \cos(x) \sin(4x)}{3x}$

4. Given there exists a function  $h(x)$  such that  $2x^3 + 8 \leq h(x) \leq x^4 + 8$  for all  $x$  near 2,  
find  $\lim_{x \rightarrow 2} \frac{h(x) + 5}{3}$ .

5. Using the conditions of continuity, determine if  $f(x)$  is continuous at  $x = 0$  and  $x = 1$ . If  $f(x)$  is discontinuous at either point, indicate the type of discontinuity.

$$f(x) = \begin{cases} 1 - x & : x < 0 \\ e^x & : 0 \leq x \leq 1 \\ x^2 + 2 & : x > 1 \end{cases}$$

6. Find a value of  $k$  for which  $g(x)$  is continuous everywhere:

$$g(x) = \begin{cases} \frac{x^2 - 9}{x - 3} & : x \neq 3 \\ kx & : x = 3 \end{cases}$$

7. Consider the function  $f(x)$  that satisfies the following conditions:

- $f(x)$  is continuous for all  $x$  except  $x = -2$ ,  $x = 0$ , and  $x = 3$ .
- $f(0)$  is undefined
- $\lim_{x \rightarrow 0} f(x) = 3$
- $\lim_{x \rightarrow -2^-} f(x) = -\infty$        $\lim_{x \rightarrow -2^+} f(x) = \infty$
- $\lim_{x \rightarrow 3^-} f(x) = \infty$        $\lim_{x \rightarrow 3^+} f(x) = -\infty$
- $\lim_{x \rightarrow -\infty} f(x) = 5$        $\lim_{x \rightarrow \infty} f(x) = 5$

(a) State the equation(s) for any horizontal asymptote(s) on the graph  $f(x)$ .

(b) State the equation(s) for any vertical asymptote(s) on the graph  $f(x)$ .

(c) At what  $x$ -value(s) does  $f(x)$  have any discontinuities? What type are they? If there are none, state that.

(d) Sketch a possible graph of  $f(x)$ .

