

**Math 171 Exam 3**  
**April 11, 2007**  
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**Name** \_\_\_\_\_

There are 5 questions, for a total of 100 points. Point values are written beside each question. Calculators may be used only for basic arithmetic operations. *Show your work for full credit.*

1. Find the following limits.

(a)  $\lim_{x \rightarrow 0} \frac{\ln(1-x)}{x^2}$

(b)  $\lim_{x \rightarrow \frac{\pi}{2}^-} (2x - \pi) \tan^{-1} x$

2. Let  $f(x) = \frac{\ln x}{x}$ ,  $x > 0$ .

(a) Find  $f'(x)$ .

(b) Find the interval(s) on which  $f$  is increasing, and the interval(s) on which  $f$  is decreasing.

3. Let  $f(x) = xe^{-2x}$ .

(a) Find  $f'(x)$ .

(b) Find all local maximum and minimum values of  $f$ .

(c) Find the interval(s) on which  $f$  is concave up, the interval(s) on which  $f$  is concave down, and any inflection points.

4. Find the absolute maximum and absolute minimum values of  $f(x) = \sin(x) + \frac{1}{2} \sin(2x)$  on the interval  $[0, 2\pi]$ .

5. A cylindrical can without a top is made to contain a volume of  $100 \text{ cm}^3$ . Find the radius and height of such a can with minimal surface area.