

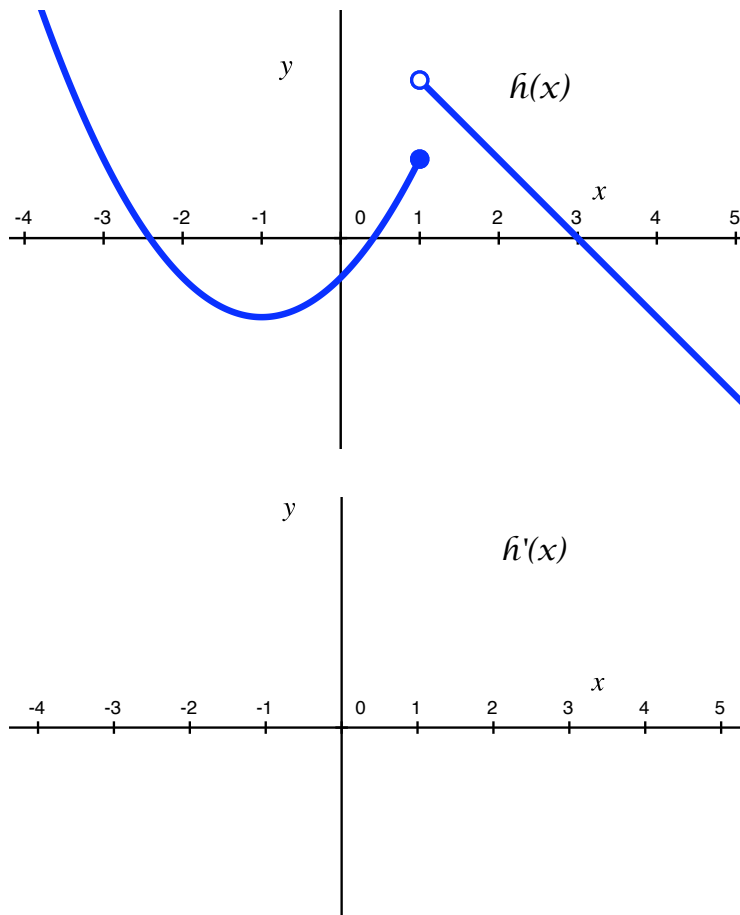
**Math 151**  
**Exam 1**  
**October 24th, 2008**

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

1. Your exam contains 5 questions and 5 pages; Please make sure you have a complete exam.
2. The entire exam is worth 100 points. Point values vary and these are indicated on each problem. You have 50 minutes for this exam.
3. Make sure to **ALWAYS SHOW YOUR WORK**; you will not receive any partial credit unless all work is clearly shown. If in doubt, ask for clarification. **Note:** To evaluate limits, proof by graph or table of values does not suffice for full credit.
4. If you need extra space, use the back of the exam and clearly indicate this.
5. You are allowed one  $8.5 \times 11$  sheet of handwritten notes (both sides).
6. Leave answers in exact form (as simplified as possible).
7. Put a box around your final answer where applicable.

Problem	Total Points	Score
1	10	
2	20	
3	20	
4	26	
5	24	
Total	100	

1. (10 pts.) The graph of the function  $h(x)$  is given below. Sketch the graph of the derivative  $h'(x)$ .



2. (20 pts.) The position of a robotic vacuum (in inches) along a straight line is given by

$$s = 6\sqrt{t^3} - 8t + 2 \quad \text{at } t \text{ minutes.}$$

**For this problem, use the differentiation rules (shortcuts) from §3.1 where appropriate.**

- (a) (9 pts.) Find the **average** velocity between  $t = 0$  and  $t = 1$  minutes. Include **units** in your final answer.

Problem #2 continued on next page →

Problem #2 Continued:

(b) (11 pts.) **When** is the **instantaneous** velocity equal to 10 inches/minute?

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3. (20 pts.)  $f(x) = \frac{9}{x+3} - 5x$

(a) (14 pts.) Find the derivative of  $f(x)$  using the **limit definition** of a derivative.

(b) (6 pts.) Find an equation of the tangent line of  $f(x)$  at  $x = 0$ .

4. (26 pts.) Consider the function  $g(x) = \begin{cases} \frac{8x^2}{x^2+2x} & \text{if } x \leq 2 \\ \frac{x^2}{x-1} & \text{if } x > 2 \end{cases}$

(a) (8 pts.) For what  $x$ -values is  $g(x)$  **discontinuous**?

For each discontinuity, state the type of discontinuity: Removable (hole), jump, or infinite.

(b) (10 pts.) Evaluate the following limits. Show work or justify your answers.

- $\lim_{x \rightarrow \infty} g(x)$

- $\lim_{x \rightarrow -\infty} g(x)$

(c) (8 pts.) What are the **equations** (if any) of the horizontal and vertical asymptotes of  $g(x)$ ?

5. (24 pts.) Evaluate the following limits. **Justify** your answers. If the limit is infinite, determine if it is  $+\infty$  or  $-\infty$ .

(a) (9 pts.)  $\lim_{x \rightarrow 2^-} \frac{x^2 - 4}{3|x - 2|}$

(b) (8 pts.)  $\lim_{t \rightarrow 0} \frac{e^{2t^2}}{t^2 + 5t + 4}$

(c) (7 pts.)  $\lim_{x \rightarrow \infty} \frac{3}{\sqrt{x} - 6}$