

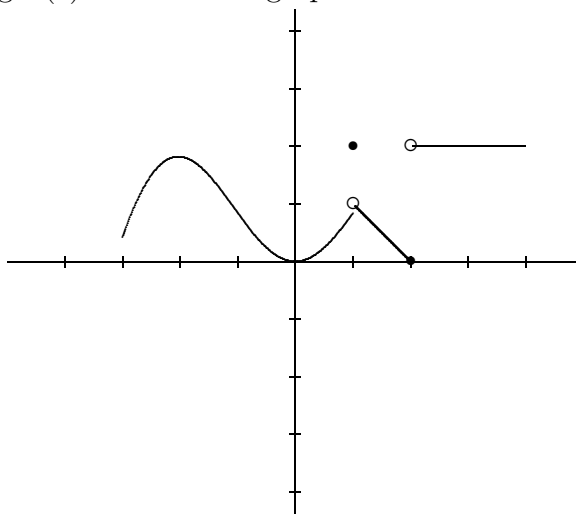
February 27, 1998

Name _____

In the first 7 problems each part counts 8 points each (56 points total) and the final four count as marked.

Multiple choice section. Circle the correct choice. You do not need to show your work on these problems.

1. Questions (a) through (e) refer to the graph of the function f given below.



- (a) $\lim_{x \rightarrow 1} f(x) =$
 (A) 0 (B) 1 (C) 2 (D) 4 (E) does not exist
- (b) $\lim_{x \rightarrow 2} f(x) =$
 (A) 0 (B) 1 (C) 2 (D) 4 (E) does not exist
- (c) A good estimate of $f'(-2)$ is
 (A) -1 (B) 0 (C) 1 (D) 2 (E) there is no good estimate
- (d) A good estimate of $f'(-1)$ is
 (A) -1 (B) 0 (C) 1 (D) 2 (E) there is no good estimate
- (e) A good estimate of $f'(2)$ is
 (A) -1 (B) 0 (C) 1 (D) 2 (E) there is no good estimate

2. Consider the function f defined by:

$$f(x) = \begin{cases} -2x + 4 & \text{if } x < 1 \\ 4 & \text{if } x = 1 \\ x^2 + 1 & \text{if } x > 1 \end{cases}$$

What is the slope of the line tangent to the graph of f at the point $(2, 5)$?

- (A) 0 (B) 1 (C) 3 (D) 4 (E) 5

3. Consider the function f defined by:

$$f(x) = \begin{cases} ax^2 + 4 & \text{if } x < 2 \\ 8 & \text{if } x = 2 \\ x^2 + b & \text{if } x > 2 \end{cases}$$

There are values for a and b which make f continuous at $x = 2$. What is $a + b$?

- (A) 1 (B) 5 (C) 6 (D) 8 (E) 10

On all the following questions, **show your work**.

4. (15 points) Find the derivative of $f(x) = \frac{1}{x^2}$ at $x = 2$ using one of the original definitions of derivative.

5. (20 points) Find each limit below if it exists. If it does not exist, state why it does not. Explain how you arrived at your answer and of course, SHOW YOUR WORK

(a) $\lim_{h \rightarrow 0} \frac{|h|}{h}$

(b) $\lim_{x \rightarrow \infty} \frac{3x^2 - 2x + 10}{2x^2 + 27x - 4}$

(c) $\lim_{x \rightarrow 2} \frac{3x - 6}{x^2 - 4}$

(d) $\lim_{x \rightarrow \infty} \sqrt{x^2 + 4x - 3} - x$

6. (15 points) The position of a particle at time t is given by $f(t) = 4t^2 + 2t + 3$, where t is measured in seconds and $f(t)$ is measured in feet.

(a) How far does the particle travel between the time $t = 1$ and $t = 3$?

(b) What is the average speed in feet per second that the particle travels during this time interval?

(c) What is the speed of the particle when $t = 3$?

7. (10 points) The graph of function $f(x)$ on the interval $[-5, 5]$ is given. On the same set of coordinate axes, sketch the graphs of $f'(x)$ and $f''(x)$, being clear about which is which.

