

Math 1210-1    HW 5  
Due Wednesday February 11, 2004

Please show all of your work neatly and in consecutive order on your own paper and box your answers. Be sure to write in complete sentences when appropriate. Also, I prefer you to leave answers like  $\sqrt{2}$  in that form, rather than in decimal form like 1.414. Note that the symbol  $\boxplus$  indicates that graph paper might be useful for that problem.

### The Derivative

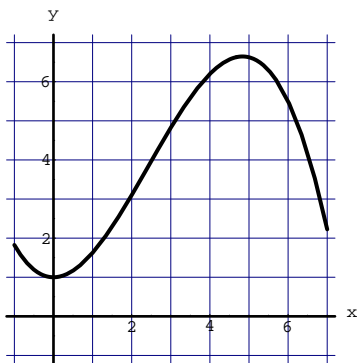
1. A physics student determines through experiment that if she drops a ball, it will fall approximately  $5t^2$  meters in  $t$  seconds after being released.
  - (a) How far will it fall between  $t = 0$  and  $t = 1$ ?
  - (b) How far will it fall between  $t = 1$  and  $t = 2$ ?
  - (c) What is the average velocity of the ball between the times  $t = 4$  and  $t = 5$ ?
  - (d) What is the average velocity of the ball between the times  $t = 4$  and  $t = 4.01$ ?
  - (e) What is the instantaneous velocity of the ball at time  $t = 4$ ?

2. Use the definition

$$f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$$

to find the derivative at  $x$  of each of the following functions:

- (a)  $f(x) = \sqrt{x}$
  - (b)  $f(x) = \frac{3}{x}$
  - (c)  $f(x) = \frac{x}{x+1}$
3. Consider graph of  $y = f(x)$  in the following figure.



- (a) Estimate  $f'(0)$ ,  $f'(2)$ ,  $f'(4)$ ,  $f'(6)$
- (b) There are two “special” points on this graph. For now let’s call them “vertices”. At one of the vertices, the graph is locally a minimum. This means that of all of the nearby points, it has the lowest value. Similarly, at the other vertex, we have a local maximum. What are the  $x$ -coordinates of these two points? What do you notice about the derivative at these two points?
- (c) Sketch the graph of  $y = f'(x)$  on  $-1 \leq x \leq 7$ .

4. The Figure below shows the graphs of two functions. One is the function  $f$  and the other is its derivative  $f'$ . Which is which?

