

Pledge:

8/30/2011  
Dr. Lunsford

MATH261 Calculus I  
Quiz 1

Name: Solution  
(20 Points Total)

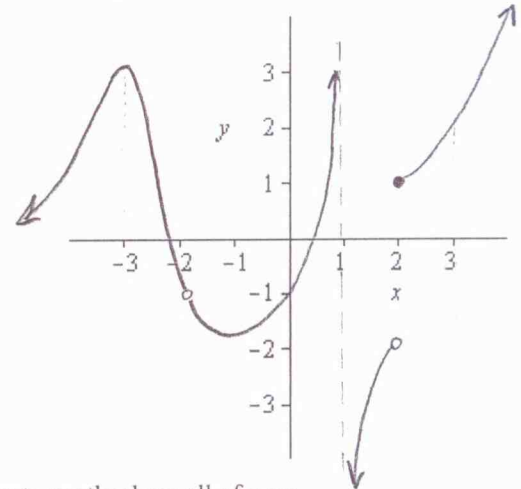
I. Use the graph of the function  $f$  below to find the indicated function values and limits. If the limit does not exist as a number indicate if it is  $\infty$ ,  $-\infty$ , or DNE. (1 point each unless indicated, 8 points total)

$$f(2) = \underline{1} \quad \lim_{x \rightarrow 2} f(x) = \underline{DNE} \quad \lim_{x \rightarrow 2^-} f(x) = \underline{-2}$$

$$\lim_{x \rightarrow 1^+} f(x) = \underline{-\infty} \quad \lim_{x \rightarrow 0} f(x) = \underline{-1} \quad \lim_{x \rightarrow -2} f(x) = \underline{-1}$$

Which is greater? The instantaneous rate of change of  $f$  at  $x = -3$  or at  $x = 3$ ? Why? (2 points)

@  $x = 3$  b/c the slope of the tangent line  
@  $x = 3$  is greater than the slope of the  
tangent line at  $x = -3$ .



II. A bird takes off from Cape Hatteras Lighthouse and 20 seconds later it dives into the ocean. We can model the vertical height (in feet) of the bird by the function  $h(t) = 200 + 10t - t^2$  where  $t$  is in seconds. A graph of this function is given below. Please answer the following questions being sure to neatly show all of your work. (12 points total)

(a) Find the average rate of change in the bird's height from  $t = 0$  to  $t = 15$  seconds. Draw the line whose slope represents this rate of change on the graph. Clearly indicate this line. (3 points)

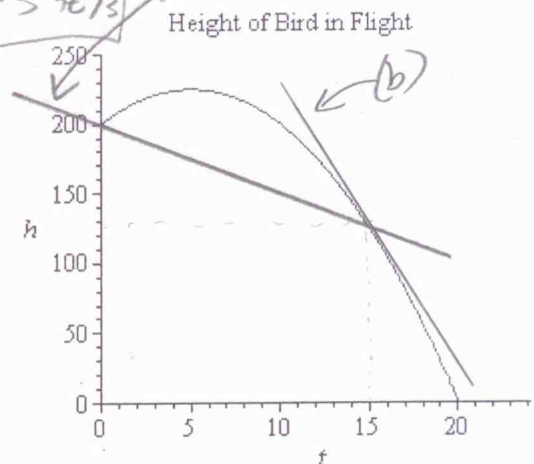
$$\frac{\Delta h}{\Delta t} = \frac{h(15) - h(0)}{15 - 0} = \frac{125 - 200}{15} = \frac{-75}{15} = \underline{-5 \text{ ft/s}} \quad (a)$$

(b) Draw the line on the graph whose slope represents the bird's instantaneous rate of change in height at time  $t = 15$  seconds. Clearly indicate this line. (1 point)

(c) Find an expression that gives the bird's average rate of change in height from time  $t = 15$  seconds to time  $t$  seconds. You should simplify this expression if possible. (5 points)

$$\begin{aligned} \frac{\Delta h}{\Delta t} &= \frac{h(t) - h(15)}{t - 15} = \frac{200 + 10t - t^2 - 125}{t - 15} \\ &= \frac{75 + 10t - t^2}{t - 15} = \frac{-(t^2 - 10t - 75)}{t - 15} = \frac{-(t - 15)(t + 5)}{t - 15} = \underline{\underline{-(t + 5)}} \end{aligned}$$

$t \neq 15$



(d) Complete the chart below and use it to estimate the bird's instantaneous rate of change in height at  $t = 10$  seconds. Please round all table entries to four decimal places. (3 points total)

Time $t$	14.99	14.999	15.001	15.01
Average Velocity from $t = 15$ to time $t$ seconds.	-19.9900	-19.9990	-20.0010	-20.0100

The bird's instantaneous rate of change in height at  $t = 15$  seconds is -20 ft/s