

MAT 241 Section 07 Fall 2009

Problem Set 2

Assigned 9/9/09

Due 9/14/09

3. The point $P = (1, \frac{1}{2})$ lies on the curve $y = x/(1+x)$.

a. If Q is the point $(x, x/(1+x))$, use your calculator to find the slope of the secant line PQ (correct to six decimal places) for the following values of x :

- i.* 0.99
- ii.* 0.999
- iii.* 1.01
- iv.* 1.001

b. Using the result of part a. (and plotting a few more points, if necessary), guess at the value of the slope of the tangent line to the curve at P .

c. Using the slope from part b., find an equation of the tangent line to the curve at P .

5. If a ball is thrown into the air with a velocity of 40 ft/s, its height in feet t seconds later is given by:

$$y = 40t - 16t^2$$

a. Find the average velocity for the time period beginning with $t = 2$ and lasting:

- i.* 0.1 seconds
- ii.* 0.01 seconds
- iii.* 0.001 seconds

b. Estimate the instantaneous velocity when $t = 2$.

8. The displacement (in centimeters) of a particle moving back and forth along a straight line is given by the equation of motion:

$$s = 2 \sin(\pi t) + 3 \cos(\pi t)$$

where t is measured in seconds.

a. Find the average velocity during the time periods:

- i.* $[1, 1.1]$
- ii.* $[1, 1.01]$
- iii.* $[1, 1.001]$

b. Estimate the instantaneous velocity of the particle when $t = 1$.

9. The point $P = (0, 1)$ lies on the curve $y = \sin(10\pi/x)$.

a. If Q is the point $(x, \sin(10\pi/x))$, find the slope of the secant line PQ for $x = 1.3, 1.2, 1.1, 0.7, 0.8$, and 0.9 . Do the slopes appear to be approaching a limit?

b. Use a graph of the curve to explain why the slopes of the secant lines in part a. are not close to the slope of the tangent line at P .

c. By choosing appropriate secant lines, estimate the slope of the tangent line at P .