

Math 113, Fall 2004, Prof. Sachs **Maple Assignment 1, due Monday, October 18**

This assignment will greatly enhance your understanding of tangent lines, derivatives, and the link between a function and its linear approximation.

You will work on this in student computer labs (Johnson Center, Innovation) or with a personal copy of Maple. You may collaborate with other students, but **your final work should be yours and you should be capable of explaining it on an exam or quiz.**

The assignment: Carry out the calculations and graphs requested below. Turn in a print-out from your work with answers to the questions. Use the attached cover sheet for your assignment.

1. In class, we found that the derivative of the falling body distance function $y = 16t^2$ is the function $y' = 32t$.

A. Use this to first write out the tangent line to the graph of $y(t) = 16t^2$ at $t = 3$ seconds.

B. Create and print two plots both the function $y(t)$ and the tangent line function (linear approximation): first with t in the interval $[2, 4]$ and then with t in the interval $[2.9, 3.1]$. Label these when you turn in your work.

C. Compute values of the change in y going from $t = 3$ to $t = 2.99$, $t = 3.01$, $t = 2.999$, $t = 3.001$ and compare these values to the linear approximation.

2. IF the power rule extended to fractional powers, which it does, then the derivative of the square root function $f(x) = \sqrt{x} = x^{\frac{1}{2}}$ would be $f'(x) = (\frac{1}{2})x^{-\frac{1}{2}}$.

A. Use this to first write out the tangent line to the graph of $f(x) = \sqrt{x} = x^{\frac{1}{2}}$ at $x = 4$.

B. Create and print two plots both the function $f(x)$ and the tangent line function (linear approximation): first with x in the interval $[3.5, 4.5]$ and then with x in the interval $[3.95, 4.05]$. Label these when you turn in your work.

C. Compute values of the change in f going from $x = 4$ to $x = 3.99$, $x = 4.01$, $x = 3.999$, $x = 4.001$ and compare these values to the linear approximation.

3. Look at the function $g(x) = \sqrt{9 - x^2}$ near the value $x = \sqrt{5}$, where $g(\sqrt{5}) = \sqrt{9 - 5} = 2$.

A. Create and print two plots of the function $g(x)$ near $x = \sqrt{5}$ by adding and subtracting first 1 and then 0.01 from $\sqrt{5}$.

B. Compute values of the change in g going from $x = \sqrt{5}$ to values that differ by ± 0.1 , ± 0.01 , ± 0.001 . What numerical value does this suggest for the derivative of g at $x = \sqrt{5}$?

Maple assignment 1, cover sheet Name: _____

Write out your main conclusions on this sheet. Attach graphs and other Maple work.

1. The tangent line (linear approximation) is the function: _____

A table of values for both the change in the function and the change in the linear approximation is:

2. The tangent line (linear approximation) is the function: _____

A table of values for both the change in the function and the change in the linear approximation is:

3. A table of values for the change in the function is:

My numerical estimate for the derivative of g is _____