Maple Introduction Written Homework (file name: LastName_Intro_W.mw)

REQUIRED REFERENCE

Maple Directions and Reference Page (linked to your class homework page)
Maple Introduction Lab (hard copy directions, .mw completed work)

- ✓ Present the following in the usual format for written homework. Have Maple do all of your calculations and graphing and use Text Typing (in Maple) to explain what you are doing.
- ✓ Use a new Maple worksheet and save a copy in your Home directory
- ✓ Delete extra pictures or calculations that you may do along the way, but don't need
- ✓ Try to make your document a "work of art"—look at print preview before turn in as needed.

1. Continuity of piecewise defined functions:

   a. Define and plot (use *discont=true*) $f(x) = \begin{cases} x^2 - 1 & x < 0.5 \\ x^3 & x \geq 0.5 \end{cases}$

   b. Is $f(x)$ continuous at $x = .5$? Support your answer with the definition of continuity and include the limit calculations (right and left side) in your Maple write up.

   c. Define and plot (use *discont=true*) $g(x) = \begin{cases} x^2 + .5 & x < 0.5 \\ x^3 & x \geq 0.5 \end{cases}$

   d. Is $g(x)$ continuous at $x = .5$? Support your answer with the definition of continuity and include the limit calculations (right and left side) in your Maple write up.

2. $c(x) = \begin{cases} x^2 + b & x < 0.5 \\ x^3 & x \geq 0.5 \end{cases}$

   a. Mathematically determine b (show and explain your work) so that $c(x)$ is continuous at $x = 0.5$.
   Note that $c(0.5)$ when $x < 0.5$ must be same as $c(0.5)$ when $x \geq 0.5$. You can type each line of your mathematical work in Maple and Maple will show your work and do some of your basic computations.

   b. Define and plot $c(x)$ once you have determined the value of b in part a).

   c. Support your conclusion that $c(x)$ is continuous at $x = .5$ using the definition of continuity and include the limit calculations in your Maple write up.

3. $w(x) = \begin{cases} \sin\left(\frac{1}{x}\right) & x \neq 0 \\ 0 & x = 0 \end{cases}$

a. Define and plot $w(x)$ from $x = -6$ to $x = 6$

b. Narrow the viewing window (plot with a redefined x domain) to zoom in more on the graph of $w(x)$ near $x = -1$.

Does the graph begin to look linear near $x = -1$? If so, indicate the viewing window when the graph of $w(x)$ begins to look linear. If not, describe what happens when you zoom in.

Use at least three different x domain ranges and after each display, explain briefly if the graph looks linear yet.

c. Narrow the viewing window (plot with a redefined x domain) to zoom in more on the graph of $w(x)$ near $x = 0$.

Does the graph begin to look linear near $x = 0$? If so, indicate the viewing window when the graph of $w(x)$ begins to look linear. If not, describe what happens when you zoom in.

Use at least three different x domain ranges and after each display, explain briefly if the graph looks linear yet.

4. According to one calculus text, if a certain cable is made of an insulating material in the shape of a long, thin cylinder, and the cable has an electric charge distributed evenly throughout it, then the electric field at a distance r from the center of the cable is given by

$$E(r) = \begin{cases} 2r & r \leq 0.1 \\ \dfrac{0.02}{r} & r > 0.1 \end{cases}$$

a. Define and plot $E(r)$. Graph $E(r)$ from $0 \leq x \leq 2$. Be sure to use the variables E and r.

b. Is $E(r)$ continuous at $r = 1$? Why or why not? Show your math calculations in Maple to support your answer.

c. Does the graph of $E(r)$ have a tangent line at $r = 0.1$? Why or why not?

5. Consider the function: $p(x) = x^3 - 2x^2 + 5x - 1$.

   a. Have Maple calculate $p'(1)$ using the limit definition of the derivative.

   b. Determine the equation for the tangent line to the graph of $p(x)$ at $x = 1$. Use Maple to determine the value of $p(1)$ and type each line of your mathematical work in Maple; Maple will show your work and do some of your basic computations.

   c. Graph $p(x)$ and the tangent line from part b) together on the same graph from $0 \le x \le 2$ in order to see if the tangent line does look like $p(x)$ at $x = 1$ Note, you can define the tangent line function for plotting or you can directly enter the *mx* + *b* portion instead of a defined function name.

6. Consider the function: $q(x) = x^x$.

   a. Have Maple calculate $q'(2)$ using the limit definition of the derivative.

   b. Determine the equation for the tangent line to the graph of $q(x)$ at $x = 2$ Use Maple to determine the value of $q(2)$, evalf() will give you a decimal approximation for irrational numbers (which you can use, or not for the slope) and type each line of your mathematical work in Maple; Maple will show your work and do some of your basic computations.

   c. Graph $q(x)$ and the tangent line from part b) together on the same graph from $0 \le x \le 4$ and $0 \le y \le 10$ in order to see if the tangent line does look like $q(x)$ at $x = 2$

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