New ground rules for Maple assignments.

1. Label axes on every graph.
2. Label every curve if there’s more than one per graph.
3. Edit your file to include only relevant stuff.

In this lab, our goal is to make Maple draw some secant lines, and then to find and graph the tangent line, for a couple of functions.

PROBLEMS

1. Consider the function \( f(t) = 3.0 \cdot (0.5)^t \), perhaps describing a declining bacterial population. Our goal is to find the instantaneous rate of change of population at \( t = 1 \).

   (a) Find the slope of the line connecting the points \((1, f(1))\) and \((2, f(2))\).
   (b) Use the point-slope form to graph the secant line, along with the function \( f \) itself.
   (c) Use the same steps to graph a secant line connecting the points \((1, f(1))\) and \((0, f(0))\).
   (d) Find the slope of the secant line connecting the points \((1, f(1))\) and \((1 + \Delta t, f(1 + \Delta t))\). Give it some sort of name (like slope). It should depend on something you might have called \( \Delta t \). Evaluate the slope at a few increment sizes \( \Delta t = .1, .01, -.1, -.01 \). Can you guess the instantaneous rate of change at \( t = 1 \)? If not, try smaller values for \( \Delta t \). Make a plot of the slope as a function of \( \Delta t \) for \(-1 \leq \Delta t \leq 1 \). Compare with your slope calculations.
   (e) If you called the slope in the previous part \( \text{slope} \) and typed \( \Delta t \) as \( \text{dt} \), you can have Maple find the limit by typing
      
      > \text{limit(slope,dt=0)};

      Do it. Does the result seem plausible?
   (f) Use this limit as the slope of the tangent line. Find the formula of the tangent line at the point \((1, f(1))\), and plot a graph with \( f \) and this tangent line. What happens if you plot the graph for a small domain around \( t = 1 \)?
2. Use the same sort of steps to find two secant lines and the tangent line to the function \( G(x) = \cos(x^2) - \sin(5x) - \cos(7x) \) at the point between \( x = 1 \) and \( x = 2 \) where it crosses \( G(x) = 0 \). This is from your first computer assignment.