Math 2250
First Maple Assignment
Due January 27, 2012

Begin by downloading this document and opening it from Maple. A shortcut is to use the "open URL" option in the "File" menu item. Alternately you can save the file to your computer, and then open it from Maple. The URL below is the location of this file:

http://www.math.utah.edu/~korevaar/2250spring12/maplehw1.mw

A list of commands you might find helpful for this assignment and later in the course is located at the link below. Open this document as well. If you use the "open URL" option it will automatically open in a new window.

http://www.math.utah.edu/~korevaar/2250spring12/maplecommands.mw

If you haven't done so before, go through the Maple commands in the document above to see what they do.
If you didn't attend any of the "Introduction to Maple" sessions you might also find these notes helpful:

http://www.math.utah.edu/~korevaar/2250spring12/mapleintro.mw

You are going to create a Maple document containing a mixture of text and mathematics, in which you answer various mathematical questions. You will submit your document on-line - through webct or Canvas- I will have this set up by January 24.

Problem 0: Create a new document:
0a) Use the file button at the top of the Maple window to create a new document. Choose "document" format as opposed to "worksheet" format. If you want to understand the difference between "documents" and "worksheets", open the help window and choose "Maple help" to search for these topics.

0b) Locate the buttons "Text" "Math" "Drawing" "Plot" "Animation" near, but not all the way at the top of this window. When you create your new document the "Math" icon may be highlighted. This means that if you start typing Maple will be in math mode. It works best to format your documents so that you only end up executing mathematics in explicit **"math execution groups"** which you get by clicking on the " [>" icon at the top of this worksheet. Here's one:
>
So, since you want to create a header for your document, make sure to press the "Text" button in your new document, before continuing.

0c) In text, and using the text formatting tools at the top of this window, type separate lines with your name; your student number; your Math 2250 section and Professor; the date. Right justify these lines.

0d) Below this header, and centered, write "Maple Project 1, Math 2250".

Congratulations, you're ready to get to work!

In the following problems, only do mathematical computations inside **Math execution groups**, as explained above. For each problem copy the number and problem from this assignment file into your new file. You can copy/paste from window to window, or you can retype the questions. You will notice that that I have mixed mathematical expressions into the text of the questions, by changing between "Text" and

"Math" mode where appropriate. You can verify this by clicking your cursor at various places below. I was careful to have each text line end with some characters or spaces in "Text" mode. If the last part of a line is in "Math" mode, then when you hit the "enter" key Maple will think you actually wanted it to compute something, and will likely create some unwanted output.

Important Directions for submission for Math 2250-4 Korevaar: Create your document so that we can regenerate your answers by using the Edit/Execute/Worksheet menu option . Before you submit your . mw solution file on webct, remove all Maple output using the menu option Edit/Remove Output/From Worksheet. If you're worried that your file may become corrupted during submission and we won't be able to regenerate your answers, you may also submit a .pdf or .ps printout which includes all the output, in addition to the .mw file.

1) Use Maple to define the function $F(x) = \sin(3x + 1) + e^{-2x} + 1$.
> *#insert math execution prompts for each problem. If you wish to enter*
  #multiple−line commands before executing, use "shift-enter", just like on Facebook :-).

2) Have Maple compute the derivative of $F(x)$ and then define this derivative function to be $f(x)$.

3) Have Maple antidifferentiate $f(x)$. Note that Maple does not add an additive constant when it antidifferentiates, so that your result won't exactly equal $F(x)$.

4) Use Maple to verify the two Fundamental Theorems of Calculus for the functions $f(x), F(x)$ you defined above, namely have Maple verify that

$$\int_a^b f(x)\, dx = F(b) - F(a) \text{ and}$$

$$\frac{\partial}{\partial x}\left(\int_a^x f(r)\, dr\right) = f(x).$$

5) Define the 2-variable function $g(x, y) = \sin(y)\, e^{0.5\, x}$. Compute its x and y partial derivatives with Maple.

6a) Use the Maple "dsolve" command to solve the initial value problem for the linear drag problem for a falling object:

$$\frac{dv}{dt} = 32 - 1.6 \cdot v$$
$$v(0) = 0$$

(This is called a linear drag problem because assuming we set the positive direction to be downwards, then in the English unit system and without friction, the acceleration of a falling object would be 32 $\frac{ft}{s^2}$. In this model, we are assuming there is also a frictional drag force, proportional to the objects velocity.)
6b) This differential equation is both separable and linear. Using either technique type in a derivation of the IVP solution "by hand". Your answer should agree with Maple's! (For examples of the sort of exposition I have in mind, see the first homework solutions, on the Math 2250-4 homework page.)
6c) What percentage of the terminal velocity is obtained at $t = 0.5\ s$? at $t = 1\ s$? (Use Maple for these computations.)

7a) We do not cover section 1.6 in our text because it is hard to explain unless students have seen multivariable calculus. However, Maple should be able to symbolically solve any differential equation which has a symbolic function solution. Have Maple find all solutions to the following challenging differential equation, which is from problem 1.6.28

$$x \cdot e^y y' = 2 \cdot \left(e^y + x^3 \cdot e^x \right) .$$

Remember that you must use $\exp(x)$ for e^x !

7b) Use Maple to verify that your solutions to (7a) really do solve the differential equation - in other words, verify that when compute both sides of the differential equation for the function $y(x)$, you get a true equation. (You could verify this by inspection, or have Maple check that the difference of the two sides of the equation is zero.)