MATH 353 MAPLETIPS W-10

This assignment can be done in MS 571, 515, 521. Printouts will go to ST 142 (Elbow Room in Science Theatres). In MS 571, 515, 521 first hold down Control-Alt-Del, click mouse on Username and type that in, click (do not use Enter button here) on Password and type that in, click Login, then click OK, then double click MAPLE 13. It might take a little while here but eventually you will have MAPLE 13, the Help boxes can be deleted and select "Blank Worksheet." **The assignment will be due in the lecture on April 7.** Of course it can be turned in earlier if so wished.

Each mathematical command starts with a cursor ⌊, and finish each command with a return (the Enter key, or use a : followed by Enter if you wish to supress the printing). Detailed instructions for completing the assignment are given below, step by step. Don't forget to logout when done. The rooms mentioned are available at times which are posted on the doors of each room. MS 571 is even available on weekends. If a class is using the room (and a terminal is free) first ask the instructor for permission.

INSTRUCTIONS

Your assignment should be turned in from the computer print-out, must be stapled, and should be about 3-5 pages long. *Unstapled assignments not accepted.* Do the questions in order and number each question clearly. Your name (or any other text) can be typed in by clicking the Menu at top on "T", typing in whatever is needed, and then "Enter". To go back to the Maths Mode click the Menu on " [>".

The specific commands for each problem follow. A couple of useful hints are first given. The basic arithmetical operations in MAPLE are $+ \quad - \quad * \quad / \quad \wedge$. Be very careful about parentheses, there must always be as many left parentheses as right parentheses. Also be careful to write capital letters as capitals and do not miss any commas. The multiplication command $*$ must often be explicitly written in (recommendation - always write it in, it's safer to do so - so $3x(y+z)$ is typed in as $3*x*(y+z)$). The command % is a short-hand for the previous line's output. The exponential function e^x is typed $\exp(x)$, other common functions are $\ln, \sin, \sinh,$ arcsin, arcsinh, etc. For most of the questions it's convenient to first define a function or symbol, but then *be careful to undefine it when the question is finished or MAPLE will keep the first meaning in all succeeding problems.* When typing in certain mathematical expressions, such as an exponent, MAPLE will switch the cursor to a higher (or lower) line. To return to your original line of typing just hit the → key.

Enter your name and lecture number (L01 or L02) on first page, and your ID number on p.2. It's probably easiest to type in the name and lecture number at the start, and then put the ID on the second page by hand once you have it printed. Papers missing this information (or not stapled) will not be accepted. For the first few questions we give all commands in detail. Some of the answers also are given on the assignment so you can be sure things are working well. In the further questions you will be a little more on your own.

1. (a) evalf(Pi) Enter (after each command, not written in henceforth)
   (b) evalf(Pi,100)
   (c) Careful here or you will get the wrong answer. **Think!** A full explanation of your answer must also be given here for credit.

2. For this question and many others, it is useful to first define the function f, this will be useful to prevent errors. Once the question is done, be sure to undefine f. Here are the steps.
   $f := (7 * (\sin(x)) \wedge 4 + 5 * (\cos(x)) \wedge 6) \wedge 2$
   int(f, x=0..(Pi/2))
   f:='f' (this will undefine f so you can use it again)

3. Again, first define the function f that is to be graphed. Now enter

   (a) plot(f,x=-3..3)
   (b) done by inspecting at the graph in (a), just a rough estimate
   (c) fsolve(f=0,x) This will give the zeros of f to 10 digit accuracy, which is the default accuracy of MAPLE. undefine f

   Before doing the further problems, we will input three "packages" that are needed for special tasks in the following problems. The commands for these will be followed by a : so they will not appear on your printout.
   with(linalg):
   with(VectorCalculus):
   with(plots):

4. C:=matrix(4,4,[4,3,1,6,2, etc -2,21])
   (a) det(C)
   (b) eigenvalues(C)
   (c) You are on your own here. Type in your answer and don't forget "explain."
   undefine C

5. First define the function f
   (a) plot3d($f, x = -1..1, y = -2..2$)
   (b) plots[contourplot]($f, x = -2..2, y = -2..2$) (c) The answer should be either relative max, relative min, or saddle point.

6. First define the function f to be integrated
   int(int(int(f,z=0..(3y-x)),y=0..x),x=1..2) undefine f

7. Define the function f.

   H:=VectorCalculus[Hessian](f,[x,y]) this dfines H, the 2×2 Hessian matrix of f.

   eqns:=diff(f,x)=0, diff(f,y)=0 this defines eqns as the two equations to be solved for the critical points.

   solve(eqns,[x,y]) MAPLE now finds the critical points. You should find 5 critical points (ignore ones saying "RootOf( )").

   x:=0

   y:=0 this converts (x, y) to the first critical point $(0, 0)$

   eigenvalues(H) MAPLE gives you the two eigenvalues of H, so now decide if this critical point is a local max, local min, or saddle point.

Now cycle back to the step where the values of x, y were entered and change them to the second critical point, then repeat procedure with the Hessian. Continue on to the third cririal point, etc. Tip: to get a numerical evaluation of the eigenvalues to quickly see if they are positive or negative, after the eigenvalues(H) command use the command evalf(%), this gives a numerical evaluation of the previous row.

Undefine x and undefine y

8. SetCoordinates(cartesian$[x, y, z]$)
   LineInt(VectorField($< y, x, z^2 >$),Path($< t^2 + t, 2t, t^4 + t^3 >, t = 1..3$))

9. SurfaceInt($x^2 + y + z, [x, y, z]$ = Surface($< s, t, s + t >, s = 0..1, t = 0..1$))

10. SetCoordinates(cartesian$[x, y, z]$)
    F:=VectorField(<the given vector field>)
    G:=Curl(F)
    Divergence(G)

To print just go to File and click on Print, similarly to exit go to File and click on Exit. It will ask you if you wish to save your work, generally the answer is No, but if you wish to continue the session later just use the Save As command as usual to create a file. The computers in the computer labs will not save your file, so if you wish to save it to return later your best option is to email it to yourself. Don't forget to logout when session is finished. Let your instructor know if any problems arise.

Caution: If you save your work and return later, be sure to re-enter the three packages again as MAPLE will have forgotten them. The easiest way to do this is to go back to the start of your file and press Enter over and over until back to where you left off.