

MATH 311 MAPLETIPS

This assignment can be done in MS 571, 515, 521. If a class is taking place in one of these rooms, you can ask the instructor for permission to use a free computer. To start, first hold down Control-Alt-Del, click mouse on Username and type in your usual U of C username, then click (do not use Enter button here) on Password and type that in, click Login, then doubleclick on the Maple 12 icon. Now choose the "Blank Worksheet" from the options on the left (there are many other options if you wish to explore or learn about MAPLE). From the menu select [$>$ to do maths, you can also select T to type ordinary symbols (such as your name). You may like to enlarge the writing by selecting one of the magnifying glasses at the top of the menu - recommendation is to use the middle magnifying glass, then before you print the assignment go back to the left (small magnifying glass to save paper on the print-out).

Each mathematical command starts with a cursor that looks like $>$, and finish each command with "Enter." Detailed instructions for completing the assignment are given below. Don't forget to logout when done. The printouts go to the Elbow Room in Science Theatres. If you wish you can do part of the assignment, then use the "Save As" command, give it a name, logout and return to it later. Thanks to Belal Elrafih and Andreea Grecu for help in the preparation of these MAPLEtips.

INSTRUCTIONS

Your assignment should be turned in from the computer print-out and stapled. Unstapled assignments not accepted. Number each question clearly and do in order. Your name (or any other text) can be typed in by clicking the Maple Menu at top on "T", typing in whatever is needed, and then "Enter". To go back to the Maths Mode click the Menu on " $>$ ".

Remember that each maths command ends with a "Return", these will not be indicated below after 2(a). The specific commands for each problem follow. A couple of useful hints are also given. The basic arithmetical operations in Maple are $+ - * / \wedge$. Be very careful about parentheses, there must always be as many left parentheses as right parentheses. Also be careful to have exact spelling and capitalization. The multiplication symbol can be omitted, as one usually does in writing something like $2x$, but notice that to write 3×5 you will have to type in $3 * 5$. Also use the arrow keys on the keyboard to move the cursor to where you want it, especially the \rightarrow to bring the cursor back to the main line such as after typing an exponent or a fraction. The command $\%$ is a short-hand for the previous line's output. The exponential function e^x is typed $\exp(x)$. The symbol I in MAPLE stands for $i = \sqrt{-1}$. For some of the questions it's convenient to first define a function or symbol. See Question 3 below for an example of this. Since MAPLE will remember this definition for the rest of your session, it's also important to undefine the symbol once finished using it, in case it is later used in a different context. Question 3 gives an example of defining and undefining.

1. Enter your name on first page, and your ID number on p.2 (can be typed or written by hand).
2. (a) $>\text{evalf}(\text{Pi},100)$ Enter (afterwards the "Enter" after each command will not be written).
(b) just type in or write your answer here, but think carefully first - otherwise the chances are 99% you will get the wrong answer!! Also, a short explanation of your answer must be given to obtain credit for (b).

Tip to save paper on your printout - ending a command with a colon ($:$) will cause MAPLE to do the command but it will not show up on the screen or on the printout. A couple of commands below will end with a colon, however it is recommended you do it first without the colon and look at the output, then go back and put in the colon at the end of the command so it no longer shows up on the printout.

3. Define $p := x^3 - 5x^2 + 7x - 12$ (remember in typing to use the \rightarrow where needed, i.e. after each exponent).

`>solve(p=0,x):`

`>evalf(%,30)` [Hint : one of the complex roots is approximately $.467652 + 1.72614i$.]

Now undefine `> p := 'p'` (use the apostrophe next to the Enter on the keyboard).

To do the rest of the assignment the linear algebra package will be needed.

`>with(linalg):` (as mentioned above, recommendation is to first do this without the `:`, have a look, then simply go back and put in the `:` for your final version)

4. `>u1 := vector([2,1,2,0])`, similarly define `u2,u3`.

`>GramSchmidt([u1,u2,u3],normalized)` [Hint : the third new vector should have as first entry $6\sqrt{117}\sqrt{53}/689$]

Now type in each of the three matrices. For example

`>C:= Matrix([[2,3,4],[3,5,0],[4,0,-2]])`

Be sure to not forget any comma or parentheses or brackets.

5. (a) For this question no work on MAPLE is necessary, just a written answer should be given.

(b) `>eigenvalues(C):`, then `>evalf(%,30)`

(c) Again just a written answer here.

6. (a) `>rank(A)`

(b) `>gaussjord(A)` Don't forget the second half of the question

(c) `>multiply(B,A)`

7. (a) `>det(B)`

(b) Written answer.

(c) `>inverse(B)`

8. Use command `>eigenvalues(B)`, don't forget to identify the eigenvalue $\lambda = -13$ and its eigenvector.

Undefine A, B, C

9. Enter the matrix P as before, but it will help to write `.3` as `3/10`, etc. this creates a little more work in writing P but saves lots of work later. To find say P^{10} , just use the command `> P ^ 10 ;`, and following this with `>evalf(%)` will also be helpful. Sometimes using the maximize window command (box in the upper right corner) will be helpful, in case the matrix appears written in a non-rectangular form. [Hint : To 6 digits, the steady state vector equals $[.122641, .086478, \quad , \quad]^T$]

10. You should be able to do this now on your own now. [Hint : One eigenvalue is -2 and its eigenvector is $[-1 \ 0 \ 0 \ 1]^T$. Also, you may find it easier to clear fractions on an eigenvector by a suitable multiplication, for example $[1/3, -2, 2/9, 0]^T$ could be multiplied through by 9.]

You are now done, don't forget to reduce the magnification before printing. 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 (but careful here, the computers in 571 do not seem to save the file). Don't forget to logout when session is finished. Bon chance, boa sorte, viel Glück, good luck!