

# MATH 353 MAPLE WARMUP

This warm-up assignment can be done in MS 571, 515, 521. It will get you acquainted with MAPLE 10, the newest version of MAPLE. It is not to be turned in. The actual MAPLE assignment will be given out a little later. It should be very easy once you have done this warm-up, and will be about 10 questions long. 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 10. Each mathematical command starts with a cursor  $\downarrow$ , which you should now see on the screen upper left, and finish each command with a return (the Enter key). 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.

In this warm-up we are going to solve the following questions, the second last one taken from Quiz 1.

1. Find  $45^{200}$ .
2. Find  $e$  to 400 significant figures.
- 3.

$$\int \frac{1}{1+x^6} dx$$

4.

$$\int_0^1 \int_0^{y^2} e^{y^3} dx dy$$

5. Find any local extrema and saddle points of  $f(x, y) = 9x^2y - 3y^2 - (3/2)x^2$ .
- 6.

$$\int 3x^2 dx$$

The instructions below will show you exactly what to type in. Just remember that as you type in MAPLE 10 is a WYSIWYG - what you see is what you get - so after you type an exponent or fraction the cursor may move up or down. To return it to the previous level simply use the right arrow (ra) button, then continue typing. For example to type in  $x^3 + 7y^3$  type  $x \wedge 3$  ra  $+ 7 y \wedge 3$  . In the typing instructions below the ra will not be included, nor will the  $\wedge$  for exponentials (except in Question 1), nor the Enter after each command.

## INSTRUCTIONS

1.  $45 \wedge 200$
2. `evalf(exp(1), 400)`
3. `int(1/1 +  $x^6$ , x)` Note: In earlier versions of MAPLE one would need parentheses around the denominator  $1 + x^6$ . However with MAPLE 10, using the ra properly, it will be written on the screen exactly as it should be, i.e.  $\frac{1}{1+x^6}$ .

4. `int(int(exp(y3), x = 0..y2), y = 0..1)`
5. `with(linalg)` [this inputs the linear algebra package]
- `f := 9x2y - 3y2 -  $\frac{3}{2}$ x2` [this defines the function  $f$ ]
- `H:= VectorCalculus[Hessian](f, [x, y])` [defines H, the  $2 \times 2$  Hessian matrix of  $f$ ]
- `eqns:= {diff(f, x) = 0, diff(f, y) = 0}` [defines eqns, the two equations in  $x, y$  that must be solved simultaneously to find the critical points]
- `solve(eqns,[x,y])` [MAPLE solves and gives the three critical points, each of which will be entered into the Hessian matrix]
- `x := 0`
- `y := 0` [this converts  $(x, y)$  to the first critical point  $(0, 0)$ ]
- `eigenvalues(H)` [MAPLE gives the two eigenvalues of H - if both negative then you have a local max, both positive a local min, mixed a saddle point]
- Now cycle back to the step where the values of  $x, y$  were inputted and change them to the second critical point, repeat procedure with the Hessian. Similarly for the third critical point. Tip: if you would like a numerical evaluation of the eigenvalues to see quickly whether they are + or -, after the eigenvalues command use the command `evalf(%)` which will do a numerical evaluation of whatever was in the previous row.
6. The last question is very simple (you can do it in your head), but if you try it directly using the same commands as Question 3 there will be trouble. This is because  $x, y$  were defined as numbers in Question 5 and MAPLE will always remember this unless you undefine them. So first use
- `unassign('x')` [then  $x$  is free again and you can now do Question 6, similarly if one wanted to undefine  $y$ ]