

Introduction to Maple by Prof. Greenfield

Goals of showing Maple to students

Students should know about `Maple`, and I would like to help them learn about `Maple` as soon as possible. My ambitions are to show students the program, to equip them with the ability to run some commands, and to work with the extensive `Maple` “help” facilities. I want them to feel confident that the system will obey them. I also want them to commit and recover from some of the simple errors that everyone makes when first using such a complex program, and to make these errors in what I hoped would be an environment which would be both emotionally and intellectually supportive.

What follows are four sheets of instructions covering, in turn, arithmetic, algebra, calculus, and graphing. I recommend that students work in pairs at two adjoining computers. Both partners should work through each sheet, helping each other when necessary (and such help likely *will* be necessary, since the instructions are rather minimal!). The students should begin each sheet together. Thus one student may need to wait (and help) if their partner is slower to complete one of the sheets.

Students should at least think of `Maple` as an effective symbolic and graphical and numerical “calculator”. It is another resource which can help them do homework and can help them communicate technical information. I do *not* discuss `Maple`’s capabilities for running user programs and only suggest that `Maple` can be a valuable **experimental tool** for investigating mathematics.

Local Rutgers note

The simplest way to begin is at a Rutgers computer lab. Please login, and click on **Start** (lower left), then **All programs**, then **Class software**, and, finally, **Maple 10**. Then begin with the algebra page.

`Maple` is available on `eden` and you may be able to use it remotely. Also there is a student edition which can be bought, but see how you like the program first.

Disclaimer! Non-advertisement!! Important information!!!

Symbolic manipulation programs such as `Maple` are becoming increasingly available. Other popular programs with about the same capabilities are `derive` and `mathematica` and there are many special purpose programs in various fields of science, engineering, and mathematics which have extensive “intelligence” to analyze models. We’re considering `Maple` here because Rutgers has a site license for this program, and it should be generally available on Rutgers systems. The specific instructions won’t be the same from program to program, but many of the same ideas will be present. Students should expect to have a machine do tiresome or elaborate symbolic computations as well as numerical computations. Please note that many of `Maple`’s capabilities are also available through `matlab`.

Part I: playing with arithmetic on Maple

What you should type will be in *this typeface* with numbers that look like this 1 4 7 9 and these suggestions will be indented about an inch. I'll ask you to hit the "enter" key (new line) with the request **RET**.

Start the **Maple** program as discussed on the **Goals ...** page. The system should eventually respond with a **Maple** screen on your display. It may take a few seconds, since **Maple** is a big program. There are standard ways for you to move or resize the screen, and various **Maple**-specific command possibilities. **Maple** has many capabilities. We'll explore only a few of them. Right now I'd like you to move your mouse into the **Maple** window. Under **Document Options** please click on Start with Blank Worksheet.

You should see what's below inside the **Maple** worksheet. This is the **Maple** command line:

> /

Your cursor position is the blinking / on an input line, indicated by the > sign. Type

3+2 **RET**

"Things" should happen: you should get 5 and a new input line. By the way, if you looked carefully, you will see that the cursor changed from a slightly tilted / to | when the input line is not empty. You can move your cursor up and down with the arrow keys. Please do this. The phrase above the **Maple** worksheet changes from **2D Input** on the **Maple** screen to **2D Output** and then to **2D Input** when your cursor gets back to the original line.

Now move your cursor back to your new input line. Type

17*3 **RET**

and see the result. The input line will display 17·3, using a centered dot for multiplication. But you must type * to tell **Maple** about the multiplication.

At the next input line type

%+5 **RET**

and explain the result. In **Maple**, % is called the *ditto operator*.

Now type the following to learn what ^ means.

2^3 **RET**

Notice that **Maple**'s graphical interface interprets ^ as a typographical request for superscripts. But I wanted to calculate the 300th power of 2. Move your cursor back to the input line with 2³ and position it as shown: > 2³ and type 00 and then **RET**. What happened?

You should learn to navigate superscripts, so please compute 2³⁰⁰ · 300². The first five digits of the answer should be 18333.

Please type (look carefully here – I'm asking for a **colon** at the end of the expression!).

5+6: **RET**

You should immediately get another input line. Type (for example)

%+7

and deduce what **Maple** does when an input line ends with a : (that is, a colon). Note that computations might and do occur (such as 2^(2^(2^(2^2)))) which have results that are huge and silly to print out if you don't need them. Try that if you'd like, with no ":" and see how **Maple** handles the result. Onward: please type

20 **RET**

Put a space between the 2 and the 0, then **RET**. What happens?

Our next experiment:

$2*3+7$ **RET**

and observe that **Maple** follows the usual rules of precedence. Can you put parentheses in so that **Maple** will compute two times the sum of three plus seven instead? Remember **RET** after you make the alterations. You should have gotten 20, of course. If you did **not** make an error inserting the parentheses, go back and take one out (create an intentional **error!**) and then hit **RET**. What happens? You haven't broken anything. Let's keep exploring. Please get a new input line and try the following commands in succession to learn how to do more arithmetic and to explore more features of **Maple**.

$2/3$; **RET**

The result on the screen is a more traditionally typeset fraction. Please go back and change this to $\frac{4}{3}$ and then change it to $\frac{4}{7}$. The arrow keys will help you. Now suppose you have entered the command $4/7$ **RET**. **Maple** computes “exactly” and can do simple arithmetic:

$\%*700$ **RET**

Now try

$\text{sqrt}(2)$ **RET**

followed by

$\%^2$ **RET**

so **Maple** knows the “meaning” of fractions and square roots – or at least how to manipulate them. And now try (remember, if you mess up with a parenthesis or something else, just go back and do it again – nothing is broken!):

$(\text{sqrt}(2)-1)^5$ **RET**

This result is puzzling. Sometimes **Maple** is lazy. Let's urge it to work by writing

$\text{expand}(\%)$ **RET**

That's better. But what if we want or need decimal approximations? Try

$\text{evalf}(\text{sqrt}(2))$ **RET**

Parentheses must match – always a source of anxiety as more complex expressions and commands are typed. We can coax *evalf* to get more digits of $\sqrt{2}$. To see how, type

$\text{help}(\text{evalf});$ **RET**

Another screen should pop up. When I use **Maple** I need a lot of *help!* Read the *evalf* screen (I usually skip down to the examples on any help screen first!) until you figure out how to get the first 100 digits of $\sqrt{2}$ (see the entry link on the left entitled *evalf,details*). What is the one-hundredth digit after the decimal point of $\sqrt{2}$? (The answer is 7: be careful with the specification of the number of digits.) Can you tell me the three-hundredth digit after the decimal point of $17^{1/3}$? (I think the answer is 5.) If we type

$1400/24;$ **RET**

we learn that **Maple** knows how to factor integers. Please get **Maple** to factor your social security number. How would you find a factoring command in **Maple**? If the first thing you try with the *help* command doesn't work, look at the references below the **See Also** line at the end or look to the left and check them out. My social security number has three distinct prime factors. How many does yours have?

We can go on to try some algebra. But you can stop your **Maple** session at any time in several ways. One way: go to **File** on the top of the window and look for **Exit**. You need not save this **Maple** session!

Part II: playing with algebra on Maple

The most attractive feature of **Maple** may be its ability to do intricate symbolic computations. Just try this:

```
(x+2*y)^5 RET
```

Darn it: lazy **Maple**! There are ways of telling **Maple** not to be so lazy, but we want to go slowly. Just type:

```
expand(%) RET
```

and see what happens. Type

```
x=2 RET
```

and see what happens. Then type

```
x RET
```

Now try

```
x:=2 RET
```

followed by

```
x RET
```

and appreciate the difference. The character string `:=` assigns the **value** on the right to the **name** on the left. Now type

```
x^3 RET
```

Did you expect that? Try to evaluate $(x+1)^8$ when x has value 2. After doing that, type

```
restart RET
```

then try

```
(x+1)^8 RET
```

again and “expand” it. Is the result unexpected? What do you think *restart* does, and (more importantly!) how could you check that *restart* has that function? Hint: just try *help(almost any word!)* when you’re curious or confused.

Please assign q the value 17 and then type the following character string **exactly** as written here **but** don’t hit **RET** yet!

```
q;2q;q2;q*2;q^2;2*q;2^q
```

The semicolon `;` is used to separate several **Maple** statements on the same input line. Think about what’s here and try to predict what will happen. Now hit **RET** and fix up any problems and hit **RET** again. Were you correct?

Warning! In older **Maple** implementations and even in **Maple**’s current command line version, the character string `2q` will be rejected (with the message **syntax error, missing operator or ` ; `**). The graphical interface to **Maple 12** will accept `2q` as an implied `2*q`. People are sometimes reluctant to use long variable names, but I think this can be a very useful **Maple** feature. Long names can help you remember what entries represent during complicated computations. For example, try

```
sumsqrts:=sqrt(x)+sqrt(y)+sqrt(z) RET
```

followed by

```
expand(sumsqrts^3) RET
```

Certainly more letters take more time to type (and increase the chance for error), but remember this freedom exists: you can call something by a character string close to its real name or with some important attribute recognized. This can reduce confusion.

Here are some other algebraic manipulations:

`factor(y^4-16) RET`

We can tell **Maple** to use imaginary numbers. See the *help* information about *factor*. Specifically, try the command `factor(y^4-16,I) RET`. **Maple** is born knowing some constants. *I* is a number whose square is -1 . You may be able to guess what *Pi* is. And the constant *infinity*. In older **Maple** systems, *E* was the number whose decimal approximation begins 2.71828..., but the latest releases of **Maple** don't "know" this. If you do need *E*, you can define it with the command `E:=exp(1) RET`.

Work with a typical expression occurring at the beginning of calculus: $\frac{(W + \Delta W)^5 - W^5}{\Delta W}$.

I used the variables *W* and *deltaW* in my **Maple** analysis and (after *expanding!*) got the usual calculus mess involving both *W* and ΔW . Notice now (if you haven't already) that **Maple** is "case-sensitive". Therefore *x* and *X* need not be the same. Be careful!

You can now have fun doing algebraic things which no sane human being would ever think of doing "by hand". For example, what is the coefficient of r^7 in $(r^2 + 3r + 4)^{10}$? Please remember all the necessary parentheses and ^'s. (I think the answer is 175173120.)

Maple can also substitute in algebraic expressions. Try

`subs(a=t,5a^3+3t*a+2sqrt(a)) RET`

This command changes *a* to *t*. It isn't equality. Try the following command with no * between *t* and *a*:

`subs(a=t,5a^3+3ta+2sqrt(a)) RET`

Maple will compute exactly what you ask! In `3t*a` the initial 3 will multiply the product of the variables *t* and *a*. `3ta` is interpreted as a request to multiply the variable *ta* by 3.

Braces or curly brackets, { and }, are used to create a list of variables for the *subs* command. Please try to predict what the result of the following will be **before** hitting **RET**:

`subs({a=t,b=t^2,c=t^3},a*b^2*c^3) RET`

Maple can solve some equations. Try

`solve(x^3=7x+1,x) RET`

and

`solve({a*b+3=2,a+b=0}) RET`

followed by

`solve({a*b+3=2,a+b=1}) RET`

and I don't know why there's such a difference in the answer (hey, **Maple** will tell you the roots of quadratics using the quadratic formula – just ask it). You could always try *help(solve)* which brings up a huge amount of information, and probably the reason for the difference is explained there somewhere!

Maple will also find approximate numerical solutions. You could explore the difference in the answers to the command

`solve(x^7-x^2+1); RET`

(**Maple** assumes you mean to ask for a root of the equation obtained by setting the expression $x^7 - x + 1$ equal to 0) and the command

`fsolve(x^7-x^2+1); RET`

which gives an approximate numerical solution.

Let's go on to calculus.

Part III: playing with calculus on Maple

The basic calculus commands do differentiation and integration. Let's try them.

```
diff(3x^7 - 22.1x^2,x) RET
```

```
int(x*sqrt(x+2),x) RET
```

This integration is not easy: **Maple** either substituted or it integrated by parts (it can do both). Typing the `*` explicitly forces **Maple** to recognize variables. I've done some "experiments" and the results suggest that writing `*`'s rather than having **Maple** guess leads to fewer misunderstandings.

Maple likely knows all the functions you do, and many others. The function $\sin(x^2\sqrt{x+1})$ and the calculus rules are known. Let's assign this expression a name and then play.

```
Q:=sin(x^2 * sqrt(x+1)) RET
```

```
diff(Q,x) RET
```

This should get the first derivative. How many ways can you think of to get the second derivative? First, immediately after the command and response above, type

```
diff(% ,x) RET
```

This will do it. For an independent computation, try the command line

```
diff(Q,x,x) RET
```

How about the tenth derivative? First type

```
x$10 RET
```

to see what `$` means. Now you can find the tenth derivative of the function $\sin(x^2\sqrt{x+1})$.

Realize (even if the tenth derivative of this function is needed) why people end commands with `:` (which turns off the output) rather than displaying the output. You may want the results of a computation, but you may not have the need or desire to actually look at it!

What is the coefficient of x^3 in the seventh derivative of $(x^2 + \frac{1}{x^2})^5$? First compute the indicated derivative. You'll get a mess. Then have **Maple** massage the result algebraically so you can read off the answer. I'm an amateur and first tried `expand(%)` and I also tried `simplify(%)` and the results were different. Another way is to first `expand(x^2 + 1/x^2)^5` and then differentiate the result seven times. The answer should be the same!

Let's look at integration a bit more closely. Define V to be $e^{\sin x}$:

```
V:=exp(sin(x)) RET
```

Now let's integrate it. First (try this carefully!) type

```
int(V,w) RET
```

and explain the result to yourself. Remember, a program will do what you tell it to do! Now try

```
int(V,x) RET
```

and you may wait a bit and then have something else to explain. **Maple** has the usual integration algorithms and many, many other antidifferentiation tricks. An answer like this is a fairly good hint that it "can't be done": that is, the antiderivative can't be expressed in terms of familiar functions with familiar ways of combining them, including sum, product, composition, . . . even using the rather large collection of functions known to **Maple**. Such results can be proved!

We can also compute definite integrals. For example,

```
int(x^3,x=1/7..b) RET
```

computes $\int_{\frac{1}{7}}^b x^3 dx$ (if you want it!). **Maple** indicates a range (for integration and for other purposes) by the notation *variable=lower_limit..upper_limit*.

Remember V ? Be sure **Maple** does (check by typing V) and compute $\int_0^1 e^{\sin x} dx$ by typing
`int(V,x=0..1) RET`

and consider the result. Disappointment is decreased if we follow that answer with
`evalf(%); RET`

You can evaluate V itself with a command like

`subs({x=3},V) RET`

followed by

`evalf(%); RET`

If you're not scared, you could have done this all together by typing

`evalf(subs({x=3},V)) RET`

but sometimes I get confused by the matching required (in count and type) of all the parentheses. We could similarly evaluate a derivative of V by differentiating with *diff*, *substituting*, and then *evaluating*. Or we could define our own functions. Initially the syntax may seem burdensome, but here is a simple example.

`N:=x->arctan(x^3) RET`

So: call N the function which takes the input x and assigns to it $\arctan(x^3)$. Try this

`N(2);N(5*z) RET`

which shows that **Maple** believes N is a function. Now type

`diff(N(x),x); RET`

That's an **expression** and not a function. There's no way to "plug in" $K + 3$ easily in it (yes, we could use the *subs* command, but that's cumbersome). So **Maple** has another way to differentiate functions (such as N) rather than expressions (such as V). Try

`D(N); RET`

and view the result. Indeed: call it by a new name, say, M :

`M:=D(N); RET`

Now evaluate $M(3)$ and $M(K + 3)$.

Please check the difference between

`int(N(x),x); RET`

and

`int(N,x); RET`

One of these has an answer that's fun to me (because I didn't have to compute it and can appreciate the work involved!) and the other seems silly: the function N hasn't been told what to evaluate, so it can't be antidifferentiated.

The difference between "expressions" like V and "functions" like N can be subtle. Expressions seem more static, while functions have a more dynamic aspect – substituting is built into their structure.

Maple also knows about such calculus topics as limits, sums, and series. If you need to work with any of these, look at *help(limit)* and *help(sum)* and *help(series)*. I almost always look at the examples first. Don't be afraid to experiment, and look at the *help* pages if the command you are investigating doesn't do exactly what you want.

It's time to graph.

Part IV: playing with graphs on Maple

The graphing capabilities of Maple explored here will probably seem rather familiar to you after your experience with graphing calculators and possibly other programs or devices. I won't discuss polar plots or parametric plots – but even those are generally available on hand-held calculators now. Maple draws lovely pictures with three-dimensional plots. This capacity will be used extensively later in this course.

Let's begin with the simple command

```
plot(x^3-6*x+1) RET
```

After the program responds, move back and alter your command to read

```
plot(x^3-6*x+1,x) RET
```

Now a graph should appear.

There are some things to notice. For this kind of plot, the “default” interval for x (what Maple assumes unless advised otherwise) is $[-10, 10]$. Maybe this is o.k. for you (suggestion: try graphing $\frac{1}{\sqrt{x^2 - 100}}$ and see what happens) but you may want more control. The `plot` command has many options. Read about them during the first free week you have by typing `help(plot)` and following all the references!

Let's look at the graph we have. By the way, when I am graphing, I tend to foul things up a great deal and I frequently end up with 5 or 10 graphs sitting around at the same time. Try to be neat. You can get rid of those graphs you don't want by (mouse) clicking on the plot and then invoking **Cut**. Of course, if they hang around until you *quit* Maple entirely, the graphs will then disappear also. But you can try to decrease your own confusion.

Again, look at the graph. Note that the vertical and horizontal axes are very differently scaled. But Maple is trained to “autoscale” so it will **distort** the picture to fill the rectangular screen. I wrote that word in a large and bold font because it's something that has repeatedly caused me confusion. Now go to the graph, right click, and click on **Scaling Constrained** and that's the way it really looks, darn it: a very, very thin graph.

Let's draw another graph.

```
plot(sin(100/x),x=.1..1) RET
```

This graph is attempting to illustrate some well-known misbehavior since $\lim_{x \rightarrow 0^+} \sin(\frac{100}{x})$ doesn't exist. The graph should bounce around a lot when x is close to 0. It certainly seems to, but notice (by pure thought: the Intermediate Value Theorem) that between each root or x -intercept of the function, there must alternately be a place where the function is $+1$ and where the function is -1 . The graph doesn't show that! (Look carefully, please.) Maple doesn't think. It plots points and connects the dots to produce the graph. The default performance is fairly simple-minded (more sophisticated alternatives can be specified) and the plotted points can be seen by clicking on **Style** and then on **Point** – you'll see just the computed points on the curve with no connections drawn. If you increase the number of points to be plotted, you will probably get a better picture, but computation time for the graph's creation increases.

Here's another type of bad picture. Please look closely at the graph resulting from

```
plot(1/(10^3*x),x=-1..1) RET
```

and you can try to determine the range of the function based only on the appearance of the graph. The range, deduced from the displayed graph, seems to be approximately the

interval $[-1, 2.5]$. Of course this is incorrect. I know that $\frac{1}{10^{3x}}$ on $[-1, 1]$ is not defined at 0 and is also unbounded both positively and negatively. So **Maple** may have difficulty graphing functions with discontinuities. Some of the options for *plot* may be useful. The *help* screen for *plot* is long and has many entries.

By the way, any of the programs (**Mathematica**, **Maple**, graphing calculators, etc.) can be “spoofed” and made to draw bad graphs. Devices with finite memories can hardly imitate all aspects of the real numbers accurately.

Try the command (but you may want to guess the result before completing the input):

```
plot({x^2,x^3},x=4..5) RET
```

Therefore you can plot collections of functions, certainly useful sometimes.

Define your own function and plot it: try to define $P(w) = \frac{e^w}{1+w^2}$ and then remember that **Maple** finds the derivative function of P with the character string $D(P)$. Try this:

```
plot({P(t),D(P)(t)},t=-2..5) RET
```

As long as the variable (here t) is used consistently, **Maple** will have no difficulty. Compare the two graphs. Where $D(P)$ is 0 then P must have a horizontal tangent. What happens to the graph of P when the graph of $D(P)$ has a maximum?

We can graph curves implicitly defined by equations. For example, try

```
implicitplot(x^3-5x*y^2=7,x=-5..5,y=-5..5)
```

and notice the result: nothing happens! Well, **Maple** is such a huge program that most of it is stored “asleep”, and these parts must be specifically recalled to active memory. In this case, we need to load the routines in the *plots* package. This is done with the command

```
with(plots)
```

Now after you have loaded the *plots* package, please try again

```
implicitplot(x^3-5x*y^2=7,x=-5..5,y=-5..5)
```

the result should be a nice picture. Implicit curve plotting is very difficult and due to problems with discontinuities frequently may give pictures which are untrue. Look at

```
implicitplot(x^3-5x*y^2=7,x=-50..50,y=-50..50)
```

which asks for the same algebraic curve in a 100×100 window. The result seems to have some corners and wiggles which I doubt are correct. Here also some of the options which can be seen with *help(implicitplot)* may be useful.

Let’s conclude by attempting to locate a root.

```
plot(x*ln(x)-sin(x),x=0..3) RET
```

This function seems to have a root. Right click on this graph and then investigate the **Manipulator**. The capabilities of **Point probe**, **Scale**, and **Pan** work very much like “zooming” and “tracing” with a graphing calculator. I can easily find an approximate location of the root (about 1.77, I think).

We can check the picture with a numerical computation:

```
fsolve(x*ln(x)-sin(x),x) RET
```

reports 1.75267781, fairly close to where the root can be located graphically. You can, of course, read about *fsolve* with the *help* command.

Continue to explore, please. And thank you for working through this.

You’ll need the command

```
assume(A,RealRange(0,infinity)); RET
```

which advises **Maple** that A is indeed positive. You can, of course, read about *assume* in the standard *help* way.

Question to test your Maple skill

I wanted to put the following question on a final examination for a large calculus course but a few sane human beings stopped me.

- a) Suppose A is a positive constant. Compute $\int_0^{\infty} (\sin Ax) e^{-x} dx$.
- b) For which value of A is the integral largest? What is the value of that largest integral?

Of course I was composing all of my exams on a computer, and I always had a **Maple** window open. I was dazed by the computational power so easily available. Luckily I was restrained. But can you answer my question **without** using anything other than **Maple**? So no paper computations are allowed. I'd suggest *restarting* first. Then compute the integral. Get a formula. Differentiate it with respect to A and set the result equal to 0 to get a maximum, etc.

Good luck, and thanks for reading with me. I hope you enjoyed this.

The Maple 10 GUI compared to the command line version and older editions of Maple

xmaple gives a graphical user interface (GUI) to the Maple program. Maple can also be used by typing *maple* at any command line. Then the commands and responses are all in ASCII characters. The plotting commands have limited responses, of course. Everyone at some time may need to use the command line version. Good displays may not be available, or there may be limited bandwidth between the user and the CPU. Images usually take many more bits than characters.

The major difference is that commands in the GUI need not end with a semicolon to be executed. This is very important, and can be rather frustrating to the naive user of the command line interface! Just typing $3+2$ gets no response. Commands *must* end with a semicolon to be executed.

Another significant difference affects Maple names indirectly. A Maple help page states:

A **name** in its simplest form is a letter followed by zero or more letters, digits, and underscore characters, with lowercase and uppercase letters distinct.

Example The input is $3x$ **RET** (here **RET** means “Hit the enter key”).

Maple 10’s GUI response

$3 \cdot x$ is displayed, and the system interprets this as 3 multiplied by x .

Command line version’s response

Both $3x$ and $3x;$ get

syntax error, missing operator or ` ; ` :

and the program does nothing further.

The GUI allows some implied use of $*$. The GUI response to the string $\text{int}(x^2 \downarrow \sin(x), x)$ (here \downarrow means the down arrow key) is the correct antiderivative. But $\text{int}(x^2 \downarrow 3\sin(x), x)$ gets **Error, missing operation** and $\text{diff}(x * 3\sin(x), x)$ does not get the correct response: the string $3\sin(x)$ is not differentiated at all, even though the command $\text{diff}(3\sin(x), x)$ is interpreted correctly! As a casual user, this seems an annoying inconsistency. I recommend that students type $*$ whenever they want to indicate multiplication.

Output differences

I’ve used $>2^{(2^{(2^{(2^2)})})}$; to show why a displayed result may not be useful (that is, using $:$ rather than $;$). The command line interface (on a fast enough computer!) will show all 19,729 decimal digits of the result. The GUI response is interesting. It gives the initial 100 digits, then the character string $\dots 19529 \text{ digits} \dots$ and then the last 100 digits. Since $19,729 = 100 + 19,529 + 100$, things are o.k., but I found the difference a bit startling¹ 10^{9999} displays entirely, but 10^{10^4} does not..

Another output difference occurs if we ask for $\text{int}(\text{diff}(\arctan(x^3), x^3), x)$; which takes a bit of work. The same answer is shown but in the command line interface, Maple abbreviates certain common algebraic pieces of the answer, using %1 and %2. The GUI answer does not bother. Just as in the previous case, this probably can be adjusted by tweaking some preset display parameters, but the defaults are different.