

Project 2: Variables

Let us begin anew; in the [file] menu click [New]. Derive has variables and we can assign values to these variables. What does that mean? Look at the following. Suppose we have done a calculation and end up with an answer of 1.99964578. Now, we wish to do a few calculations with this number. We can do the following in the input box.

a:=1.99964578

Hitting the **enter** button produces the following in the main box.

#1: a := 1.99964578

Suppose we wish to add 3 to 1.99964578. Typing

a+3

in the input box and hitting **enter** produces

#2: a+3

in the main box. Clicking the \surd symbol (to the left of the input box) produces

#3: a+3

#4:
$$\frac{249982289}{50000000}$$

which is perfectly correct, though some may not find it as illuminating as they were hoping.

Clicking the \simeq symbol produces

#5: a+3

#6: 4.999645780

The difference is just that the last answer is just the decimal equivalent to the previous answer. If you want a decimal expression, then the \simeq symbol is the one to click.

Likewise, to square the result of adding 4 to 1.99964578.

$(a + 4)^2$

#7: $(a + 4)^2$

#8: 35.99574949

Here is another example of what we can do.

base:=3.1

and **enter**

```
#9: base:=3.1
```

```
height:=2.5
```

and enter

```
#10: height:=2.5
```

```
hypot:=sqrt(base^2+height^2)
```

followed by \checkmark gives

```
#11: hypot := sqrt(base^2 + height^2)
```

```
#12:                                     3.982461550
```

This computes the length of the hypotenuse of a right triangle which has a base of length 3.1 and height of 2.5.

If we want to try a new value for the base, we just rewrite the line.

```
base:=2.1
```

```
#13: base := 2.1
```

Then we want to recompute line #11, (**Careful**, your line number may be different) so we enter the line number #11. (You will enter whatever line number is appropriate for you.)

```
#11
```

and click on \checkmark . We see

```
#14: hypot:=sqrt(base^2+height^2)
```

```
#15:                                     3.264965543
```

and the “hypot” is recomputed.

Later in the course we will find ourselves in the situation where `base` and `height` will be functions of x , and we will be thinking of `hypot` as the function of x formed by composition.

For example, suppose

$$\text{base} = x + 3 \quad \text{and} \quad \text{height} = 2x.$$

Derive will quickly find the composition for us as follows.

```
base:=x+3
```

followed by Enter. #16: base : = x + 3

```
height:=2x
```

followed by Enter. #17: base : = 2 x

Then reevaluate `hypot` as before (**Again**, note that the line number you use might not be #11).

```
#11
```

```
#18: hypot := sqrt(base^2 + height^2)
```

```
#19: hypot := sqrt(5 * x^2 + 6 * x + 9)
```

Set $x = 3$,

```
x:=3
```

followed by enter.

```
#20: x:=3
```

Evaluate `hypot` again

```
#11
```

using \checkmark .

```
#21: hypot := sqrt(base^2 + height^2)
```

```
#22: 8.485281374
```

Factoring and Multiplying

While we are getting Derive to do useful algebraic type stuff for us let's try the following.

```
(x - 5)(x + 3)
```

(and Enter), producing

```
#23: (x-5) (x+3)
```

Now, go to the drop-down menu labelled *simplify* on the top menu row, and click on *expand*. You get a new window. In that window click the *expand* button on the bottom. You should see

#24: $x^2 - 2 \cdot x - 15$

Go back to the *simplify* menu and click on *factor*, which opens a new window. In that window click the *factor* button on the bottom. You should see

#25: $(x-5)(x+3)$

NOW, we check the following out. Enter

$x^3 + 4x^2 + x - 6$

Enter.

#26: $x^3 + 4 \cdot x^2 + x - 6$

Now factor this (*simplify* menu, click on *factor*; new window, click the *factor* button).

You should see

#27: $(x - 1) \cdot (x + 2) \cdot (x + 3)$

The process can be reversed with the expansion process we used earlier. On the *simplify* drop-down menu we click on *expand*, and in the new window we click the *expand* button, again, getting

#28: $x^3 + 4x^2 + x - 6$

Graphing/Plotting

We now move to graphing. Let's begin with a tame and predictable function. The correct way to enter functions is the following. Notice, we use function notation on the left. By function notation I mean the x inside the parentheses, like $f(x)$.

$$f(x) := 2x^3 + 6x^2 - 4$$


An **Enter**, gives us

$$\#29: \quad f(x) := 2x^3 + 6x^2 - 4$$





To plot f there are three steps.

1) With the mouse, highlight the equation $f := 2x^3 + 6x^2 - 4$ in the display window. (If you are following the steps carefully here, the equation is already highlighted, in this case.)

2) click on the menu (top right) 2-dim plot button  (a new window will pop up)

3) In the **new** window's menu (also up top) click on the (new) 2-dim plot button .

The graph should appear.

We can change the appearance of the graph by changing the range of the x -axis and the y -axis displayed in the graphing window. This is also done using the menu. It can be done automatically by clicking on the buttons which look like , , , , etc..

The advantage of the automatic method of changing the range is that it is quick. However, sometimes it doesn't give you precisely what you want. There are several methods to specify precisely where the window should begin and end in the x direction and the y direction. One method is to click the **Set** button on the top menu line. A window will open with the current minimum and maximum values for the x and y directions of the graphing window (and the number of tick marks), which you can now change.