

PHY 122 Mathematical Techniques 2

Hints and Help for Mathematica

The **Mathematica Documentation Center** contains useful information on the mathematical operations that you can perform and on the commands that Mathematica uses to perform these. Don't be scared to use it - in fact the **Documentation Center** should be one of the first places that you call at when you encounter a problem or are unsure of how to correctly use a command or are unsure of the command at all!

One of the easiest ways to use **Documentation Center** is to use its search function. Here you can search for keywords. For example if you wanted to know about the **Simplify** command, then searching for *Simplify* will get you straightforwardly to the correct place. Searching for *integration* will bring you to a list of articles on the topic of integration. If you want to know about how to treat vectors in Mathematica then searching for *vector* will give you a long list of things related to vectors, from which you can choose the appropriate information.

Sometimes it is helpful to be more general with your search by searching for a general area. For example vectors often come under the general area of *linear algebra*, so searching for *linear algebra*, or *linearalgebra*, or just *linear* or *algebra* will take you to many relevant pages, from which you may select the relevant information. Similarly, there is a package called **VectorAnalysis**, which you will learn about later in the course, which helps with the implementation of many aspects of vector analysis such as *div*, *grad* and *curl*. Searching for *vector analysis* will bring you to a list of articles including the Vector Analysis Package Guide which contains a list of all the commands that are specific to it. You may then select a command to help you figure out what's going on.

If you can't remember a command, then it is sometimes helpful to guess what it might be and search for your guess! The commands are often intuitive! For example, the command that is used to Integrate expressions is the **Integrate** command. Searching for these or similar things will take you to many relevant pages where you can then find out the details of how to implement the commands such as the arguments that they take, types of brackets etc.

It is often much more useful to look at the EXAMPLES given in the help files rather than the explanations of how they work. Look for examples which resemble or seem related to the question at hand. The explanations may then clarify points of confusion.

- Mathematica will complain a lot if you use the wrong type or number of brackets. The default are rounded ones () in mathematical expressions like $2*(3+4)$, and square ones for all Mathematica functions, for example **Sin[x]**. For lists, vectors and matrices curly ones { } are used, and double square brackets are used to extract specific elements of vectors and matrices, for example **vec[[3]]** gives you the third or z component of the vector **vec**. You shouldn't use these 'exceptional' brackets in normal mathematical expressions however!
- **Simplify** and the more powerful **FullSimplify** are useful commands if your expression is large and ugly, or if it should look like something else but doesn't appear to. When applying these commands to vectors or matrices Mathematica automatically simplifies each component of the vector or matrix expression in turn as appropriate.
- When we write mathematical expressions on paper we usually omit the multiplication sign \times . In Mathematica, multiplication is via the ***** symbol or simply a space between two expressions. For example $2a$ can be input as **2*a**, **OR** as **2 a**. However, make sure to leave a space between the two expressions to be multiplied.