Maple Funsheet 1

**Directions:** Work in MAPLE. This worksheet is just to get you somewhat familiar with the basics of MAPLE. By the end of the day on Monday, January 20, e-mail me and all of your group members your MAPLE worksheet as an attachment with all output deleted. I will return my comments by replying. Please turn in a group worksheet, but be sure to enter all group members’ names at the beginning. Also, I do not want to see all of your scratch work: turn in as clean a MAPLE file as possible. (I do want to see your commands, though.) Text comments are helpful; there is a “T” button at the top of the screen you can click to give you a comment line.

Work together on each problem; do not delegate different problems to different people.

You will need the `with(plots):` and `with(VectorCalculus):` commands for these exercises. Note that many commands and examples are available on my webpage. You should also make liberal use of the MAPLE help system as needed.

Here are just a few tips to get you started.

1. Maple has a couple of different formats for entering and viewing things. I find the default format very hard to work with, so I recommend the following:
   (a) Click on Tools, then Options
   (b) Click the Display tab. Select “Maple Notation” on the “Input display” drop-down menu.
   (c) Click the Interface tab. Select “Worksheet” in the “Default format for new worksheets” drop-down menu.
   (d) Click “Apply Globally.”
   (e) Click on File, then New, then Worksheet Mode. You should now be ready to start.

2. To load the `plots` and `VectorCalculus` packages, enter the commands
   
   ```maple
   with(plots): with(VectorCalculus):
   ```
   
   You can also use semicolons instead of colons, and Maple will give you a list of the commands in each package. (Note that multiple commands can be entered on the same line as long as the colons or semicolons are where they belong.)

3. If a command gives you an error, you do not need to retype it. You can use the arrow keys or your mouse to go up to where you gave the command and just edit it there. Once you are finished, you can just hit <enter>; you do not need to go to the end of the line.

4. The `%` symbol works like the ANS button on your TI calculator. It represents the last output from Maple. Note that this is not necessarily from the line right above where you use the `%` symbol.

5. It is very helpful to assign names to quantities so you can refer to them later. For example, in Exercise 1(a) below, I would assign the names `u` and `v` to the two vectors. This is done with `a := (“colon equal”)` rather than just `=` (“equal”) as follows:
   ```maple
   u:=<2,4,-3>;v:=-<1,3,2>;
   ```
   Now for the problems below you can substitute `u` and `v` as needed rather than retyping the whole vector.

6. Most commands require “arguments,” which usually follow the command and are enclosed in parentheses. For example, the `evalf` command gives a decimal approximation of its argument. If you want an approximation of π/2, enter
   ```maple
   evalf(π/2);
   ```
   Here, the π/2 is the argument of the `evalf` command. Many commands require more than one argument; use Maple’s help to see what arguments are needed and in what order they should come.

7. Here is a good rule of thumb: if you have to have certain information to do something by hand, Maple needs that information too. For example, if you want to graph a function, you need to know what the function is and what scale you want on your axes. Maple must also have this information, so you would tell Maple, for example,
plot(x^2, x=-5..5)

to have Maple graph \( x^2 \) with \( x \) ranging from \(-5\) to 5. (Notice that we use a carat (shift-6) to indicate an exponent.) You can also specify the range for \( y \) after the range for \( x \); if you do not, Maple will choose one automatically.

8. Watch very carefully what you type! Maple is case-sensitive, so if a command has a capital letter, make sure you enter it that way. Multiplication requires an asterisk (*) between the factors, like \( 2 \times x \) for \( 2x \). Delimiters (parenthesis, brackets, etc.) are also important, but it is very easy to forget the right delimiter if the expression enclosed is very long.

9. Finally, remember that Maple is here to do computations for you. You must still know how to do things by hand in order to know what to tell Maple to do (and also to pass exams!). You don’t necessarily have to find a “length” command for 1(e) below; you can put together what you know of computing a vector’s length by hand with how to perform the same operations using Maple.

**Maple Exercises**

1. Let \( u = \langle 2, 4, -3 \rangle \) and \( v = \langle -1, 3, 2 \rangle \).

   (a) Use Maple to compute \( 3u - 2v \). Remember that Maple requires an asterisk (*) to indicate multiplication. If you forget it, strange things will happen!

   (b) The \texttt{arrow} command works as follows:

   \[
   \texttt{arrow}(<1, 2, 3>, <3, 4, 5>);
   \]

   draws an arrow from \((1, 2, 3)\) to \((3, 4, 5)\). (Note that these are not the vectors you were given.) To draw an arrow from the origin, you may simply omit the first vector. You can also use a vector’s name if you have given it one (like \( v := <3, 4, 5> \)). Use Maple’s help to play with the display options for the arrow until it looks like you want it to. To draw different arrows from the same initial point, enclose the set of ending points in curly braces. For example:

   \[
   \texttt{arrow}(<1, 2, 3>, \{<1, 7, 5>, <2, 4, 1>\});
   \]

   (c) Now draw \( u \), \( v \), and \( u + v \) in a way that illustrates the parallelogram law (\( u \), \( v \), and \( u + v \) along with copies of \( u \) and \( v \) to form a parallelogram).

   (d) Draw \( u \), \( 2u \), and \( -3u \) on one set of axes.

   (e) Use a period (.) between two vectors to compute a dot product in MAPLE: \( u \cdot v \); Use the dot product in Maple to find the length of \( u \). Then find a unit vector in the direction of \( u \). [Hint: what scalar multiple of \( u \) has length 1?]

   (f) Use MAPLE to find the angle between \( u \) and \( v \). Use the \texttt{evalf} command to find a decimal approximation: \texttt{evalf(whatever)};

   (g) We will discuss the \textbf{cross product} in Section 12.4. We will see that \( u \times v \) is perpendicular to both \( u \) and \( v \). To compute \( u \times v \) in Maple, enter \( u \&x v \); – note that you need a space between the \( x \) and the \( v \). Use the cross product to find a vector perpendicular to both \( u \) and \( v \) and graph it with those two vectors.