Maple Funsheet 2: Vector Operations and Parametric Curves

**Directions:** Work in MAPLE. By the end of the day on Monday, January 27, one group member should e-mail me and all other group members your group’s 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.

**Maple Exercises**

1. Let $u = <2, 4, -3>$ and $v = <-1, 3, 2>.$
   
   (a) Use Maple to compute $u \times v$.
   
   (b) Verify that $u$ and $v$ are both orthogonal to $u \times v$.
   
   (c) Find the area of the parallelogram determined by $u$ and $v$.

2. Find the volume of the parallelepiped determined by $u = <1, 1, 5>, v = <-2, 4>,$ and $w = <3, 1, -1>$.

3. To plot parametric curves in Maple, use the regular plot command with modifications as shown:

   ```maple
   plot([f(t), g(t), t=a..b]);
   plot3d([f(t), g(t), h(t)], t=a..b, s=0..1);
   ```

   for 2D and 3D parametric plots, respectively. (The s=0..1 is a dummy parameter because Maple expects two parameters in plot3d.) Plot the parametric curves shown below.

   (a) $x = t^2, y = 3t + 1$
   
   (b) $x = \cos t, y = \sin t$ and $x = 2\cos(t), y = 2\sin(t)$ on the same set of axes. **plot**(\{[stuff],[stuff2]\));
   
   (Note the curly braces.)
   
   (c) $x = 2t, y = t^2 + 1, z = t^3$ (include the optional argument axes=boxed.)

4. Plot the parametric curves below.

   (a) $x = t, y = 2t$
   
   (b) $x = t, y = 2t + 1$
   
   (c) $x = t + 3, y = 5t - 2$
   
   (d) $x = -3t + 1, y = 4t - 5$
   
   (e) $x = 3t, y = 2t - 2, z = t + 4$

   On a text line (Ctrl-T), describe the kind of curves these are. In general, what geometrical object is a parametric curve of the form $x = at + b, y = ct + d$? What if we also include $z = et + f$?

5. Put together a few interesting functions to make a cool parametric curve. Just play around with this for a few minutes and only turn in your favorite.