Maple Questions

Here are some sample Maple assessment questions for this chapter.

1. Create a worksheet which allows a user to supply a list of points and a list of vectors associated with those points.

2. Allow a user to supply the parameterization $\mathbf{r}(t) = \langle x(t), y(t) \rangle$, t in $[a, b]$, of a simple closed curve C that contains the origin. Create a worksheet which uses Green's theorem to convert a line integral over C into a double integral over the region that is the image of $[0, 1] \times [a, b]$ in the uv-plane under the transformtion $T(u, v) = \langle u\, x(v), u\, y(v) \rangle$. Maple should then evaluate that integral.

3. Allow a user to supply a curve C on a surface by supplying the parameterization $\mathbf{r}(u, v)$ and the coordinate functions $u(t)$ and $v(t)$. Also allow the user to supply a vectorfield $\mathbf{F}(x, y, z)$. Express the arclength integral in terms of the fundamental form of the surface. Then express the work integral in terms of the fundamental form. Illustrate both types of integrals.

4. Create a worksheet which uses the **dsolve** command to construct the flow of a 2-dimensional vector field. The worksheet should also plot the vector field and its flow together.

5. Use Maple to show that $div(curl(\mathbf{F})) = 0$. That is, if $\mathbf{E}(x, y, z) = curl(\mathbf{F}(x, y, z))$, then $div(\mathbf{E}) = 0$. Is the converse also true? That is, if $\mathbf{E}(x, y, z)$ is a vector field such that $div(\mathbf{E}) = 0$, then is there a vector field $\mathbf{F}(x, y, z)$ such that $\mathbf{E} = curl(\mathbf{F})$. Under what conditions? How would you use Stoke's theorem to answer this question? Use Maple to explore this idea and to illustrate it in whatever fashion you find most suitable.