Math 303, Worksheet #14 **Name:** ______________________________
Fall 2008

You will be using commands from the plots and plottools packages, so you should start your Maple file with the line:

with(plots):with(plottools):

1. Consider the vector field $\vec{F}(x, y) = 4y\vec{\imath} - x\vec{\jmath}$.

a. Use Maple to graph this vector field.

b. Write down the associated system of differential equations.

c. Check that $\vec{r}(t) = 2\sin(2t)\vec{\imath} + \cos(2t)\vec{\jmath}$ is a flow curve by showing that it satisfies the system of differential equations.

d. Use Maple to graph $\vec{r}(t)$ and compare this graph to the vector field.

e. You can get Maple to superimpose a graph onto a vector field by doing the following:

(**i**) Assign the variable a to be the graph of the vector field by typing:
a:=fieldplot([v1,v2],x=a..b,y=c..d)

(**ii**) Assign the variable b to be the graph of the parameterized curve by typing:
b:=plot([f(t),g(t), t=r..s],x=a..b,y=c..d)
Note: your limits for x and y should be the same for both graphs.

(**iii**) Now display both graphs together by typing:
display(a,b)

Use this process to create a graph of the vector field $\vec{F}$ and the flow curve $\vec{r}(t)$ above.

f. Find a formula for the flow curve passing through the point $(1, 0)$, then use Maple to graph this curve together with the vector field and the other flow curve.

2. Consider the vector field $\vec{F}(x, y) = x\vec{\imath} - y\vec{\jmath}$.

a. Use Maple to graph this vector field.

b. From looking at your Maple graph, sketch the flow curve that passes through (1,1), and the flow curve that passes through $(-1, 1)$.

c. Suppose $\vec{r}(t) = x(t)\vec{\imath} + y(t)\vec{\jmath}$ is a flow line for $\vec{F}(x, y)$. Write down the associated system of differential equations.

d. Find a formula for the flow curve that passes through the point $(1, 1)$. Don't be afraid to ask if you get stuck!

e. Find a formula for the flow curve that passes through the point $(-1, 1)$.

f. Use Maple to graph each of your flow curves along with the vector field. Do these graphs look familiar?

g. Find a formula for general solution.