

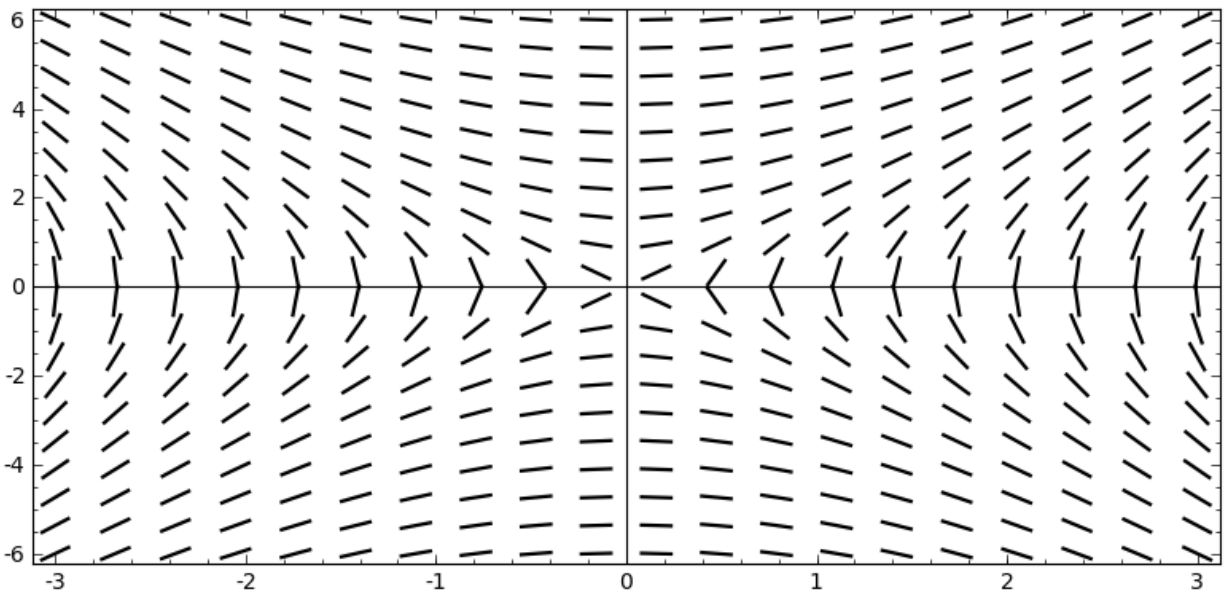
DF-examples

Dr.F.G. Garvan

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Contents

```
## Ex 1.3
## Problem 2
var('x,y')
df=plot_slope_field(4*x/y,(x,-3,3),(y,-6,6))
show(df)
(x, y)
```



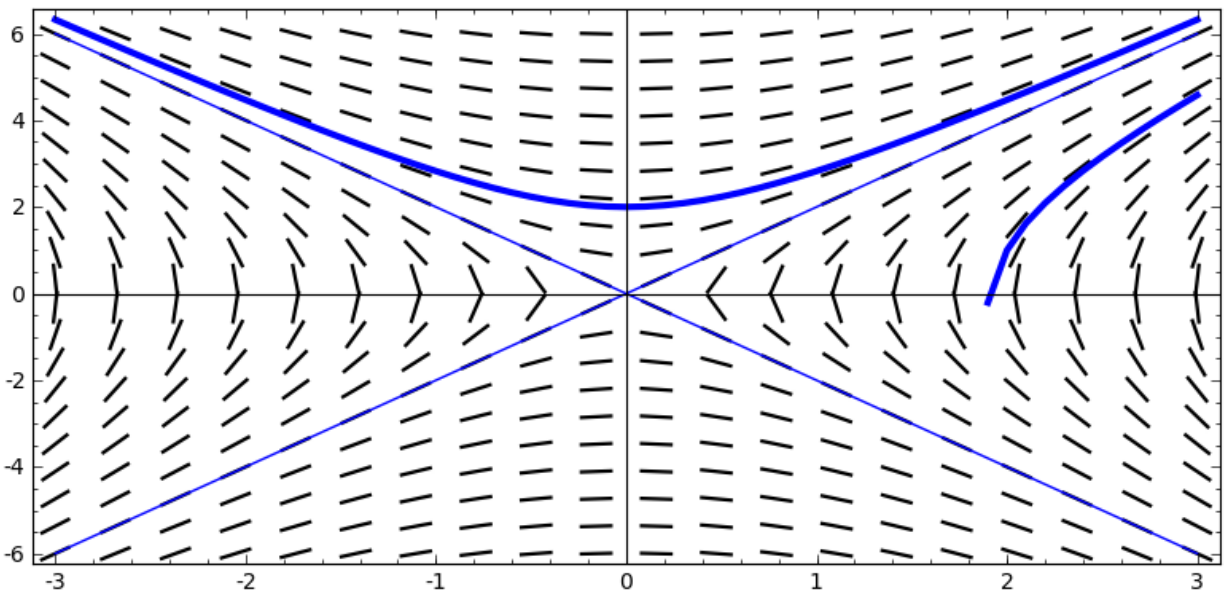
```
# NOTE: Above we produced the direction field plot of the DE
# dy/dx = 4x/y
# for -3 < x < 3, -6 < y < 6.
# In general the syntax for producing the direction field plot of the DE
# dy/dx = f(x,y)
# for a < x < b, c < y < d is
# plot_slope_field(f(x,y), (x,a,b), (y,c,d))
#
```

```
P1=plot(2*x,(x,-3,3))
```

```
P2=plot(-2*x,(x,-3,3))
```

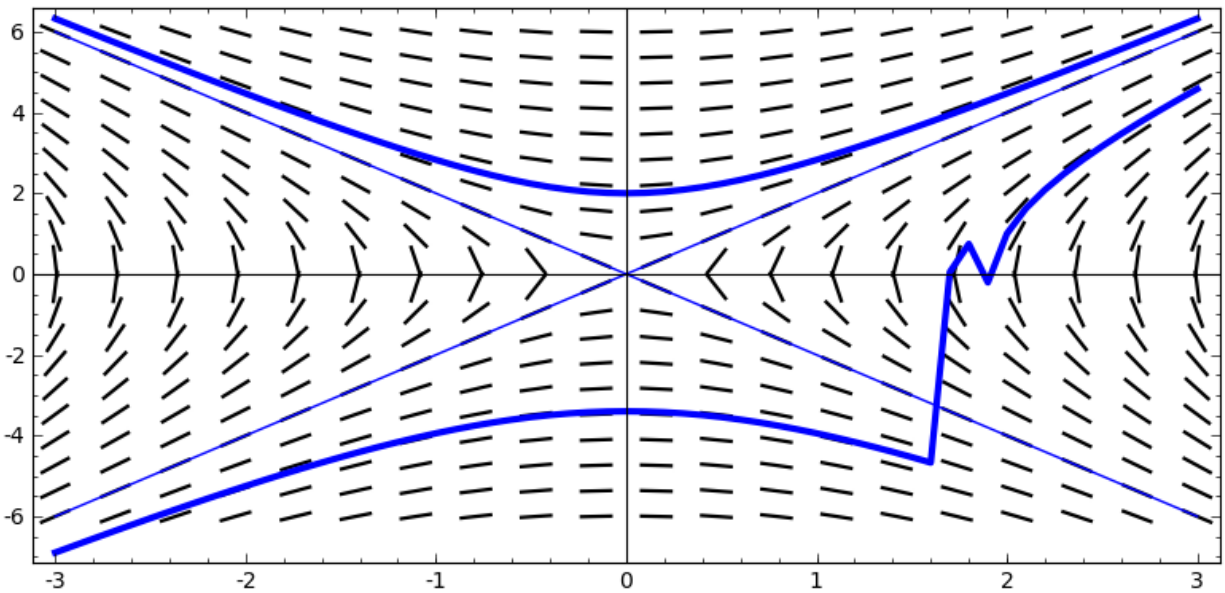
```
# These commands were used to produce the plot of y=2x and y=-2x.
# In general to plot y=f(x) for a < x < b use
# plot(f(x),(x,a,b))
```

```
x,y=var('x y')
PB=desolve_rk4(4*x/y,y,ics=[0,2],ivar=x,output='plot',end_points=[-3,3],\
    thickness=3)
PC=desolve_rk4(4*x/y,y,ics=[2,1],ivar=x,output='plot',end_points=[1.9,3],\
    thickness=3)
show(df+PB+PC+P1+P2)
```



```
# PB corresponds the plot of the solution of the IVP dy/dx=4x/y \
    satisfying y(0)=2
# PC corresponds the plot of the solution of the IVP dy/dx=4x/y \
    satisfying y(2)=1
# In general to plot numerically a solution to the IVP dy/dx=f(x,y), y(x0\
    )=y0 for a < x < b use
#
# desolve_rk4(f(x,y),y,ics=[x0,y0],ivar=x,output='plot',end_points=[a,b],\
    thickness=3)
#
# Here y is the dependent variable and x is the independent variable.
# NOTE: Use something like show(plot1+plot2+plot3) to plot multiple \
    graphs on one diagram.
#
# It is clear that in our example we can not have y=0 so a solution \
    satisfying y(2)=1 can
# not have two small an x-value. Look what happens when we try to plot a \
    solution satisfying -3 < x < 3.
```

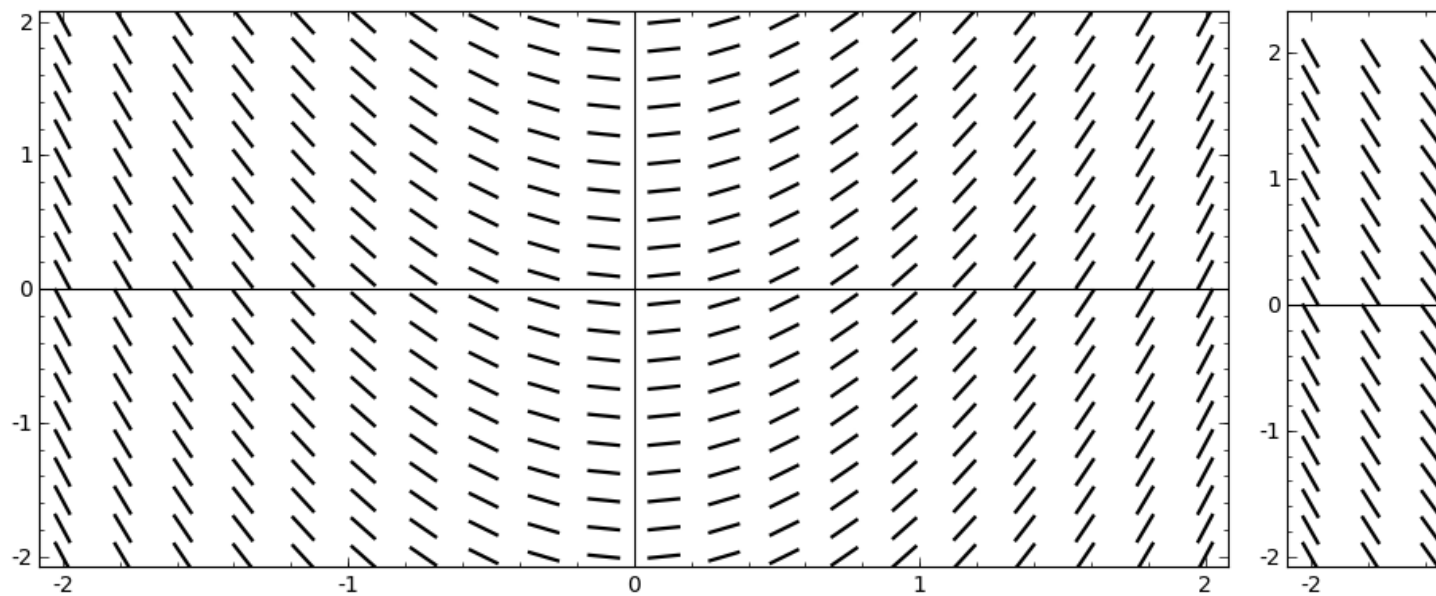
```
PD=desolve_rk4(4*x/y,y,ics=[2,1],ivar=x,output='plot',end_points=[-3,3],\
    thickness=3)
show(df+PB+PD+P1+P2)
```



```
# The computer has clearly made a mistake in trying to plot these \
    erroneous solution.
```

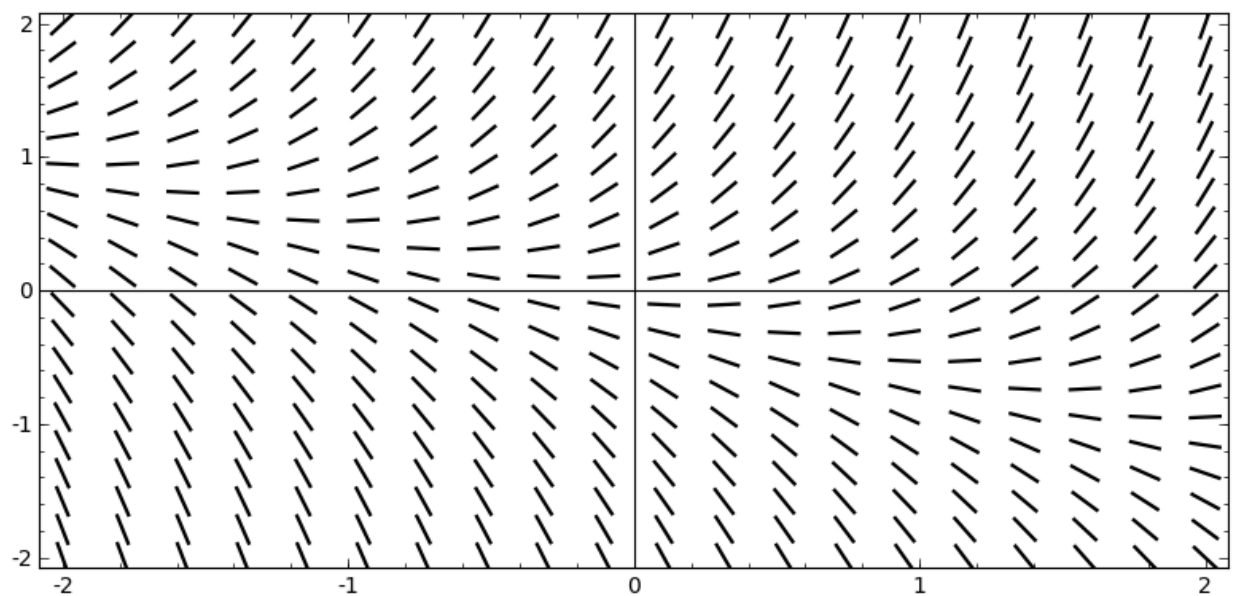
```
## Problem 13
```

```
df13=plot_slope_field(2*x,(x,-2,2),(y,-2,2))
show(df13)
P13B=desolve_rk4(2*x,y,ics=[0,0],ivar=x,output='plot',end_points\
    =[-3/2,3/2],thickness=3)
P13C=desolve_rk4(2*x,y,ics=[0,1],ivar=x,output='plot',end_points=[-1,1],\
    thickness=3)
show(df13+P13B+P13C)
```



Problem 16

```
df16=plot_slope_field(x+2*y,(x,-2,2),(y,-2,2))
show(df16)
```



```
P16B=desolve_rk4(x+2*y,y,ics=[0,0],ivar=x,output='plot',end_points\
=[-2,1.2],thickness=3)
P16C=desolve_rk4(x+2*y,y,ics=[0,1],ivar=x,output='plot',end_points\
=[-2,0.3],thickness=3)
show(df16+P16B+P16C)
```

