

We'll load a package that provides us with some nice tools for studying differential equations.

```
with(DEtools) :
```

Note, the colon after. This signifies to Maple that it doesn't need to tell us anything has happened.

From here, we can start inputting our first exciting input, an actual differential equation:

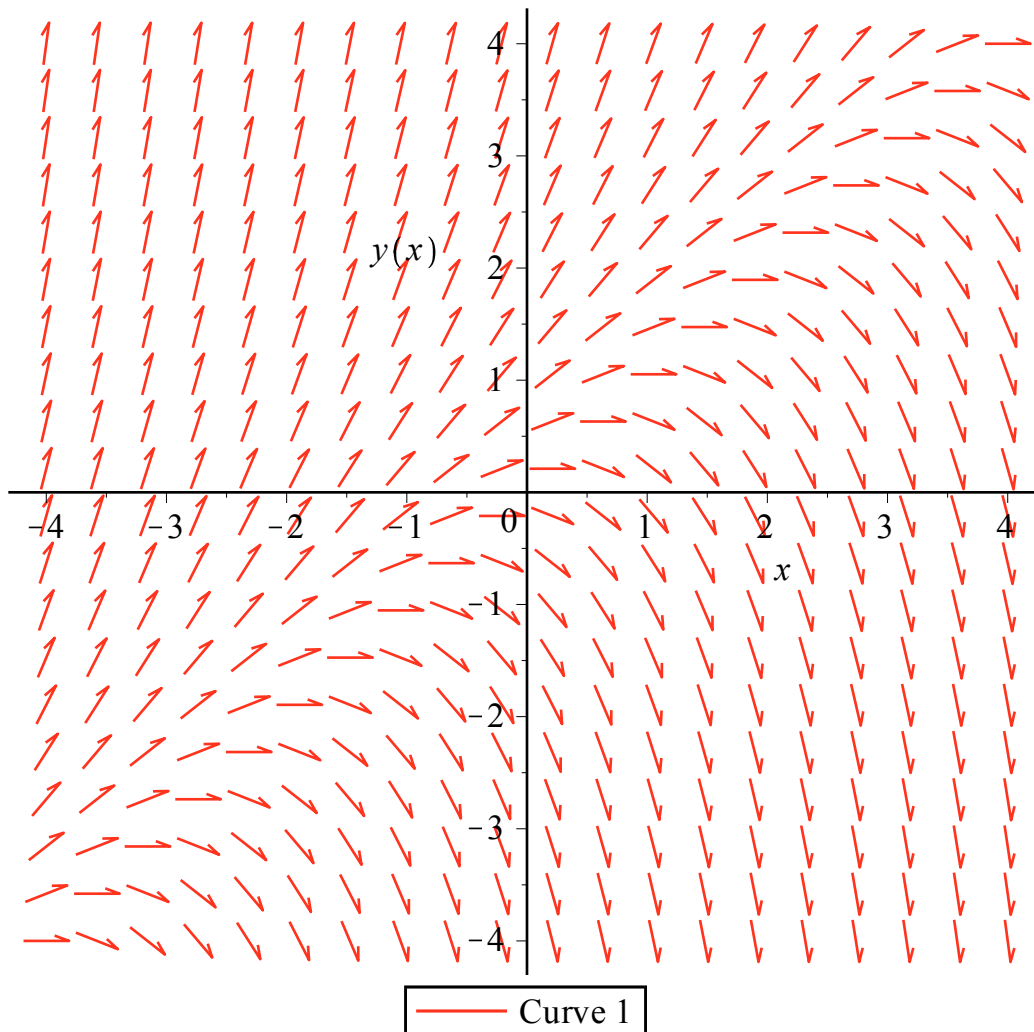
```
ode1 := diff(y(x), x) = y(x) - x;
```

$$\frac{d}{dx} y(x) = y(x) - x \quad (1)$$

There are a variety of things to note about this line. For one, we're assigning something, which is what := signifies. We're assigning the differential equation to the name 'ode1', specifically. The way Maple knows how to take derivatives is through the diff() command. We're saying: take the derivative of y(x) with respect to x. Finally, note that I've used a semicolon and Maple said something back. This is differs from the colon, which would print nothing.

With the DEtools package, we can immediately plot a slope field of our differential equation.

```
dfieldplot(ode1, y(x), x=-4 ..4, y=-4 ..4);
```



This output is exactly what we hoped: a slope field. The input syntax is effectively: what ODE do we want to plot a slope field of, what is the function that it describes, and then over what range should Maple draw the slope field. The notation  $x=-4..4$  tells Maple to draw the slope field from  $x=-4$  to  $x=4$ , for instance. **These inputs need to be in this order for dfieldplot!**

Something we often want to do with slope fields is draw trajectories. To do so, we need initial conditions. Let's pick two different initial conditions through  $x=0$ :

```
init1 := {[0, 2/3], [0, 2]};
```

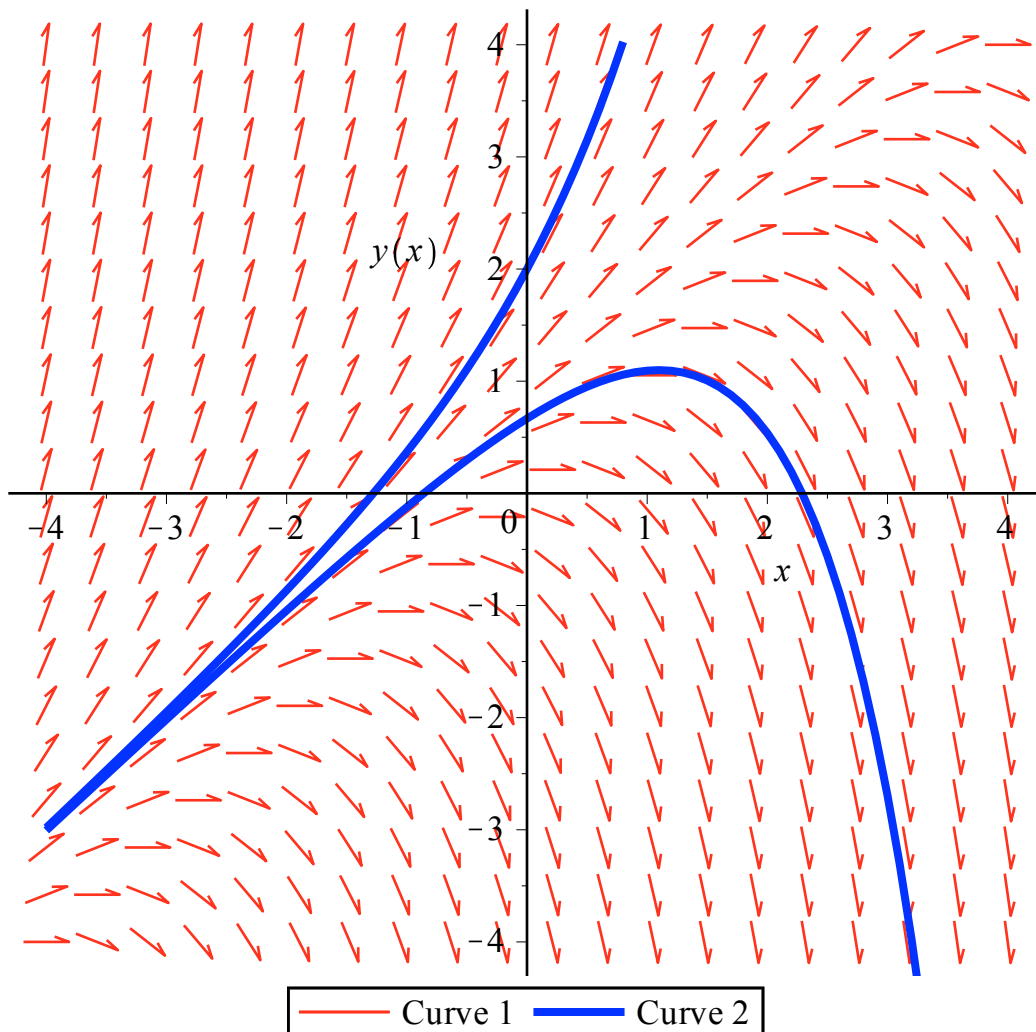
$$\left\{ [0, 2], \left[ 0, \frac{2}{3} \right] \right\}$$

(2)

The syntax we've used here is:  $\{ \}$  denotes a list of things. We're assigning the list of initial conditions to the name 'init1', which we've done through the assignment operator  $:=$ . From there, we've put two things in our list, one initial condition  $[x_1, y_1]=[0, 2/3]$  and  $[x_2, y_2]=[0, 2]$ .

Finally, we want to plot this slope field with the initial conditions, which we use a slightly different function for called DEplot:

```
DEplot(ode1, y(x), x=-4..4, y=-4..4, init1,  
       stepsize=0.1, linecolor=blue);
```



Note that the trajectories go through our initial conditions, so we have reason to believe we are successful. One minor note in the

syntax is that the stepsize here we specified tells Maple how often to draw the lines. We could have more lines by decreasing the step size or less lines by increasing the step size. **Again, these inputs need to be in this order for DEplot!**