Math 2280-1

Wednesday January 11

The geometric interpretation of a first order differential equation is connected to slope fields. Consider the differential equation

$$\frac{dy}{dx} = f(x, y).$$

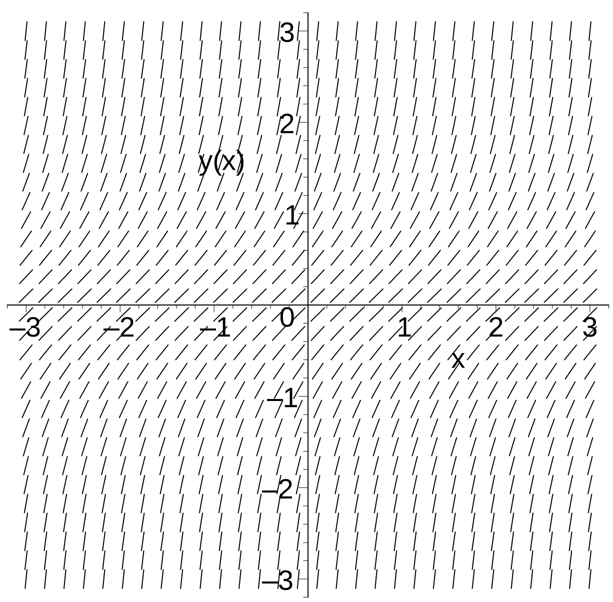
The associated slope field in the x-y plane is a field of slopes, where the slope at point (x,y) is given by the formula f(x,y). A solution y(x) to the differential equation above will have a graph y=y(x), the tangent line slope dy/dx will exactly equal f(x,y). This means that we can use the slope field to draw the graph of y(x), even if we don't have a formula for y.

Example 2:

```
> with(DEtools):
     #Maple tools for differential equations
  deqtn:=diff(y(x),x)=1+y(x)^2;
     #Example 1
```

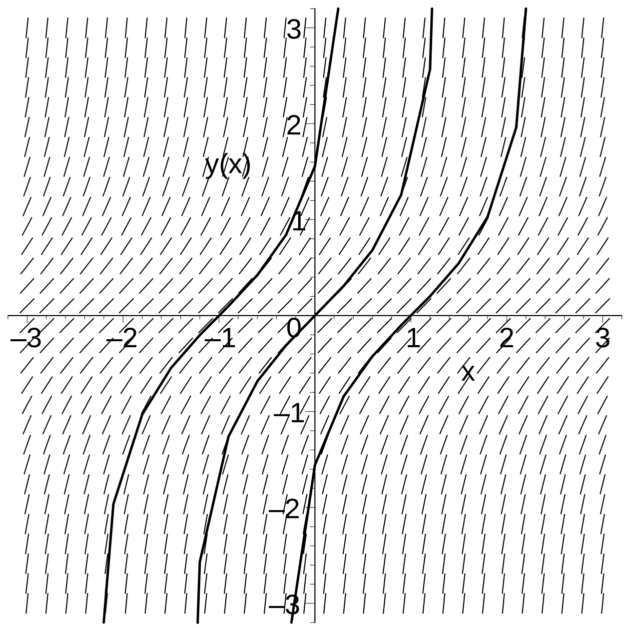
$$deqtn := \frac{d}{dx}\,y(x) = 1 + y(x)^2$$

```
> dfieldplot(deqtn, y(x),x=-3..3,y=-3..3, arrows=line,
  color=black, dirgrid=[30,30]);
```



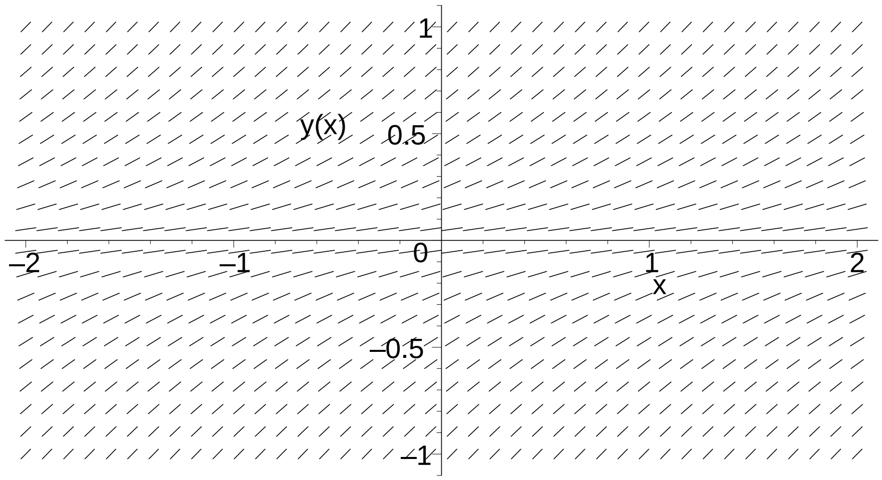
Just for fun:

```
> DEplot(deqtn,y(x),x=-3..3,{[y(0)=0],[y(1)=0],[y(-1)=0]},
  y=-3..3, arrows=line,color=black,linecolor=black,
  dirgrid=[30,30]);
```



```
> deqtn:=diff(y(x),x)=abs(y(x))^(2/3);
     #Example 3, written so that Maple will draw right
  dfieldplot(deqtn, y(x),x=-2..2,y=-1..1, arrows=line,
  color=black, dirgrid=[40,20]);
```

$$deqtn := \frac{d}{dx}\,y(x) = |y(x)|^{(2/3)}$$




```
>
```