Math 2250−1
Introduction to MAPLE
Monday August 29

This is a Maple 15 document. As you can see it's a mixture of text and mathematics. I've created it as a "Maple Document", as opposed to "Maple Worksheet." I will use the menu bar at the top of Maple to keep the unbracketed fields as text (or copied and pasted Maple work), and use the brackets with ">" prompts to do math.

1a) Toricelli Experiment: Here I'll just use Maple as a calculator which records computations into an easily usable file. These are numbers I got in my office today. We can see how they compare to what we do in class.

Model:

```
> 1/(1-sqrt(.5));
```

$$3.414213563 \quad (1)$$

```
> Thalf := 35.;
  Tpredict := 3.414*Thalf;
```

$$Thalf := 35.$$

$$Tpredict := 119.490 \quad (2)$$

```
> Tact := 60 + 53;
```

$$Tact := 113 \quad (3)$$

```
> Tpredict/Tact; #only accurate to within 6%:
```

$$1.057433628 \quad (4)$$

```
>
```

Notice that the experiment is close, but doesn't exactly match the prediction. Aside from experimental inaccuracies, can you think of places in which the model itself is inexact (there are several)?

1b) Here's a Maple picture of the direction field for the differential equation. Explain where uniqueness for the IVP fails, and what it means in terms of the experiment we just did:

```
> with(DETools) : #differential equations package
```

```
> deqtn := diff(y(x), x) =-sqrt(y(x)) : #this is the DE
  dsolve({deqtn, y(0) = 1}); #solution!
```

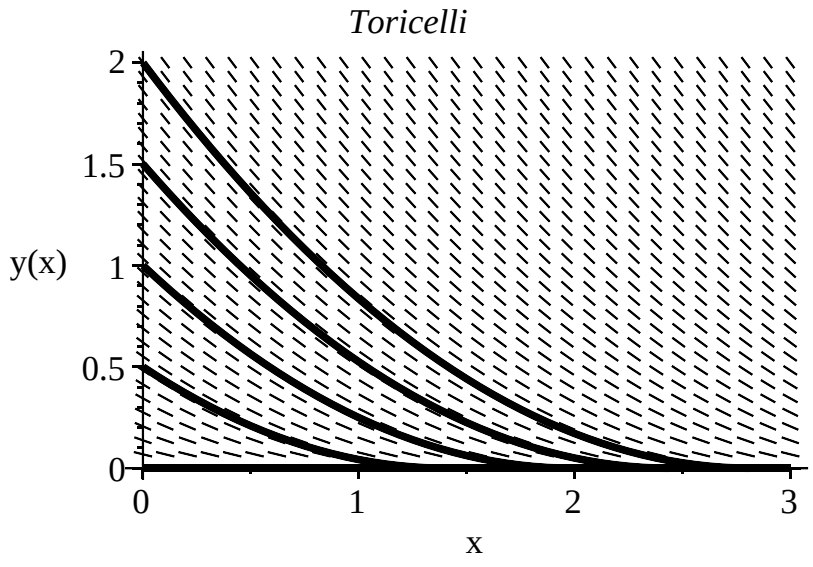
$$y(x) = \frac{1}{4}x^2 - x + 1 \qquad \textbf{(5)}$$

```
> factor((1/4)*x^2 - x + 1); #of course, you could factor by hand too
```

$$\frac{1}{4}(x-2)^2 \qquad \textbf{(6)}$$

```
> DEplot(deqtn, y(x), 0..3, {[y(0) = 0], [y(0) = 1.],
    [y(0) = 2.], [y(0) = 0.5], [y(0) = 1.5]},
    y = 0..2, arrows = line, color = black, linecolor = black,
    dirgrid = [30, 30], stepsize = .1, title = 'Toricelli'); #Maple's not as
    #cool as "dfield", but you can still draw slope fields and solution
    #trajectories
```

```
Warning, plot may be incomplete, the following errors(s) were issued:
   cannot evaluate the solution further right of 1.4141924, probably a
singularity
Warning, plot may be incomplete, the following errors(s) were issued:
   cannot evaluate the solution further right of 1.9999776, probably a
singularity
Warning, plot may be incomplete, the following errors(s) were issued:
   cannot evaluate the solution further right of 2.4494671, probably a
singularity
Warning, plot may be incomplete, the following errors(s) were issued:
   cannot evaluate the solution further right of 2.8283979, probably a
singularity
```



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