Today

- Test Prep – first 10 minutes
- Office Hours Today:
  3:00-4:30pm, Com B-006
- HW 1 closes Mon (1.1-1.2)
  HW 1 overview
    - 1, 3: Algebra review
    - 2: Integration review
    - 4-6: Check a sol'n
    - 7-8: Applications & units
    - 9-10: Applications set up
- Lecture
  a) More motivating examples
  b) Slope/Direction Fields

Ch. 1: Motivating Examples

Recall: $\frac{dy}{dx} = rate$

Rates come up everywhere!

a) *Populations, Savings Accounts, Newton's Law of cooling, Mixing Problems, melting ice (see handout)*

b) *Free-fall (no air resistance):*

$$mv' = F_g = -mg$$

***I**nitial **V**alue **P**roblem* (IVP)

$$v' = -g$$
$$v(0) = 0$$

c) …with air resistance

$$mv' = F_g + F_A = -mg - rv$$

$$v' = -g - \frac{r}{m}v$$
$$v(0) = 0$$

d) Mass-Spring Example:

$$Force = -kx$$

$$m\,x'' = -kx$$

It turns out that one solution to this is $x(t) = cos(\omega t)$

e) *Circuits (read lecture notes, follow instructions on HW):*

$$V = Rq' + \frac{1}{C}q + Lq''$$

Slope/Direction Fields

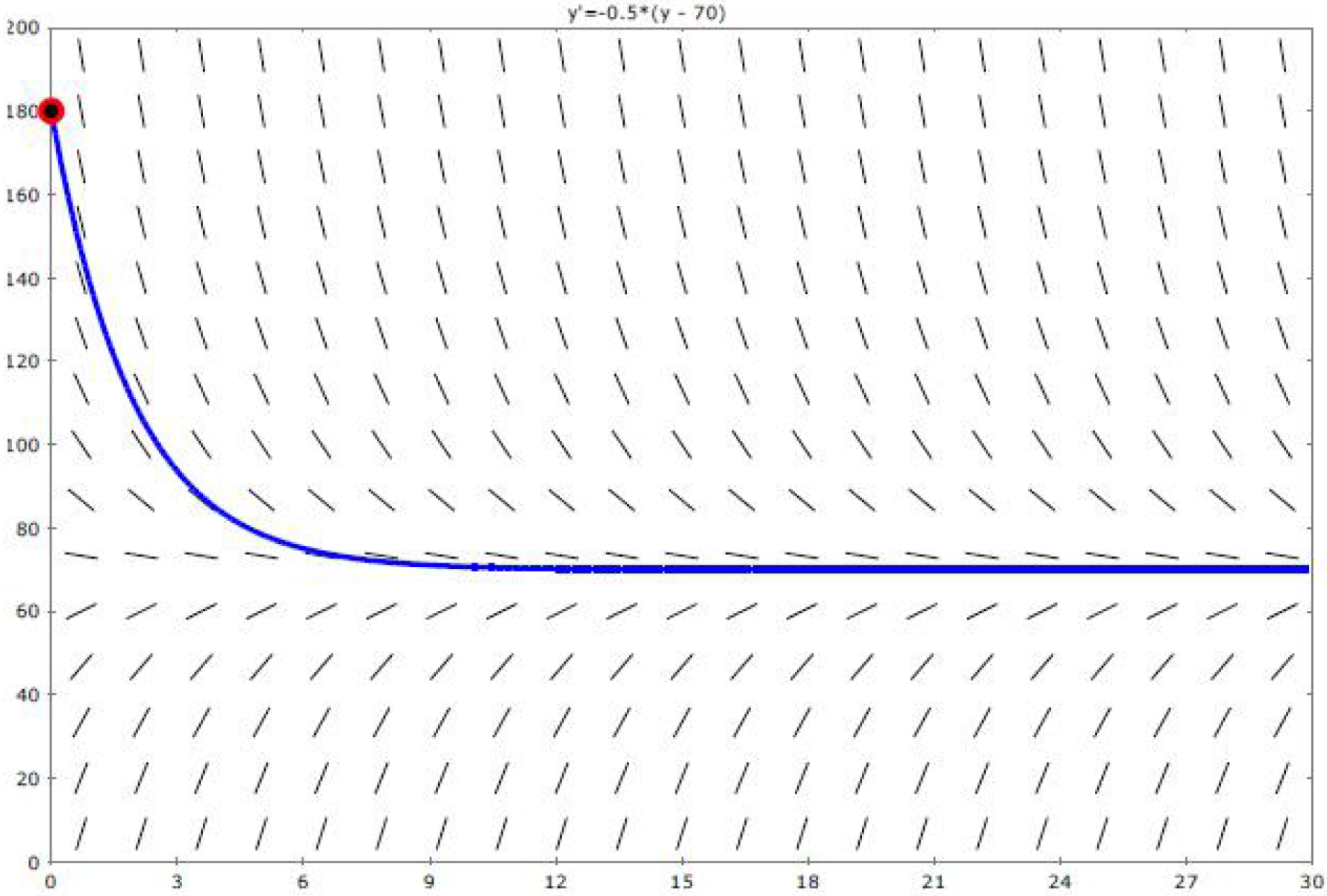
Recall: $\frac{dy}{dx} = slope$

We can visualize slope!

Example 1:

$$\frac{dT}{dt} = 0.5(70 - T)$$

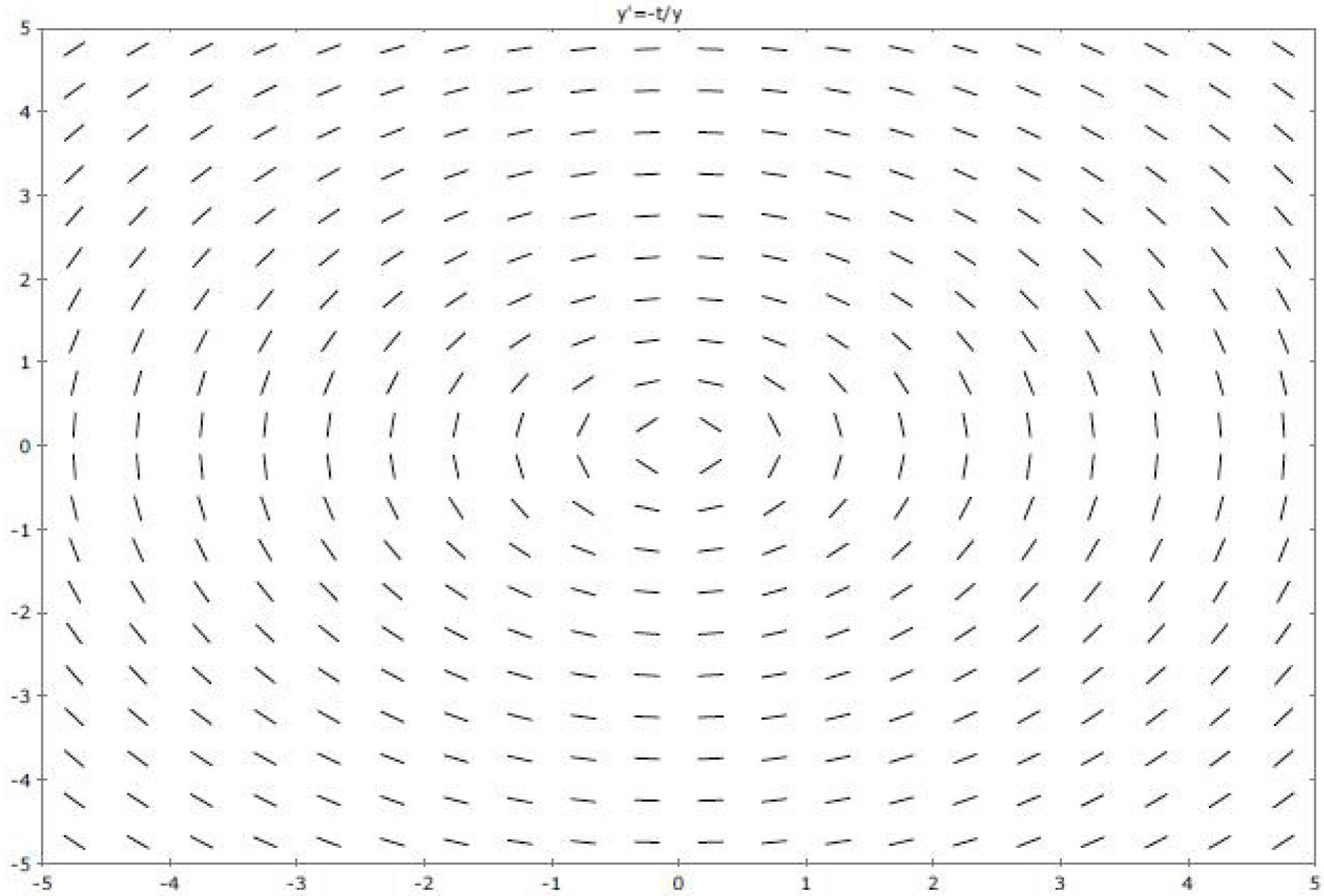
	T=0	T=35	T=70	T=105
t=0				
t=10				
t=20				
t=30				


y'=-0.5*(y - 70)
200
180
160
140
120
100
80
60
40
20
0
0
3
6
9
12
15
18
21
24
27
30

Example 2:

$$\frac{dy}{dx} = -\frac{x}{y}$$

	y=-1	y=0	y=1	y=2
x=-1				
x=0				
x=1				
x=2				


y'=-t/y
5
4
3
2
1
0
-1
-2
-3
-4
-5
-5
-4
-3
-2
-1
0
1
2
3
4
5