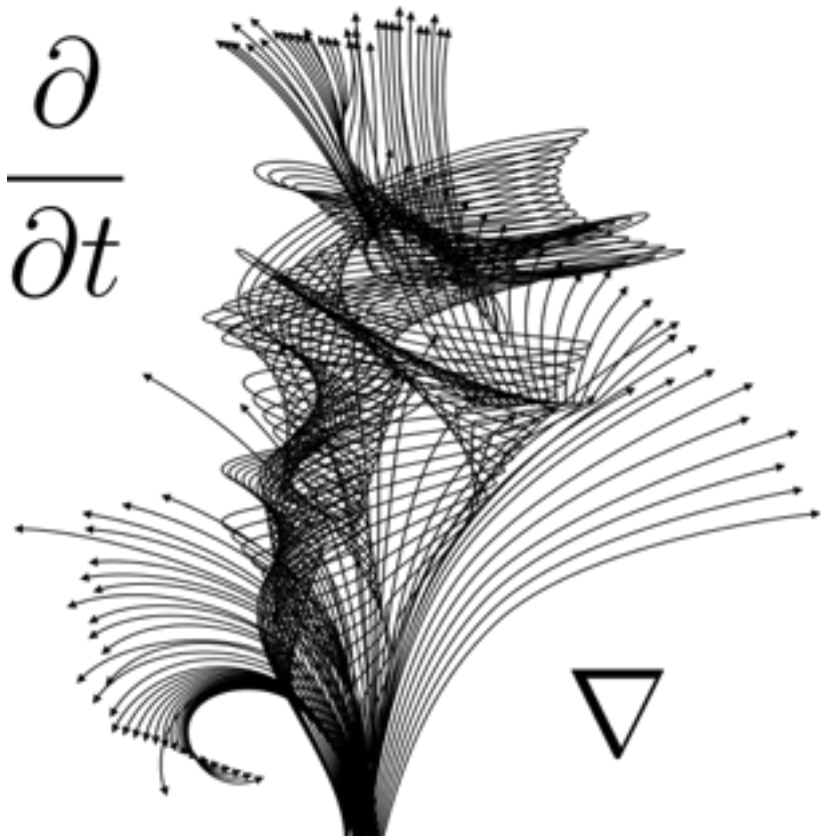
Differential Calculus with Applications to Life Sciences

Math 102:105

Pooya Ronagh

Agenda for today:

- Linear differential equations



Newton's law of cooling (revisited)

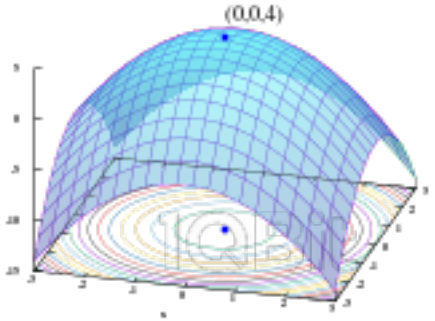
How to solve this? $$T'(t) = k(E - T(t))$$

First of all… What is the unit of k?

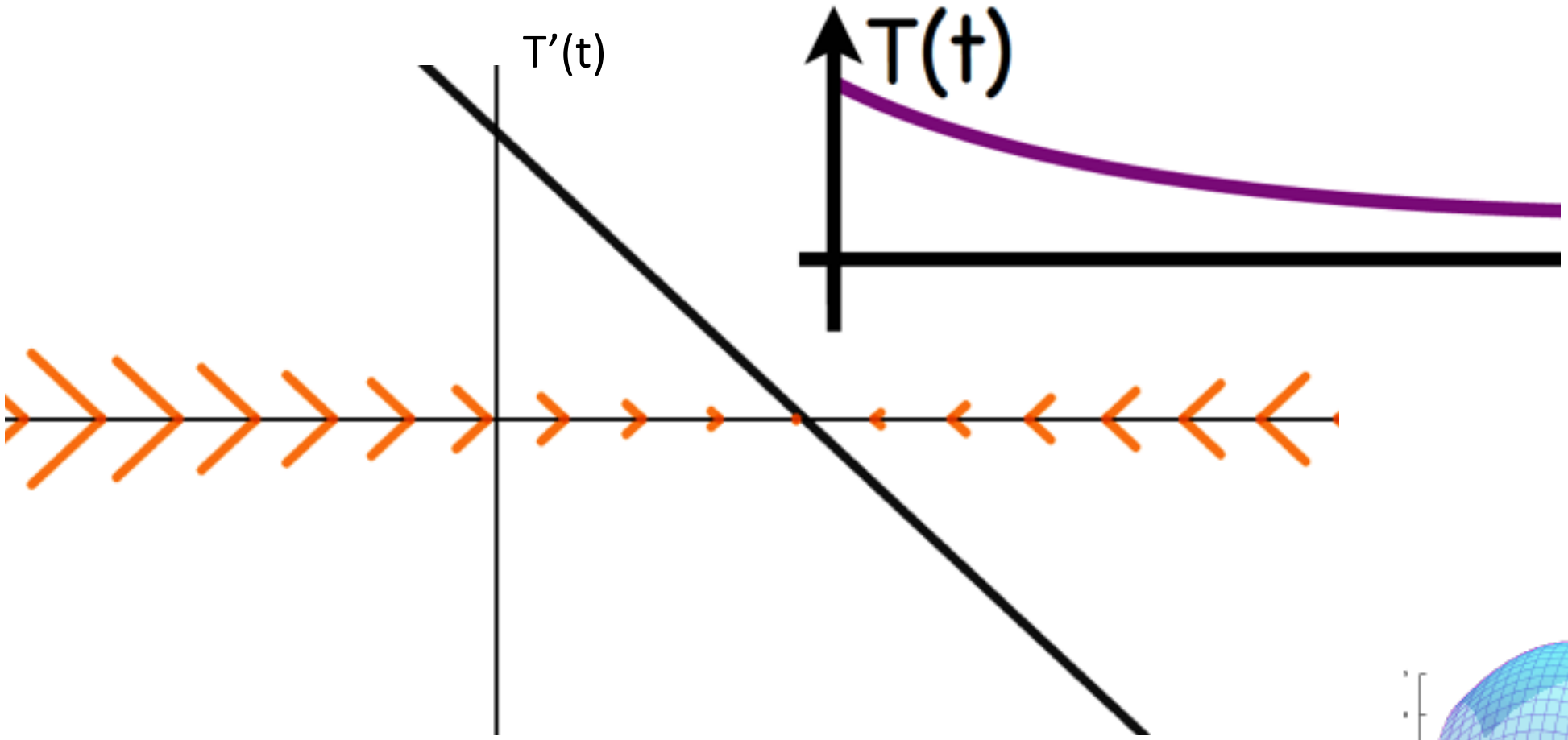
Let's assume the surrounding is water at temperature 273K. What is the DE expressing this same phenomena is temperature was measures in centigrades? $$S'(t) = -kS$$

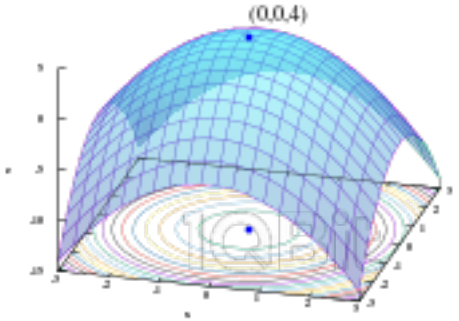
BUT! We CAN solve this one! $S(t) = S_0 e^{-kt}$

And we can convert back to Kelvin: $T(t) = (T_0 - E)e^{-kt} + E$

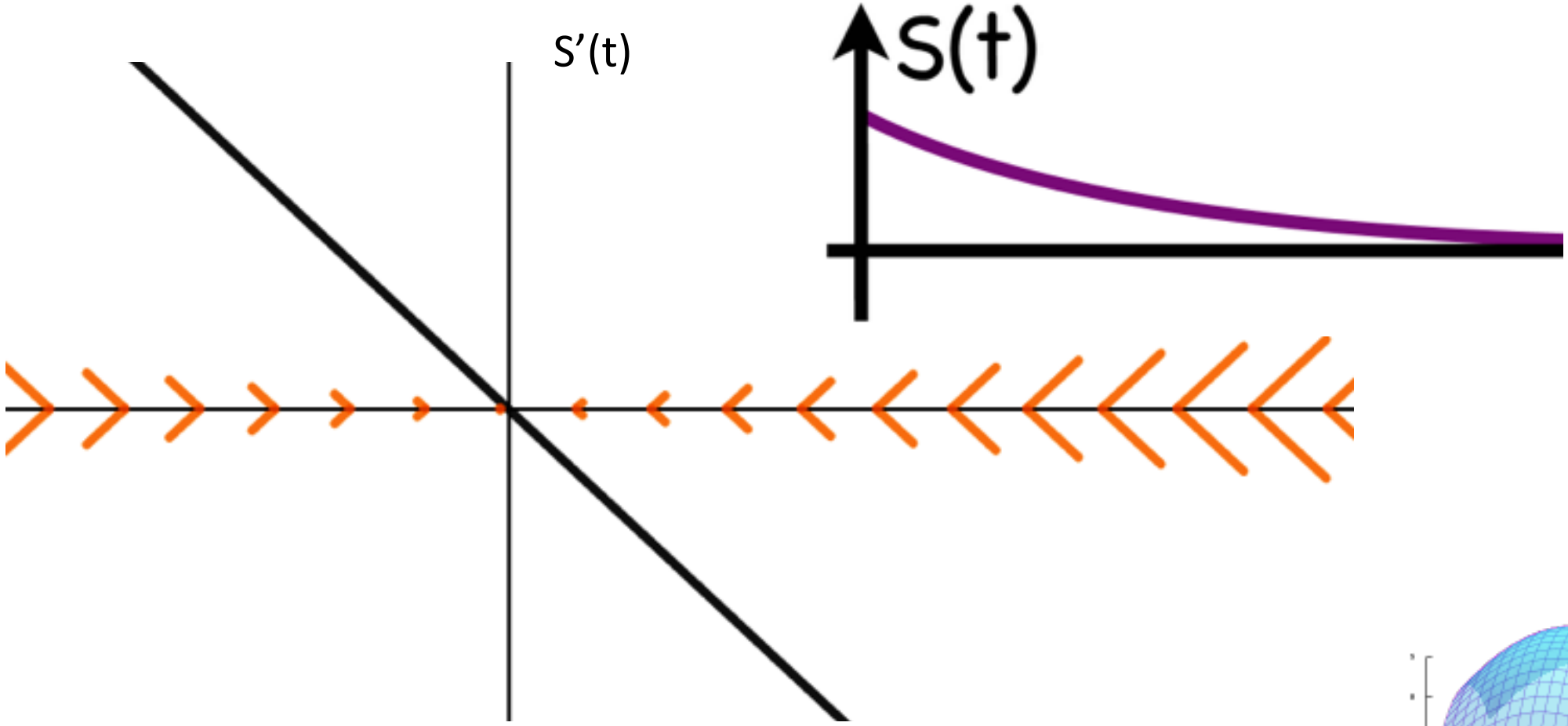


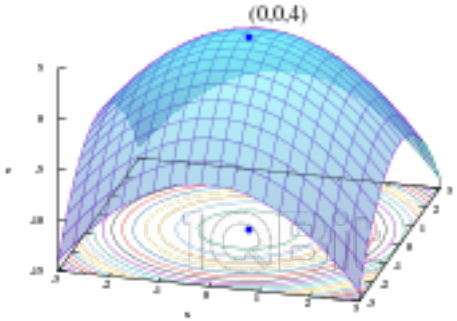
Newton’s law of cooling (revisited)





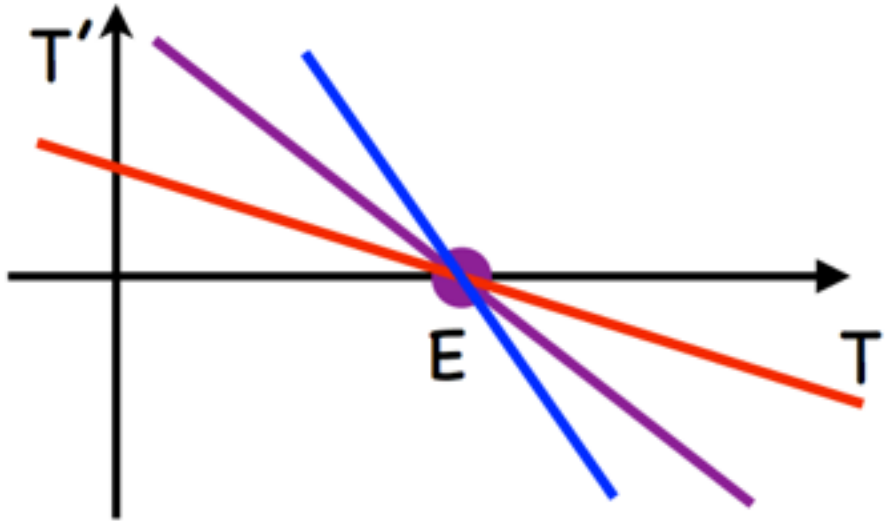
Newton’s law of cooling (revisited)

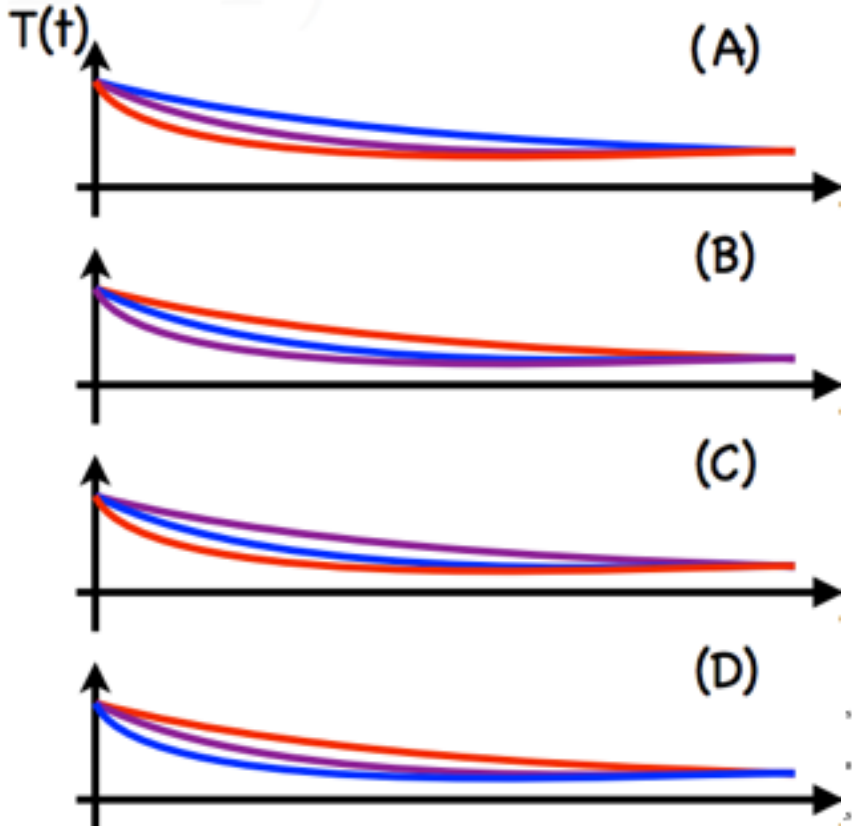


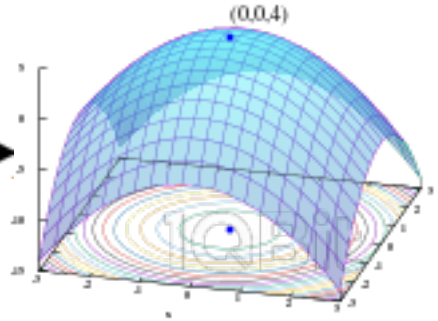


Newton’s law of cooling (revisited)

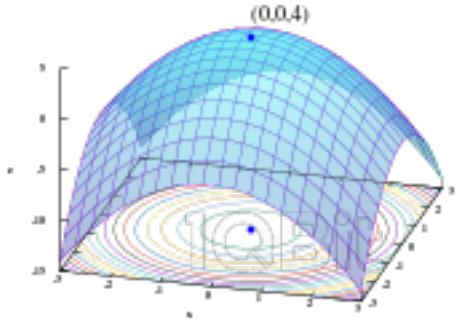
Match the phase curves of different cooling phenomena with their corresponding temperature curves.





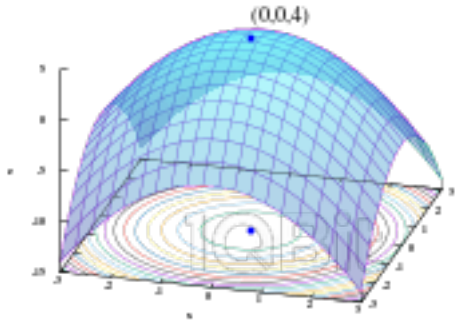


Solutions of y' = a - by



Solutions of y' = a - by

$$y(t) = \frac{a}{b} + \left(y_0 - \frac{a}{b}\right) e^{-bt}$$



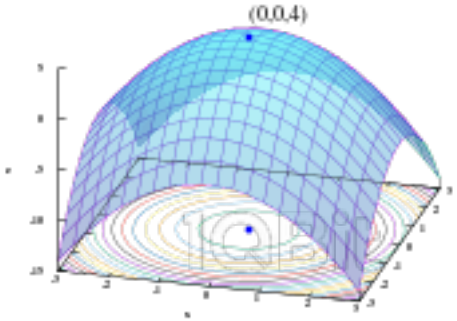
Solutions of y' = a - by

$$y(t) = \frac{a}{b} + \left(y_0 - \frac{a}{b}\right) e^{-bt}$$

Question: Let's assume b>0. What is a horizontal asymptote for a solution?

Question: What is a steady state solution?

Question: What is a good definition for characteristic time here?



Have a great weekend =)

Nov 17	WW 10
Nov 21	PL12.1
Nov 23	PL12.2