Topics in Mathematical Physics (PHYS 320):1 Spring 2019

Read: Sections 1-2 Chapter 8 of Boas

(1) In class I mentioned the fermi-dirac distribution,

$$\bar{n}_{FD} = \frac{1}{1 + e^{(\epsilon-\mu)/kT}}$$

and its relation to the finite capacity model solution. Explore this relation more precisely. One way to get started is to map[1]

$$\alpha \to -(\epsilon - \mu) \text{ and } t \to \frac{1}{kT}.$$

Find where you should match the fermi-dirac distribution to the finite capacity model. What is C? What does it represent?

(2) You might have wondered what the optimists' equation would have done if we reciprocated the right hand side like this

$$\frac{d\varphi}{dt} = \frac{\alpha}{2}\frac{1}{\varphi}.$$

(I added the 1/2 for fun.) What sort of ODE is this (order, etc.)? Solve this ODE. Is this 'optimistic'? If so, what sort of growth is it? If not, what is the behavior?

[1] As it turns out the mapping between time and temperature is common in problems in statistical mechanics and field theory.