

Lecture 10

9/23

* Project #1 released, due Fri, Oct 15th

- 25 pts (~25% of grade)
- Statement of Collaboration is required.

If you wish, ~~the~~ geometry can be built outside Ansys (e.g. using Solidworks)

Design Modules → guaranteed to be consistent

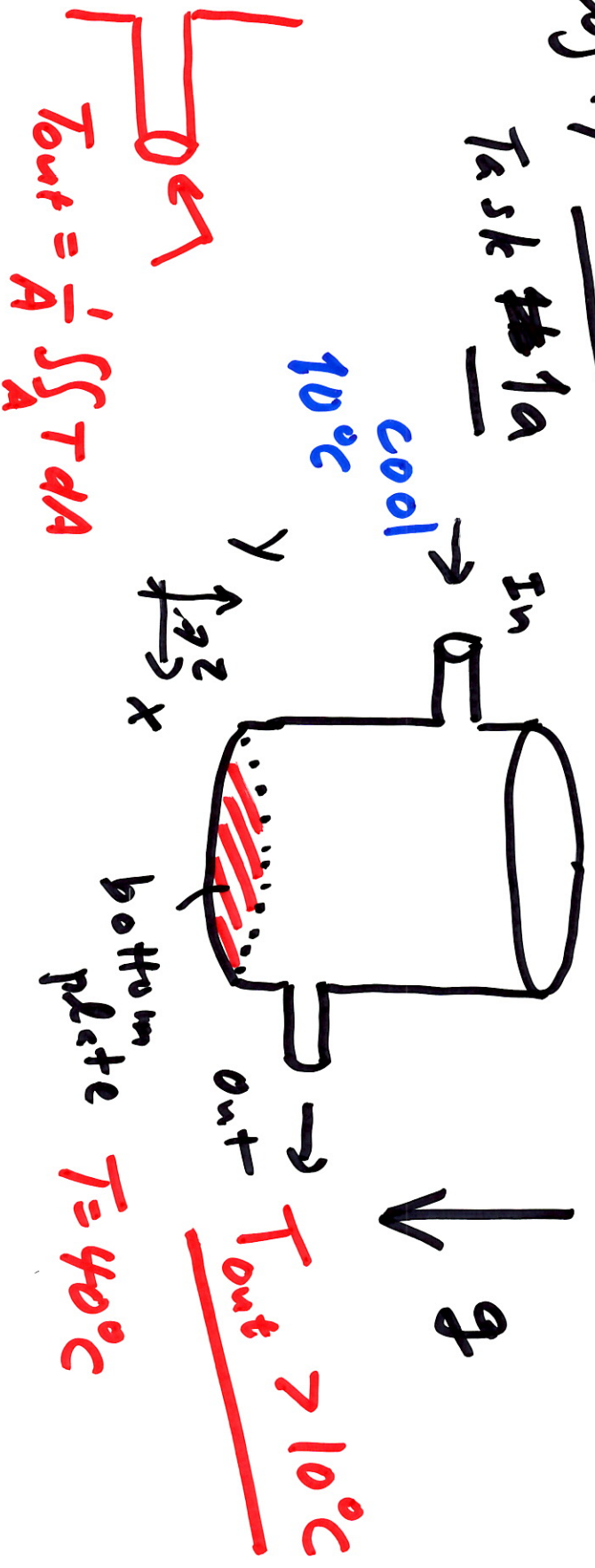
Recap (Lec 9):
 Background on "Boussinesq" approximation
 for treating thermal convection buoyancy

water

$\rho \equiv \rho(T)$

Proj 1 / Task 1

Task 1a



$$T_{out} = \frac{1}{A} \iint_A T dA$$

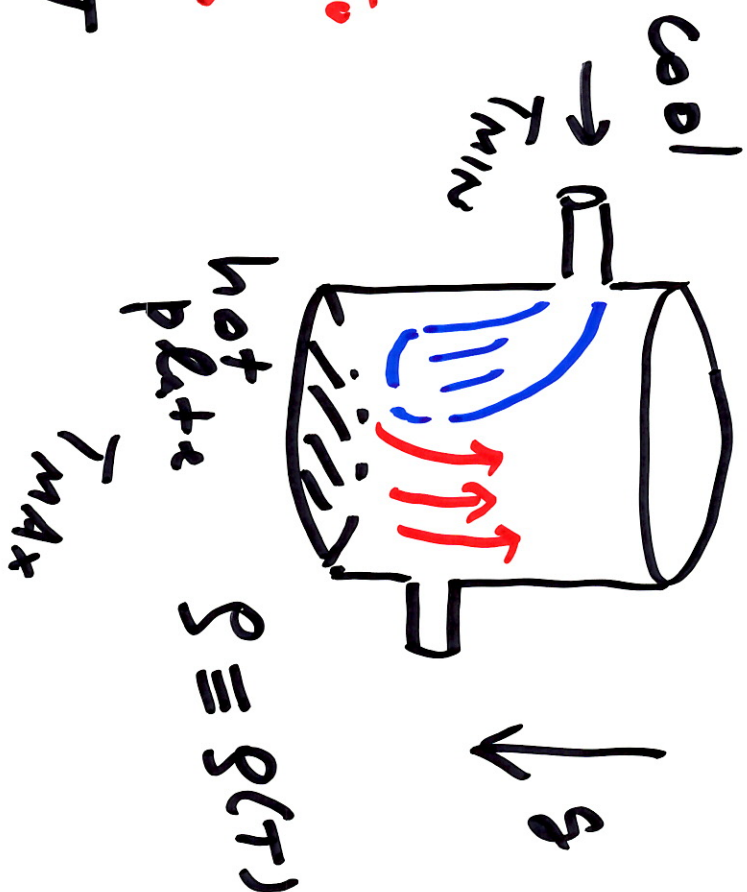
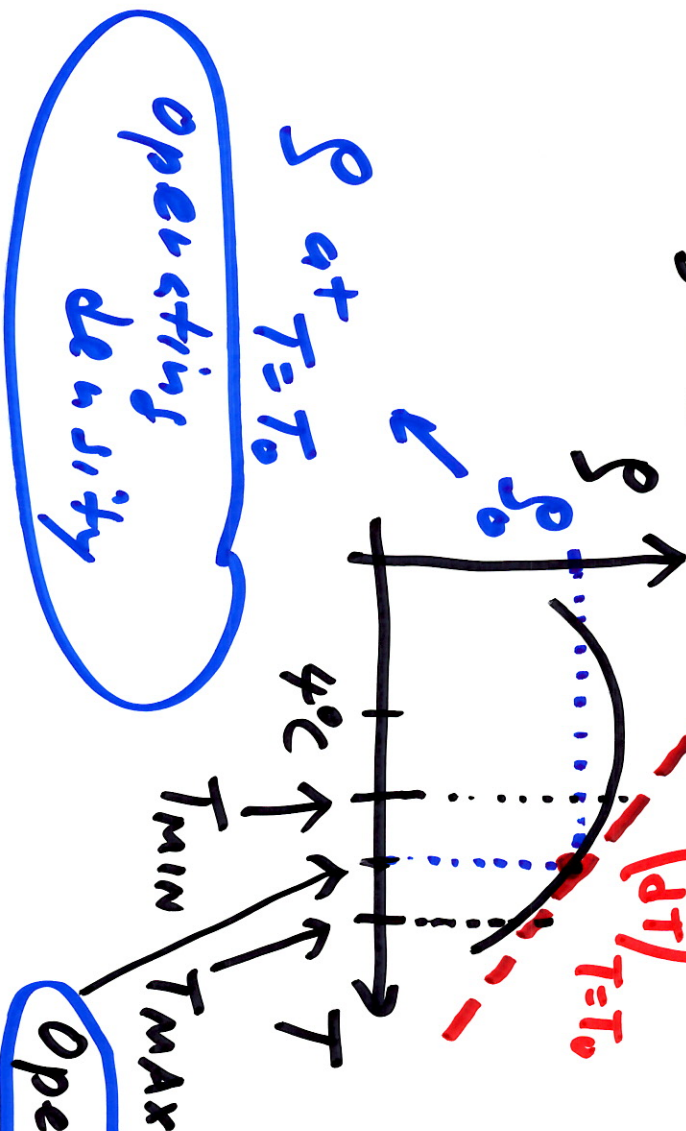
Demo: ① Boussinesq

- ② Monitor / Convergence
- ③ Local mesh refinement
- ④ Making a good contour plot

Boussineq.

(Lec 9):

$\rho \equiv \rho(T)$ slope = $\left(\frac{d\rho}{dT}\right)$



Reference "NIST formula"

$\rho(T) = A + BT + CT^2 + DT^3 + ET^4 ?$

Operating temperature T_0

we design to

$T_0 = \frac{T_{min} + T_{max}}{2}$

Thermal expansion coefficient

$$\beta \equiv \frac{1}{\alpha} \frac{d\alpha}{dT} = -\frac{1}{\rho} \frac{d\rho}{dT}$$

$$\alpha \equiv \frac{1}{\rho}$$

$$\beta = -\frac{1}{\rho_0} \left(\frac{d\rho}{dT} \right)_{T=T_0}$$

↑
set as

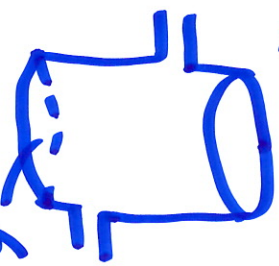
Proj 1 Task 1a: $T_0, \rho_0, \beta = ?$

293.16

Need to answer

Demo: Use **arbitrary** values. !!

20°C



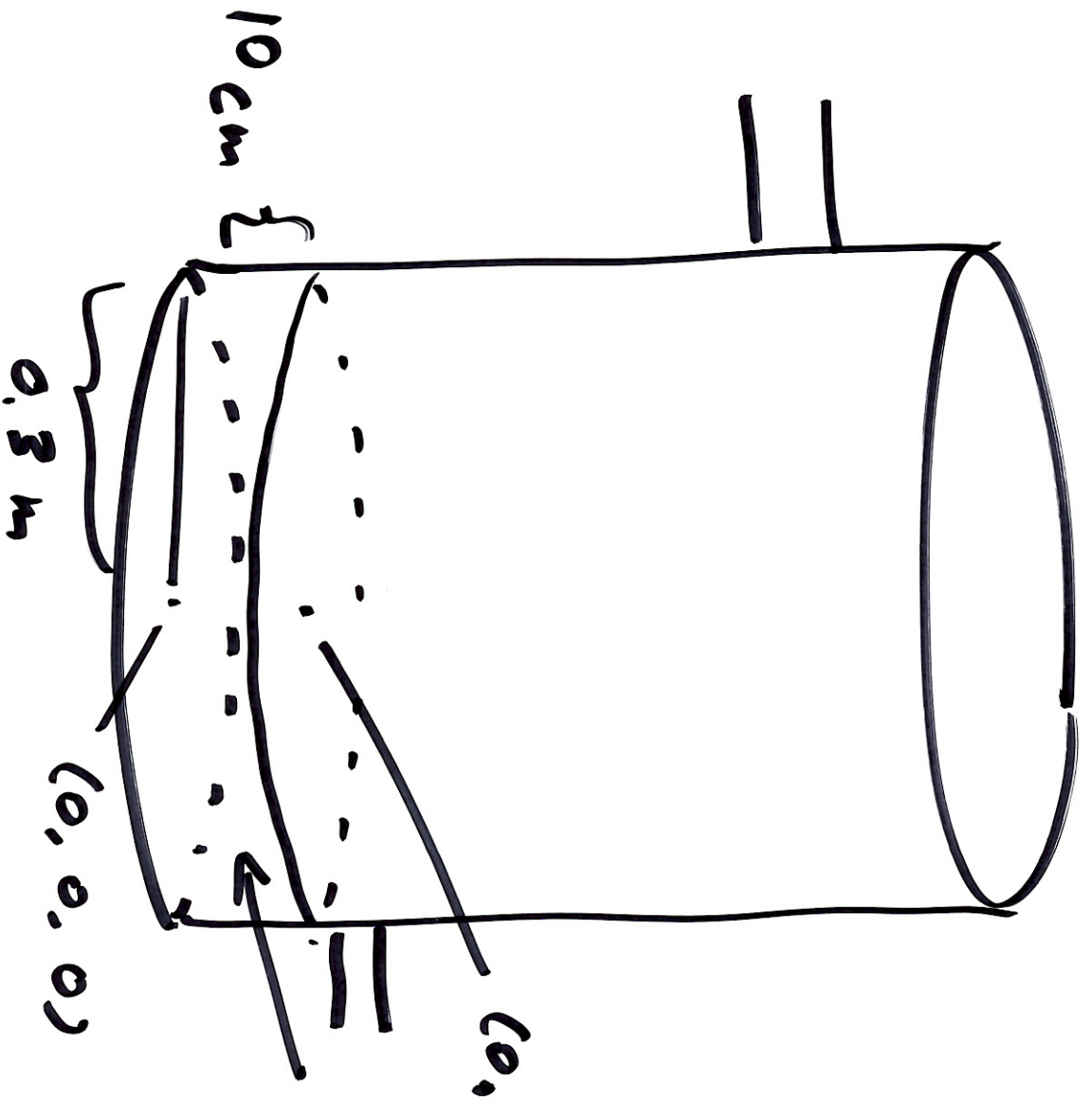
$$\rho_0 = 995, \quad \beta = 0.0003$$

60°C

$$T_0 = 40^\circ\text{C}$$

333.16

313.16



~~Adapt~~

Adapt

- Manual
- Cell Register
- New
- Region

$(0, 0, 0.1)$

pancake?