

Nov. 16

Afternoon tea

$$T(t) = E + (T_0 - E)e^{-bt}$$

$$T(10) = 40 \Rightarrow E + (T_0 - E)e^{-10b} = 40$$

$$T(20) = 25 \Rightarrow E + (T_0 - E)e^{-20b} = 25$$

We want  $E$ .

"just boiled"  $\Rightarrow T_0 = 100$

$$\begin{cases} E + (100 - E)e^{-10b} = 40 \\ E + (100 - E)e^{-20b} = 25 \end{cases}$$

We only need  $E$ , so  
let's eliminate  $b$ .

$$\Rightarrow \begin{cases} e^{-10b} = \frac{40 - E}{100 - E} \\ e^{-20b} = \frac{25 - E}{100 - E} \end{cases} \Rightarrow e^{-20b} = \frac{(40 - E)^2}{(100 - E)^2}$$

simplify before expanding!

$$\Rightarrow \frac{(40 - E)^2}{(100 - E)^2} = \frac{25 - E}{100 - E} \Rightarrow \frac{(40 - E)^2}{100 - E} = 25 - E$$

$$(40 - E)^2 = (100 - E)(25 - E)$$

$$1600 - 80E + \cancel{E^2} = 2500 - 125E + \cancel{E^2}$$

$$45E = 900$$

$$E = 20$$