2. (a) (4 points) The temperature T_{R} of a certain nuclear reactor is decaying exponentially in time toward a background temperature $T_{\mathrm{B}} = 25^\circ$ C: $T_{\mathrm{R}} = T_{\mathrm{B}} + a\mathrm{e}^{-t}$ where t is measured in hours and a is a constant. The temperature T of a container of water placed in the reactor is subject to Newton's Law of Cooling/Heating: the time rate of change of the temperature T is proportional to the difference between T and the reactor temperature. If at time $t = 0$,

   - The reactor temperature is at 325° C,
   - The water temperature is the same as the background temperature, and
   - The water temperature is increasing by 600° C per hour,

   find (but do not solve) the precise first-order ODE satisfied by the water temperature $T(t)$.

   (b) (4 points) The number $F(t)$ of fish in a small lake t weeks after the beginning of summer is governed by the differential equation $F' = -4F + S(t)$, where $S(t)$ (fish/week) is the rate at which the lake is stocked with fish by the park ranger. The park ranger starts out putting in 1000 fish/week but gets busy with other things and ends up adding fewer fish every week so that $S(t) = 1000\mathrm{e}^{-2t}$. If there aren't any fish in the lake at the beginning of summer, find $F(t)$.