4.8 #1 HW Solutions 5, 11, 13, 15

5.) $\frac{1800}{1000} = \frac{\cancel{1000}e^{K(1)}}{\cancel{1000}}$

$1.8 = e^K$

$\ln 1.8 = \ln e^K$

$\ln 1.8 = K$

$A(t) = 1000e^{\ln(1.8)t}$

$A(3) = 1000e^{\ln(1.8)(3)} = \boxed{5832}$

$\frac{10{,}000}{1000} = \frac{1000e^{\ln(1.8)t}}{1000}$

$\ln 10 = \ln e^{\ln(1.8)t} \rightarrow \frac{\ln 10}{\ln(1.8)} = \frac{\ln(1.8)t}{\ln(1.8)} \rightarrow \boxed{t \approx 3.9 \text{ DAYS}}$

11.) a.) $\frac{1}{2} = e^{K(5600)} \rightarrow \ln\frac{1}{2} = \ln e^{5600K} \rightarrow \frac{\ln\frac{1}{2}}{5600} = K$

$.3 = e^{\frac{\ln 1/2}{5600}t} \rightarrow \ln(0.3) = \ln e^{\frac{\ln 1/2}{5600}t}$

$\frac{\ln(0.3)}{\frac{\ln\frac{1}{2}}{5600}} = \frac{\frac{\ln\frac{1}{2}}{5600}t}{\frac{\ln\frac{1}{2}}{5600}} \rightarrow \boxed{t \approx 9727 \text{ yrs ago}}$

b.) $y_1 = e^{\frac{\ln(1/2)}{5600}x}$

c.) $y_1 = e^{\frac{\ln(1/2)}{5600}x}$

$y_2 = 0.5$

> graph, 2nd trace → intersect, $\boxed{5600 \text{yrs}}$

d.) $A(5600) = e^{\frac{\ln(1/2)}{5600}(5600)} = \frac{1}{2}$

13.) a.) $u(t) = 70 + (450 - 70)e^{Kt}$

$u(t) = 70 + (380)e^{Kt}$

$300 = 70 + 380e^{K(5)}$

$\frac{230}{380} = \frac{380e^{5K}}{380}$

$\frac{23}{38} = e^{5K}$

$\frac{\ln\left(\frac{23}{38}\right)}{5} = \frac{\cancel{5}K}{\cancel{5}} \rightarrow K = \frac{\ln\left(\frac{23}{38}\right)}{5}$

$\rightarrow 135 = 70 + 380e^{\frac{\ln\left(\frac{23}{38}\right)}{5}t}$

$\frac{65}{380} = \frac{\cancel{380}e^{\frac{\ln(23/38)}{5}t}}{380}$

$.17105 = e^{\frac{\ln(23/38)}{5}t}$

$\ln(.17105) = \ln e^{\frac{\ln\left(\frac{23}{38}\right)}{5}t}$

$\frac{\ln(.17105)}{\frac{\ln\left(\frac{23}{38}\right)}{5}} = \frac{\cancel{\frac{\ln\left(\frac{23}{38}\right)}{5}}t}{\cancel{\frac{\ln\left(\frac{23}{38}\right)}{5}}}$

$t \approx 17.6$, so @ 5:18pm

13.) b.) $y_1 = 70 + 380e^{\frac{\ln\left(\frac{23}{38}\right)}{5} x}$ (graph on calc)

Xmin = -10, Xmax = 100, XSCL = 10, Ymin = 0, Ymax = 1000, YSCL = 100

c.) $y_2 = 160$, 2^{ND} trace → intersect, $\boxed{t = 14.34 \text{ mins}}$

d.) As time approaches infinity (gets really large), the temperature of the pizza approaches 70°.

15.) a.) $u(t) = 35 + (8 - 35)e^{kt} \rightarrow u(t) = 35 - 27e^{kt}$

$15 = 35 - 27e^{k(3)} \rightarrow \frac{-20}{-27} = \frac{-27e^{3k}}{-27} \rightarrow \frac{20}{27} = e^{3k}$

$\ln\left(\frac{20}{27}\right) = \ln e^{3k} \rightarrow \frac{\ln\left(\frac{20}{27}\right)}{3} = \frac{3k}{3} \rightarrow \boxed{k = \frac{\ln\left(\frac{20}{27}\right)}{3}}$

$u(t) = 35 - 27e^{\frac{\ln\left(\frac{20}{27}\right)}{3} t}$

$u(5) = 35 - 27e^{\frac{\ln\left(\frac{20}{27}\right)}{3}(5)} = \boxed{18.63°C}$

$u(10) = 35 - 27e^{\frac{\ln\left(\frac{20}{27}\right)}{3}(10)} = \boxed{25.1°C}$

b.) $y = 35 - 27e^{\frac{\ln\left(\frac{20}{27}\right)}{3} x}$

Xmin = -10, Xmax = 100, XSCL = 10, Ymin = 0, Ymax = 40, YSCL = 5

↳ graph

- 2^{ND} trace → value → 5 → Enter 18.63
- 2^{ND} trace → value → 10 → Enter 25.1