SOLVING EXPONENTIAL EQUATIONS

$$4^{x+1} = 8^{2x-5}$$

$$(2^2)^{x+1} = (2^3)^{2x-5}$$

$$2^{2x+2} = 2^{6x-15}$$

$$2x+2 = 6x-15$$

$$17 = 4x$$

$$17/4 = x$$

$$13^{2x+3} = 2150$$

$$\log(13^{2x+3}) = \log(2150)$$

$$\frac{(2x+3)\log 13}{\log 13} = \frac{\log(2150)}{\log(13)}$$

$$2x+3 = \frac{\log(2150)}{\log(13)}$$

$$\frac{\Box}{\Box} = \frac{\Box}{\Box} - 3 \qquad \frac{\cancel{2}x}{\cancel{2}} = \frac{\log(2150)}{\log(13)} - 3$$

$$x = -0.0042$$

$$5^{2x+1} = 3^{x-1}$$

$$\log 5^{2x+1} = \log 3^{x-1}$$

$$(2x+1)\log 5 = (x-1)\log 3$$

$$2x\log(5) + \log(5) = x\log(3) - \log(3)$$

$$2x\log(5) - x\log(3) = -\log(5) - \log(3)$$

$$x\left(2\log(5)^2 - \log(3)\right) = -\log(5) - \log(3)$$

$$x(\log 25 - \log 3) = -(\log(5) + \log(3))$$

$$x \cdot \log\left(\tfrac{25}{3}\right) = -\log(15)$$

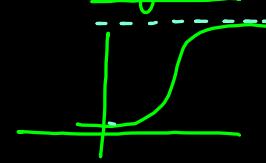$$x = \frac{-\log(15)}{\log(25/3)} \approx \boxed{-1.28}$$

$$\frac{7e^{4x-2}}{7} = \frac{147}{7}$$

$$\ln e^{4x-2} = \ln 21$$

$$4x - 2 = \ln(21)$$

$$\frac{4x}{4} = \frac{\ln(21) + 2}{4}$$

$$x \approx \boxed{1.26}$$

$$\frac{370}{1 + 2e^{-0.5x}} = 120 \quad \underline{\text{logistic}}$$

$$\frac{370}{120} = \frac{120(1 + 2e^{-0.5x})}{120}$$

$$\frac{37}{12} = 1 + 2e^{-0.5x} \quad \leftarrow \frac{\text{Isolate}}{e}$$

$$\frac{1}{2} \cdot \frac{25}{12} = \frac{2e^{-0.5x}}{2}$$

$$\frac{25}{24} = e^{-0.5x}$$

$$\ln \frac{25}{24} = \ln e^{-0.5x}$$

$$\frac{\ln\left(\frac{25}{24}\right)}{-0.5} = \frac{-0.5x}{-0.5}$$

$$\boxed{-0.082 = x}$$

$$e^{2x} - 4e^x = 12 \qquad x^2 - 4x = 12$$

$$e^{2x} - 4e^x - 12 = 0$$

$$(e^x - 6)(e^x + 2) = 0$$

$$e^x - 6 = 0 \qquad e^x + 2 = 0$$

$$\ln e^x = \ln 6 \qquad \ln e^x = \ln -2$$

$$x = \ln(6) \qquad \cancel{x = \ln(-2)}$$

$$\approx 1.79$$

Solve by calculator.

$$\underbrace{\frac{x^2 - 25}{x^2 - 9}}_{f_1} = \underbrace{-\ln(x+9) + 6}_{f_2}$$

* graph

* intersection

$$x = -1.94, \; 1.71$$

Newton's Law of Cooling

$$\mu = T + (\mu_0 - T)e^{Kt}$$

- final temp
- air temp
- initial temp
- air temp
- constant
- time

A bowl of soup has a temperature of $200°F$ & is placed in a room at $70°F$. How long (min) will it take the soup to cool to $100°F$. $K = -0.04855$

$$\mu = T + (\mu_0 - T)e^{Kt}$$

$$100 = 70 + (200 - 70)e^{-0.04855t}$$

$$100 = 70 + 130e^{-0.04855t}$$

$$\underline{-70 \quad -70}$$

$$\frac{30}{130} = \frac{130e^{-0.04855t}}{130}$$

$$\ln\frac{3}{13} = \ln e^{-0.04855t}$$

$$\frac{\ln(3/13)}{-0.04855} = \frac{-0.04855t}{-0.04855}$$

$$\boxed{\begin{array}{c}30.2\\ \text{min}\end{array}} = \longleftarrow$$