Natural Log Operations

$$\ln x + \ln(x+3) = 2$$

$$e^{\ln(x^2+3x)} = e^2$$

$$x^2+3x = e^2$$

$$x^2+3x-e^2 = 0$$

$$x = \frac{-3 \pm \sqrt{9-4(1)(-e^2)}}{2(1)}$$

$$= \frac{-3 \pm \sqrt{9+4e^2}}{2}$$

$$\approx 1.605, \cancel{-4.605}$$

$$\frac{2e^{2x-5}}{2} = \frac{32}{2}$$

$$\ln e^{2x-5} = \ln 16$$

$$2x-5 = \ln 16$$

$$\frac{\cancel{2}x}{\cancel{2}} = \frac{\ln(16)+5}{2}$$

$$x \approx 3.886$$

$$4^{2x+3} = 7^{x-1}$$

$$\ln 4^{2x+3} = \ln 7^{x-1}$$

$$(2x+3)\ln 4 = (x-1)\ln 7$$

$$2x\ln 4 + 3\ln 4 = x\ln 7 - \ln 7$$

$$2x\ln 4 - x\ln 7 = -\ln 7 - 3\ln 4$$

$$x\cdot(2\ln 4 - \ln 7) = -\ln 7 - 3\ln 4$$

$$x = \frac{-\ln 7 - 3\ln 4}{2\ln 4 - \ln 7}$$

$$x \approx -7.385$$

$$e^{2x} + 3e^{x} = 28$$

$$1e^{2x} + 3e^{x} - 28 = 0$$

$$x^2 + 3x - 28$$

$$(e^x + 7)(e^x - 4) = 0$$

$$\ln e^x = \ln -7 \qquad \ln e^x = \ln 4$$

$$\cancel{x = \ln(-7)} \qquad x = \ln 4$$

$$\approx 1.386$$

Radioactive Iodine has a half-life of 60 days. It is considered to be safe when 5% or less is left. How many days will it take to reach a safe level.

$N = N_0 e^{Kt}$

$0.5 = 1 e^{K \cdot 60}$

$0.5 = e^{60K}$

$\ln(0.5) = \ln e^{60K}$

$\frac{\ln(0.5)}{60} = \frac{60K}{60}$

$-0.0116 = K$

$0.05 = 1 e^{-0.0116t}$

Newton's Law of Cooling

$u = T + (u_0 - T)e^{Kt}$

u = Final temp, u_0 = Initial temp

Room Temp = 71°

Normal body tem = 98.6°

Body found = 75°

1 hr. later = 72°

T = air temp

$72 = 71 + (75 - 71)e^{K \cdot 1}$

$72 = 71 + 4e^{K}$

$-71 \qquad -71$

$1 = 4e^{K}$

$\ln \frac{1}{4} = \ln e^{K}$

$\ln(1/4) = K$

$-1.386 = K$

$4.7E^{-3}$

$75 = 71 + (98.6 - 71)e^{-1.386t}$

$75 = 71 + 27.6e^{-1.386t}$

-71

$4 = 27.6e^{-1.386t}$

$\ln\left(\frac{4}{27.6}\right) = \ln\left(e^{-1.386t}\right)$

$\ln\left(4/27.6\right) = -1.386t$

$\frac{\ln\left(\frac{4}{27.6}\right)}{-1.386} = t$

1.39 hrs. $= t$