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$$\log(5x^2+4) = \cancel{2}\log(3x^2)^2 - \log(2x^2-1)$$

$$= \log 9x^4 - \log(2x^2-1)$$

$$\log(5x^2+4) = \log\left(\frac{9x^4}{2x^2-1}\right)$$

$$10 \qquad\qquad 10$$

$$(2x^2-1)\, 5x^2+4 = \frac{9x^4}{\cancel{2x^2-1}}\cancel{(2x^2-1)}$$

$$10x^4+8x^2-5x^2-4 = 9x^4$$

$$-9x^4$$

$$x^4+3x^2-4=0$$

$$(x^2+4)(x^2-1)=0$$

$$\cancel{x^2+4=0} \qquad (x-1)(x+1) \qquad \sqrt{x^2}=\sqrt{1}$$

$$\cancel{\sqrt{x^2}=\sqrt{-4}} \qquad \boxed{x=1,-1} \qquad x=\pm 1$$

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$$\log_5\left(\frac{x^2}{8}\right) - 3 = \log_5 \frac{x}{40}$$

$$\log_5\left(\frac{x^2}{8}\right) - \log_5\left(\frac{x}{40}\right) = 3$$

$$\log_5\left(\frac{x^{\cancel{2}}}{\cancel{8}} \cdot \frac{\cancel{40}^{\,5}}{\cancel{x}}\right) = 3$$

$$\log_5(5x) = 3$$

$$5 \qquad\qquad 5$$

$$5x = 125$$

$$\boxed{x = 25}$$

Natural Log Operations

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

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

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

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

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

$$x = \frac{-3 \pm \sqrt{9 + 4e^2}}{2} = \boxed{1.605}, \cancel{-4.605}$$

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

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

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

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

$$x \approx 3.886$$

$$\log 4^{2x+3} = \log 75$$

$$\frac{(2x+3)\cdot \cancel{\log 4}}{\cancel{\log 4}} = \frac{\log 75}{\log 4}$$

$$2x+3 = \frac{\log 75}{\log 4}$$

$$\frac{\cancel{2}x}{\cancel{2}} = \frac{\frac{\log 75}{\log 4} - 3}{2}$$

$$\approx 0.057$$

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

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

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

$$e^{x} + 7 = 0 \qquad e^{x} - 4 = 0$$

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

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

$$\approx 1.386$$

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.

$$N = N_0 e^{kt}$$

$$\frac{0.5}{1} = \frac{1 e^{k \cdot 60}}{1}$$

$$\ln 0.5 = \ln e^{60k}$$

$$\frac{\ln(0.5)}{60} = \frac{\cancel{60}k}{\cancel{60}}$$

$$-0.0116 = k$$

$$N = N_0 e^{kt}$$

$$\ln 0.05 = \ln e^{-0.0116t}$$

$$\frac{\ln(0.05)}{-0.0116} = \frac{-0.0116t}{-0.0116}$$

$$\boxed{258 \text{ days} = t}$$

Newton's Law of Cooling

Room Temp = 71°

Normal body tem = 98.6

Body found = 75°

1 hr. later = 72°

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

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

$$-71 \quad -71$$

$$\frac{1}{4} = \frac{4e^{k}}{4}$$

$$\ln 0.25 = \ln e^{k}$$

$$-1.386 = k$$

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

$$-71 \quad -71$$

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

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

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

$$1.39 = t$$

1.39 hrs. = t