Section 5.5: cont'd

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8:36 AM

recall: 1 rat $\to$ 15,000 rats in one year.

$r = \ln 15000 \approx 9.61581$

time for 1 rat $\to$ 1 million rats

$$P = P_0 e^{rt}$$

$$1000\,000 = 1\,e^{9.61581t}$$

$$\ln 1000\,000 = \ln e^{9.61581t}$$

$$\ln 10^6 = 9.61581\,t$$

$$t = \frac{\ln 10^6}{9.61581}$$

$$= 1.43675 \text{ years}$$

$$\approx 1.4 \text{ years}$$

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exponential decay:

Scientists at the Kellogg Radiation Lab are studying the radioactive substance Linoleum-237. The halflife of Ln-237 is 2.95 days. If the lab has exactly 1.00 grams of Ln-237 to begin with, how much will be left after exactly one week?

half-life: time for ½ of the material to decay away

$$P = P_0 e^{-rt}$$

finding r:

$$\frac{1}{2} \cancel{P_0} = \cancel{P_0} e^{-r(2.95)}$$

$$½ = e^{-2.95r}$$

$$\ln ½ = \ln e^{-2.95r}$$

$$\ln ½ = -2.95r \cancel{\ln e}^{\,1}$$

$$\frac{\ln ½}{-2.95} = r$$

$$r \approx 0.234965$$

now, find P:

time in days

how much left after one week

$$P = P_0 e^{-rt}$$

$$= 1.00\, e^{-0.234965(7)}$$

$$= 0.19306 \text{ g}$$

$$= 0.19 \text{ g}$$