p195 #56

$$Q = Q_0 e^{-t/\tau}$$

$\tau$ - elimination time.

$\tau = 2.5$ hours

$Q_1 = 0.10 \rightarrow$ start $Q_0$

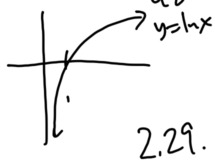
$Q_2 = 0.04$

$$0.04 = 0.10\, e^{-t/2.5}$$

$$0.4 = e^{-t/2.5}$$

$$\ln 0.4 = -t/2.5$$

$$2.29 \approx -2.5 \ln 0.4 = t$$




43.

$$* \; Q = Q_0 e^{kt}$$

vs.

$$Q = Q_0 (1+r)^t$$

well when Q has doubled

$$\boxed{Q = 2Q_0}$$

$$2Q_0 = Q_0 e^{kt}$$

$$2 = e^{kt}$$

$$\ln 2 = kt$$

$$\boxed{\frac{\ln 2}{k} = t}$$ doubling time

#51

half life = 5728 years

54% of the $C^{14}$ is still there.

$$Q = Q_0 e^{kt}$$

half-life

$$\boxed{k = \frac{\ln(0.5)}{t}}$$

$$k = \frac{\ln(0.5)}{5728}$$

$$k = -1.21 \times 10^{-4}$$

model

$$Q = Q_0 e^{-1.21\times10^{-4} t}$$

$$\frac{Q}{Q_0} = 0.54$$

$$0.54 = e^{-1.21\times10^{-4} t}$$

$$\ln 0.54 = -1.21\times10^{-4} t \rightarrow -1.14108 = -1.21\times10^{-4} t$$

$$5{,}092 \text{ yrs} = t$$

$$\tfrac{1}{2} Q_0 = Q_0 e^{kt}$$

$$\tfrac{1}{2} = e^{kt}$$

$$\ln(0.5) = kt$$

Diversity = count # of species.

let $i$ be a specific species.

then $p_i = \dfrac{n_i}{N} = \dfrac{\text{\# of ith species}}{\text{\# of organisms}}$

Simpson's Index $D = \dfrac{1}{\sum_{i=1}^{s} p_i^2}$

note: $\sum_{i=1}^{s} p_i^2 = p_1^2 + p_2^2 + p_3^2 + \cdots + p_s^2$

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Shannon's $H = -\sum_{i=1}^{s} p_i \ln(p_i)$