Hastings

1. $r = 0.1$ / day

$N(0) = 10$

$N(t) = N(0)e^{rt}$

$N(t) = 100$, 1000, $100{,}000{,}000$, $100{,}000{,}000{,}000$

$\ln N(t) = \ln N(0) + rt$

$\ln N(t) - \ln N(0) = rt$

$\dfrac{\ln N(t) - \ln N(0)}{r} = t$

$\dfrac{\ln (N(t)/N(0))}{r} = t$

A) $\dfrac{\ln(100/10)}{.1} = 23.03$ days

B) $\dfrac{\ln(1000/10)}{.1} = 46.01$ days

C) $\dfrac{\ln(100{,}000{,}000/10)}{.1} = 161.18$ days

D) $\dfrac{\ln(100{,}000{,}000{,}000/10)}{.1} = 230.26$ days

2. • Human pop expected to double in 50 years
• Continuous exp. pop. growth
• Calculate r for the pop.
if pop size in 2009 was 6.9 bill, projected for 2050.

2. $N(T) = N(0)e^{rt}$

$\ln N(t) = \ln N(0) + rt$

$\dfrac{\ln N(t) / \ln N(0)}{t} = r$

$N(0) = 6.9$ billion

$N(50) = 13.8$ billion

$t = 50$

$$r = \frac{\ln(13{,}800{,}000{,}000) / \ln(6{,}900{,}000{,}000)}{50} = \frac{\ln(2)}{50} = \boxed{0.014 \text{ per year}}$$

$N(t) = N(0)e^{rt}$

$= 6{,}900{,}000{,}000 \cdot e^{(.014 \cdot 41)}$

$\boxed{= 1.22 \times 10^{10} \text{ People}}$

let

3. $N_T = N_0 \lambda^T$ $\quad \lambda = 1.12$ $\quad N_0 = 1$, $N_t = 2$

$2 = 1 \cdot (1.12)^T$

$2 = (1.12)^T$

$\log 2 = T \log(1.12)$

$T = \frac{\log(2)}{\log(1.12)}$

$\boxed{T = 6.12 \text{ years}}$

4. The human death rate in Eugene is density independent because the factors causing death (old. age for example) are independent of the size of the population. Regardless of how big the population gets people will still die due to old age. Density dependence could be introduced if there was a disease that increased death as population size also increased. Another example would be if as population increased that the resources would be less available because of higher population so more people would die. A final example could be crime, where if ~~the~~ a bigger population would provide criminals and murderers more opportunities to kill → making this density dependent.

5. Online