POPULATION PROBLEM SET: ANSWERS

1. $dn/dt = rN$
   $dn/dt = 0.111(100)$
   $dn/dt = 11.1$ lice per day

2. Rate of increase r = (900,000,000 – 600,000,000)/600,000,000 per 100 yr
   r = (3/6) per 100 yr = 0.5/100
   r = .005 ind. per ind. per year

3. Individual birth rate = 36/1000 = 0.036 per year
   Individual death rate = 19/1000 = 0.019 per year
   r (= b-d) = (0.036 – 0.019) = 0.017 per year
   $dN/dt = rN$ = 0.017 X 2,907,000,000 = 49,419,000 individuals per year

4. b = 400/3000 = 0.13333 births / (ind•month)
   d = 150/3000 = 0.0500 deaths / (ind•month)
   r (= b-d) = 0.08300 individuals / (ind•month)
   $N_t = N_0 e^{rt}$
   $N_t = 3000 (e^{(0.0833)(6)}) = 4945$ beetles

5. Elapsed time from 1959-1975 = 16 years
   $N_t = N_0 e^{rt}$
   $N_t = 137{,}000{,}000(e^{(0.023)(16)}) = 137{,}000{,}000(e^{0.37})$
   N_t = 198,000,000

6. $t_2 = \ln 2/r$
   $r = \ln (2)/t$
   $r = \ln (2) / 50$ yr
   r = 0.01386 ind (ind• yr)
   $N_t = N_0 e^{rt}$
   $N_7 = 5.4^{(0.01386)(7)}$
   N = 5.955 billion humans

7. An annual = geometric model of discrete population growth
   12% increase / year, so $\lambda = 1.12$
   $r = \ln (\lambda) = \ln (1.12) = 0.113$ ind (ind• yr)
   $t_2 = \ln (2)/r = \ln (2)/0.113$
   t_2 = 6.1 years

8. Age structures of the two populations are different.
   If a large proportion in pre- or post-reproductive age classes → lower growth rate
   If a large proportion in reproductive age class → higher growth rate
   These differences are independent of population size and age-specific birth and death rates.

9. Similar: Each female contributes, on average, same total number of offspring in her lifetime.
   Different: Population growth rate depends on timing of reproduction. Population 1 with shorter generation time (reproduce earlier) will grow more quickly than population 2.