2. [14 points]

a. [3 points] The population of aliens on planet Maize increases at a constant rate of 10 aliens every two years. We know that in 2005 there were 120 aliens on planet Maize. Find a formula for $M(t)$, the function which gives the number of aliens on planet Maize t *years after 2000*.

Solution: $M(t) = 5(t-5) + 120 = 5t + 95$

b. [3 points] Suppose that the population of aliens on planet Yellow in any given year is a thousand more the population of aliens on planet Maize ten years earlier. Find a formula for $Y(t)$, the population of planet Yellow t *years after 2000*, in terms of the function M.

Solution: $Y(t) = M(t-10) + 1000$

c. [3 points] The population of aliens on the planet Blue decreases at a continuous percent rate of 10 % per year. We know that in 2002 there were 100 aliens on planet Blue. Find a formula for $B(t)$, the function which gives the number of aliens on planet Blue t *years after 2000*.

Solution: $B(t) = \frac{100}{e^{-0.2}} e^{-0.1t} \approx 122.14 e^{-0.1t}$

d. [5 points] The alien population on planet Navy t *years after 2000* is given by the function $N(t)$, where

$$N(t) = \frac{100}{1+t^2}.$$

Find the average rate of change of $N(t)$ over the interval $[1, 3]$ and give a practical interpretation of your result.

Solution:

$$\frac{N(3) - N(1)}{2} = \frac{10 - 50}{2} = -20$$

Between 2003 and 2001 the alien population on Planet Navy decreased on average by 20 aliens per year.