

# Question 8

The set of the given ODEs representing the Prey-Predator Model are as follows:

$$\frac{dN_1(t)}{dt} = rN_1(t) \left[ 1 - \frac{N_1(t)}{k} \right] - \alpha N_1 N_2$$

$$\frac{dN_2(t)}{dt} = -cN_2(t) + \beta N_1 N_2$$

$N_1 \rightarrow$  Prey Population

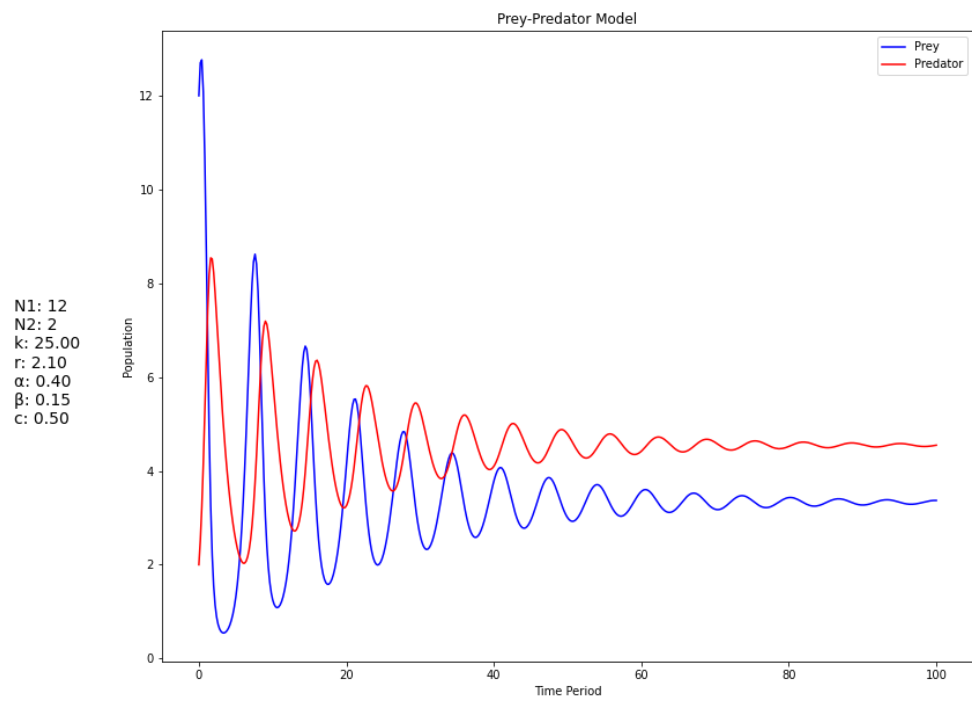
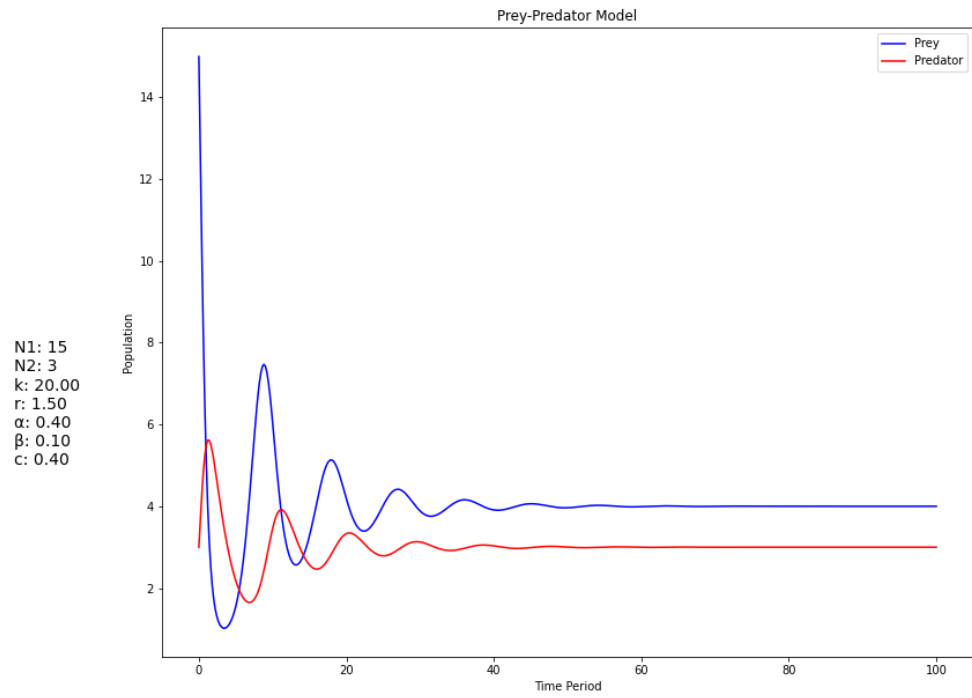
$N_2 \rightarrow$  Predator Population

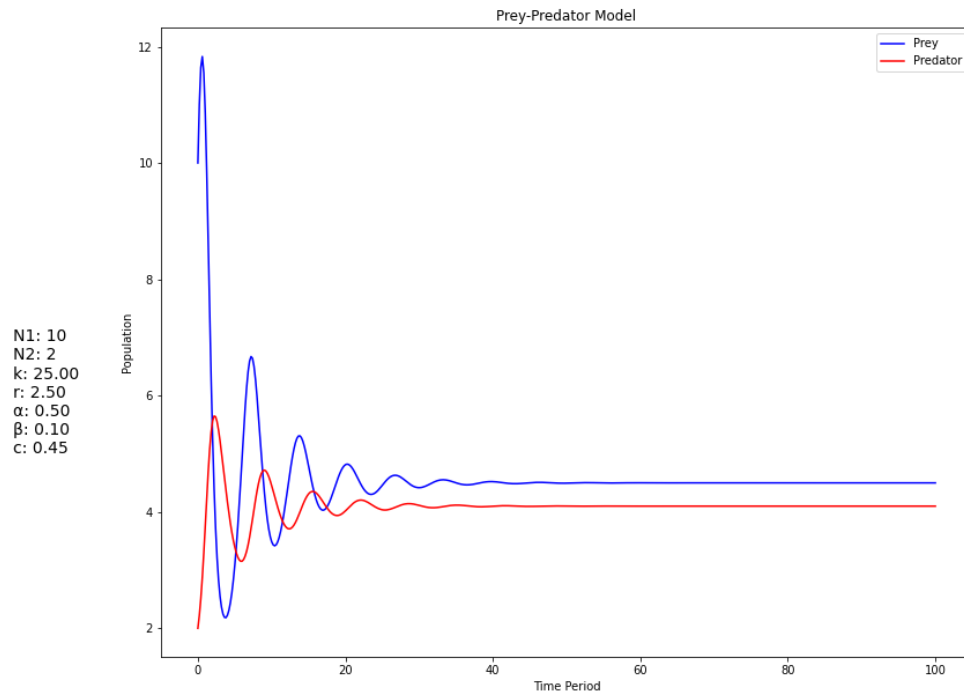
$\alpha \rightarrow$  Rate at which the predator captures its prey

$\beta \rightarrow$  Growth rate of the predator

$c \rightarrow$  Decay rate of the predator if  $N_1 = 0$

The various graphs simulated with various values of the above mentioned parameters are as follows:





The trajectories of the populations seem to fit the logic that

More Prey  $\implies$  More Predator  $\implies$  Less Prey  $\implies$  Less Predator  $\implies$  More Prey

This logic yields 2 oscillatory curves representing the 2 populations, where the curve for the prey population leads to curve for the predator population, which is evident from the plot.

The trajectories of the populations also show a convergent nature, i.e., the amplitudes of the oscillations seem to reduce as time passes. This is a direct consequence of the logistic nature of the growth of the prey population.