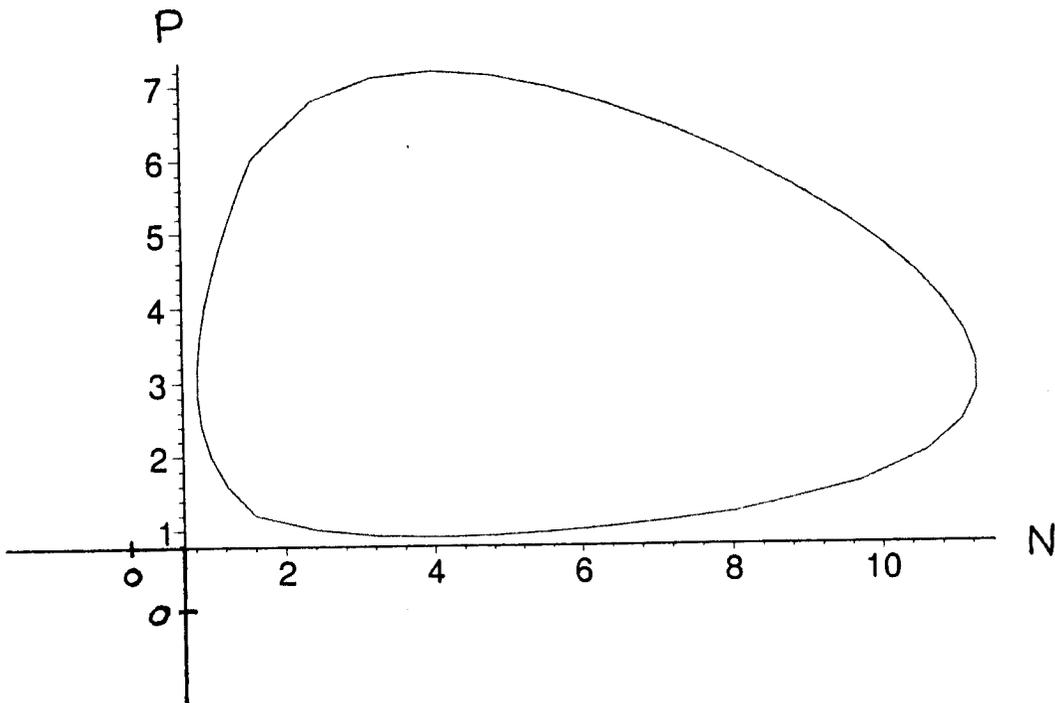


1.) (Lotka-Volterra Predator-Prey Model) Let $N(t)$ be the prey population at time t and let $P(t)$ be the predator population at time t . Assume that

$$\begin{aligned} \frac{dN}{dt} &= 6N - 2PN \\ \frac{dP}{dt} &= PN - 4P \end{aligned}$$

- Determine all equilibria for this nonlinear system of differential equations.
- Use the analytical approach (Jacobi Matrix and eigenvalues) to determine (if possible) the stability of each equilibria.
- Separate variables and integrate to get an implicit solution (in N and P) for this system.
- The solution to part c. is graphed below using MAPLE and assuming that the integration constant C is -1 . Determine the direction of motion of the solution. Assume that $(N, P) = (6, 1)$ is the initial value, then use this graph to set up a table of values (as many as you think you need) for pairs (N, P) which satisfy the equation and travel one complete cycle of this graph. Finally, on the same set of axes, plot N and P as functions of time t . Use the graphs of N and P to describe the interaction between the predator and prey species over time.



- 2.) How many ways can you pick a captain and co-captain from among 12 basketball players ?
- 3.) A group consists of 15 people made up of 9 women and 6 men. How many ways can you pick a committee
- a.) of 5 people ?
 - b.) of 5 people, if exactly 3 must be women ?
 - c.) of 5 people, if exactly 3 must be men ?
 - d.) of 5 people, if all must be women ?
 - e.) of 5 people, if there must be at least one woman on the committee ?
- 4.) You are to make ordered arrangements of three letters chosen from X, Y, Z, and W.
- a.) Determine how many there are by directly listing all possibilities.
 - b.) Determine how many there are by using a permutation, $P(n, k)$.
- 5.) There are 6 math, 4 music, 5 biology, and 3 chemistry classes available for you to take. How many different class schedules are possible if you must pick one of each class ?

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"Kids are great. That's one of the best things about our business, all the kids you get to meet. It's a shame they have to grow up to be regular people and come to the games and call you names.- former NBA player and current NBA commentator, Charles Barkley