SECTION 9.7 PREDATOR-PREY SYSTEMS

- Without predators, the food supply would support the exponential growth of the prey. That is, $\boxed{\frac{dR}{dt}=kR}$, where k is a positive constant, R is the number of prey, and t is time.
- Without prey, the predator population would decline at a rate proportional to itself. That is, $\boxed{\frac{dW}{dt}=-rW}$, where r is a positive constant, W is the number of predators and t is time.
- When both species interact, we assume that the principle cause of death for the prey is the predator, and birth and survival rates depend upon available food supply.
- We assume the 2 species encounter each other at a rate proportional to both. Thus, $\boxed{\frac{dR}{dt}=kR-aRW}$ and $\boxed{\frac{dW}{dt}=-rW+bRW}$

  These are the predator-prey equations, or the Lotka-Volterra equations.
- When the solutions of a system of differential equations are represented, the RW-plane is the <u>phase plane</u>, and the solution curves are <u>phase trajectories</u>.
- When solving for $\frac{dW}{dR}$ or $\frac{dR}{dW}$, use the Chain-rule to get rid of t.

SECTION 11.1 INFINITE SEQUENCES AND SERIES

- A sequence can be thought of as a list of numbers in a definite order.
- The sequence $\{a_1, a_2, a_3, \ldots\}$ can be denoted by $\{a_n\}$ or $\{a_n\}_{n=1}^{\infty}$
- Sequences can be defined by giving a formula for the n^{th} term.
- The Fibonacci Sequence is defined recursively as having each term as the sum of the preceding 2 terms
- A sequence $\{a_n\}$ has the limit L, where $\lim_{n\to\infty} a_n = L$ or $a_n \to L$ as $n\to\infty$.
- If for every $\varepsilon>0$ there is a corresponding integer N such that $|a_n - L|<\varepsilon$ when $n>N$
- If $\lim_{n\to\infty} a_n$ exists, the sequence <u>converges</u>. Otherwise, it <u>diverges</u>.
- If $\lim_{x\to\infty} f(x) = L$ and $f(n)=a_n$ when n is an integer, then $\lim_{n\to\infty} a_n = L$.
- $\lim_{n\to\infty} a_n = \infty$ means for all positive numbers M there exists an integer N such that $a_n > M$ when $n>N$

Limit Laws For Sequences

$\lim_{n\to\infty}(a_n+b_n)=\lim_{n\to\infty}a_n+\lim_{n\to\infty}b_n$	$\lim_{n\to\infty}(a_nb_n)=\lim_{n\to\infty}a_n\cdot\lim_{n\to\infty}b_n$
$\lim_{n\to\infty}(a_n-b_n)=\lim_{n\to\infty}a_n-\lim_{n\to\infty}b_n$	$\lim_{n\to\infty}\frac{a_n}{b_n}=\frac{\lim_{n\to\infty}a_n}{\lim_{n\to\infty}b_n}$ if $\lim_{n\to\infty}b_n\neq 0$
$\lim_{n\to\infty}ca_n=c\lim_{n\to\infty}a_n$	$\lim_{n\to\infty}c=c$