3.2: Nonlinear Models

Our basic pop. model is that the pop. grows at a rate proportional to the size of the population: $\frac{dP}{dt} = kP$

There are many important factors for which this does not account:

(1) limited resources

(2) harvesting/stocking

(3) immigration/emigration

and many more.

Construct a model where for small P, P's growth is roughly proportional to P. And if the pop. exceeds the carrying capacity, the growth rate should be negative.

$$\frac{dP}{dt} \approx kP \quad (\text{small } P)$$

$$\frac{dP}{dt} < 0 \quad \text{for} \quad P > K$$

that is $\frac{dP}{dt} \propto \left(1 - \frac{P}{K}\right)$

Together $\frac{dP}{dt} = kP\left(1 - \frac{P}{K}\right)$

3.2
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suppose we have the additional information that the population of splake in 2004 was estimated to be 5000. Use a logistic model to estimate the population of splake in the year 2020. What is the predicted limiting population? [*Hint:* Use the formulas in Problem 12.]

$\boxed{\begin{matrix}3.2\\3/4\end{matrix}}$

In 1990 the Department of Natural Resources released 1000 splake (a crossbreed of fish) into a lake. In 1997 the population of splake in the lake was estimated to be 3000. Using the Malthusian law for population growth, estimate the population of splake in the lake in the year 2020.

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Partial Fractions

$$\int \frac{x-9}{(x+5)(x-2)}\,dx$$

$$\int \frac{du}{a^2-u^2}$$

and talk about hyperbolics and their inverses.