

## Logistic Growth sample problems.

**1. Suppose a population of butterflies is growing according to the logistic equation. If the carrying capacity is 500 butterflies and  $r = 0.1$  individuals/(individual\*month), what is the maximum possible growth rate for the population?**

To solve this, you must first determine  $N$ , population size. From the plot of  $dN/dt$  vs.  $N$ , we know that the maximum possible growth rate for a population growing according to the logistic model occurs when  $N = K/2$ , here  $N = 250$  butterflies. Plugging this into the logistic equation:

$$\begin{aligned} DN/dt &= rN [1 - (N/K)] \\ &= 0.1(250)[1 - (250/500)] \\ &= 12.5 \text{ individuals / month} \end{aligned}$$

**2. A fisheries biologist is maximizing her fishing yield by maintaining a population of lake trout at exactly 500 individuals. Predict the initial instantaneous population growth rate if the population is stocked with an *additional* 600 fish. Assume that  $r$  for the trout is 0.005 individuals/(individual\*day).**

For a populations growing according to the logistic equation, we know that the maximum population growth rate occurs at  $K/2$ , so  $K$  must be 1000 fish for this population.

If the population is stocked with an additional 600 fish, the total size will be 1100. From the logistic equation, the initial instantaneous growth rate will be:

$$\begin{aligned} DN/dt &= rN [1 - (N/K)] \\ &= 0.005(1100)[1 - (1100/1000)] \\ &= -0.55 \text{ fish / day} \end{aligned}$$