LOGISTIC FUNCTIONS

Logistic functions can take the following forms

$f(x) = \frac{N}{1+Ab^{-x}}$

$f(x) = \frac{N}{1+Ae^{-kx}}$ (where $k = \ln b$)

for some constants *A*, *N*, and *b* ($b > 0$ and $b \neq 1$).

In both forms the N = ***the limiting value***

This mean when x is large, $f(x) \approx N$

In both forms the ***y-intercept*** = $\frac{N}{1+A}$

That means $f(0) = \frac{N}{1+A}$

Small values of *x* and the role of *b*

$f(x) = \frac{N}{1+Ab^{-x}} \approx f(x) = (\frac{N}{1+A})\, b^x$

For small *x*, the logistic function grows approximately exponentially with base *b*

Steps to Calculate a Logistic Function

1. *Identify the limiting value*
2. *Use the y-intercept formula to solve for constant A.* $f(0) = \frac{N}{1+A}$
3. *Based on the given data pick 2 of the smallest values of x and their corresponding y values and plug them into the TI-84/83 calculator*
4. *Calculate the exponential regression for the two values selected in step 3. In this case the b value for the exponential regression will be the same for logistic regression. (refer to small values of x and the role of b).*

Now you have all the required constants to complete the logistic function for a set of data.

Steps to Predict *x* with a Logistic Function

In other words you have the *f(x)* but you do not know the *x*. *To avoid confusion f(x) = y*

1. *Use the formula* $-x = \log_b(\frac{N-y-1}{A})$
2. *Based on the law of logarithms this means* $-x = \frac{\log(N-y-1)}{\log(b)} - \frac{\log(A)}{\log(b)}$
3. *Make sure to take the absolute value of the answer from step 3, to get the correct predicted value for x.*

Note: To predict *f(x) use the logistic function that you calculated in "Steps to Calculate a Logistic Function."*