We know that the general formula for the Logistic sigmoid growth curve is:

$$f(x) = \frac{M}{1 + e^{-k(x-x_0)}}$$

Where *M* is the curve's maximum value, *k* is the logistic growth rate and x_0 is the x-coordinate of the Sigmoid midpoint.

The only problem with applying this model to the data provided is that there are also negative values for *y*. This cannot be the case given that *f(x)* is always positive for all real values of *x*. In order to deal with this, we can attach a negative constant to the end of *f(x)*. The largest negative value of *y* is -0.3171173. Therefore, we can attach a constant of -1 for simplicity. Hence, the function will be:

$$f(x) = \frac{M}{1+e^{-k(x-x_0)}} - 1$$

We can see from the curve that the highest value of y is around 10. We can see from the data that the highest value is 10.0421165 at time = 31 and it then drops to 9.8477874 at time = 32. This means that the true value of *M* occurs anywhere in range:

$$31 \leq x < 32$$

Where *x* is the time.

For the purpose of just trying to get an estimate of the parameters for the growth curve, we can assume the value at *x* = 31 to be the highest value. However, because of the -1 we put at the end of *f(x)*, we must add 1 to this value to get *M* hence *M* = 11.0421165.

Since x_0 is the point where the maximum intensity of the curve is achieved, we can first calculate 0.5 * 10.0421165 which equals: 5.02105825. Therefore, we can say that x_0 = 5.02105825 for the purposes of estimation.

The next step is the calculation of the logistic growth rate, *k*. The first way I have done this is by first rearranging the function in terms of *k*, shown below.

$$k = \frac{\ln\left(\frac{M}{y+1} - 1\right)}{x_0 - x}$$

The method I then used is to calculate the *k* values for all the data points provided using a program in R and then used that program to calculate the average of those *k* values. The R program used to do this is in this folder in this repository titled 'Easy R Test.R'. The value obtained by running this program is k = 3.349129. Hence, the model obtained is:

$$y = \frac{11.0421165}{1+e^{-3.349129(x-5.02105825)}} - 1$$