Data used for calculating $e$ and $a$:

| No. of weeks | Date | Recovered | Death | Infected $I(t)$ | Recovered + Death $R(t)$ | $e$ | $a$ |
|---|---|---|---|---|---|---|---|
| 0 | March, 02 | 0 | 0 | 1 | 0 | 0 | 0 |
| 1 | 9 | 0 | 0 | 1 | 0 | 0 | 0 |
| 2 | 16 | 0 | 0 | 4 | 0 | 0 | 0 |
| 3 | 23 | 0 | 0 | 33 | 0 | 0 | 0 |
| 4 | 30 | 14 | 6 | 57 | 20 | 10129659 | 0.5399 |
| 5 | April, 6 | 45 | 11 | 308 | 56 | 5999957 | 0.3532 |
| 6 | 13 | 103 | 17 | 472 | 120 | 7905346 | 0.2946 |
| 7 | 20 | 186 | 23 | 663 | 209 | 9347382 | 0.23569 |
| 8 | 27 | 332 | 25 | 646 | 357 | 13881166 | 0.229706 |
| 9 | May, 04 | 585 | 29 | 471 | 614 | 22069738 | 0.23207 |
| 10 | 11 | 801 | 30 | 444 | 831 | 25418440 | 0.144821 |
| 11 | 18 | 1002 | 34 | 556 | 1036 | 25378907 | 0.109755 |
| 12 | 25 | 1164 | 56 | 700 | 1220 | 24780630 | 0.08366 |
| 13 | June, 01 | 1491 | 88 | 1213 | 1579 | 22055444 | 0.126135 |
| 14 | 08 | 1742 | 142 | 1858 | 1884 | 19634551 | 0.08985 |
| 15 | 15 | 2766 | 187 | 2240 | 2953 | 22175879 | 0.20088 |

Avg $e$ = 13918475

Avg $a$ = 0.176019

## Derivation for $e$ :-

$$\frac{dI}{dt} = rSI - aI \quad \text{and} \quad \frac{dS}{dt} = -rSI$$

dividing both the equations,

$$\frac{dI}{dS} = -\frac{(rS-a)I}{rSI} = -1 + \frac{\rho}{S} \qquad \text{where } \rho = \frac{a}{r}$$

$$dI = -dS + \frac{\rho}{S} dS$$

Integrating both sides;

$$I + S - \rho \ln S = \text{constant} = c$$

From initial condition;

$$I_0 + S_0 - \rho \ln S_0 = c$$

Therefore;

$$I + S - \rho \ln S = I_0 + S_0 - \rho \ln S_0$$

$$I + S - \rho \ln S = N - \rho \ln S_0$$

$$N - (I + S) = \rho(\ln S_0 - \ln S)$$

$$R(t) = \rho \ln\left(\frac{S_0}{S}\right)$$

$$\boxed{\rho = \frac{R(t)}{\ln\left(\frac{S_0}{S}\right)}}$$

Formula used for calculating a:

$$\frac{dR}{dt} = a\left[N - S_0 + \left(\frac{S_0}{\rho} - 1\right)R - \frac{S_0 R^2}{2\rho^2}\right]$$