Table 1 shows data on the percentage of voluntary nonprofit hospitals in the United States with Intensive Care Units during the period 1958 to 1974. These hospitals in this survey had between 200 and 299 beds.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>%</td>
<td>14</td>
<td>16</td>
<td>22</td>
<td>33</td>
<td>38</td>
<td>47</td>
<td>54</td>
<td>65</td>
<td>86</td>
<td>90</td>
<td>91</td>
<td>92</td>
<td>93</td>
<td>95</td>
<td>96</td>
</tr>
</tbody>
</table>

Table 1. Data on the percentage of voluntary nonprofit hospitals in the United States with Intensive Care Units during the period 1958 to 1974. Gaps for 1966 and 1967 indicate years in which data is not available from the survey. Data is from [1]

Activities

1. Graph the data in Table 1. Hint: Make $t = 0$ correspond to year 1958.

2. Suppose we let $P(t)$ be the percentage of voluntary nonprofit hospitals in the United States with Intensive Care Units at time $t = 0$. Assume the units for $t$ are in years and $t = 0$ corresponds to year 1958. Give an argument for why the logistic differential equation,

$$P'(t) = rP(t) \frac{100 - P(t)}{100},$$

is a good candidate for modeling this data. Be sure to address the meanings of the rate of change in $P(t)$, the value of 100, the parameter $r$, and the algebraic nature of the right hand side of the differential equation.

3. Fit a logistic curve (the solution to (1)) to the data in Table 1.
4. Locate, using your eye only, the year and percent during which there was the greatest increase in $P(t)$.

5. From your final model from (3) determine when $P'(t)$ is greatest.

6. How do your answers to (4) and (5) compare?

7. Suppose you only had the data for years 1958-1965, but there was a consensus that the percentage of voluntary nonprofit hospitals in the United States with Intensive Care Units would grow according to (1). Fit a logistic curve (the solution to (1)) to this smaller data set from Table 1.

8. Discuss how you could use your results from (7) in a policy discussion for the progress of medical care in the country.

REFERENCES