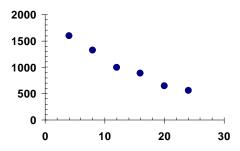
## **Solution 17.27**

## (a) The data can be plotted

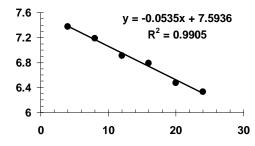


The plot indicates that the data is somewhat curvilinear. An exponential model (i.e., a semi-log plot) is the best choice to linearize the data. This conclusion is based on

- A power model does not result in a linear plot
- Bacterial decay is known to follow an exponential model
- The exponential model by definition will not produce negative values.

The exponential fit can be determined as

t (hrs)	c (CFU/100 mL)	In c
4	1600	7.377759
8	1320	7.185387
12	1000	6.907755
16	890	6.791221
20	650	6.476972
24	560	6.327937



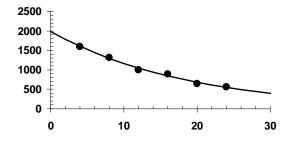
Therefore, the coefficient of the exponent ( $\beta_1$ ) is -0.0535 and the lead coefficient ( $\alpha_1$ ) is  $e^{7.5936} = 1985.437$ , and the fit is

$$c = 1985.437e^{-0.0535t}$$

Solution continued on the next page...

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Consequently the concentration at t = 0 is 1985.437 CFU/100 ml. Here is a plot of the fit along with the original data:



(b) The time at which the concentration will reach 200 CFU/100 mL can be computed as

$$200 = 1985.437 \ e^{-0.0535t}$$

$$\ln\left(\frac{200}{1985.437}\right) = -0.0535t$$

$$t = \frac{\ln\left(\frac{200}{1985.437}\right)}{-0.0535} = 42.8973 \text{ d}$$