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Prerequisite Section 5.2, Modeling data with power functions

Comments
The sample data shown here was obtained using a string and a spool of thread for a pendulum. Lengths of string varying from about 15 inches to about 36 inches were given to students, and they tied the string to the spool and the stand.

In the conclusion of the lab, students are encouraged to experiment to verify their finding that the period of a pendulum depends only on the length. One should note that in fact this is only true if the angle of release is less than about 20 degrees. Students could also experiment with bobs of different weights to verify that the relation does not depend on the weight of the bob.

Sample Data

<table>
<thead>
<tr>
<th>Length (inches)</th>
<th>5</th>
<th>9</th>
<th>12</th>
<th>16</th>
<th>20</th>
<th>25</th>
<th>28</th>
</tr>
</thead>
<tbody>
<tr>
<td>Period (seconds)</td>
<td>0.75</td>
<td>1.00</td>
<td>1.16</td>
<td>1.30</td>
<td>1.46</td>
<td>1.63</td>
<td>1.69</td>
</tr>
</tbody>
</table>

Answers to Questions
1. Here is the plot of the data.

![Plot of data](image)

2. Since the graph is increasing, the power should be greater than 0. Note also that the graph is concave down, so the power should be between 0 and 1. We estimate that the power \( k \) is about 0.5, since the graph resembles that of the square root function.

3. Here is the graph of \( \ln P \) versus \( \ln L \).

![Graph of ln P vs ln L](image)
The period of the pendulum does appear to be a power function of the length since the graph of \( \ln P \) versus \( \ln L \) is approximately linear.

4. The equation of the regression line is \( \ln P = 0.474 \ln L - 1.043 \).

5. Since \( e^{-1.043} \) is about 0.35, we take \( P = 0.35L^{0.47} \).