In[62]:=
```
Remove["Global`*"]
```

Data Manipulations.

The period of a pendulum made of a light string of length l and massive bob is given by t where g is the acceleration due to gravity. Data d gives values of time in seconds, for ten swings of the pendulum, at given lengths in inches.

In[63]:=
```
d = {{70, 26.75}, {59, 24.86}, {47, 21.81}, {33, 18.29}, {26, 16.13}, {19, 13.78}, {8, 8.87}}
```

Out[63]=
```
{{70, 26.75}, {59, 24.86}, {47, 21.81}, {33, 18.29}, {26, 16.13}, {19, 13.78}, {8, 8.87}}
```

In[64]:=
```
t = (2 Pi) * Sqrt[l / g]
```

Out[64]=
$$2\sqrt{\frac{l}{g}}\,\pi$$

In[65]:=
```
s = Solve[t == T, g][[1]]
```

Solve: Solutions may not be valid for all values of parameters.

Out[65]=
$$\left\{g \to \frac{4\,l\,\pi^2}{T^2}\right\}$$

Values of length converted to meters

In[66]:=
```
lv = d[[All, 1]] * (2.54)
```

Out[66]=
```
{177.8, 149.86, 119.38, 83.82, 66.04, 48.26, 20.32}
```

Values of time in seconds

In[67]:=
```
tv = d[[All, 2]]
```

Out[67]=
```
{26.75, 24.86, 21.81, 18.29, 16.13, 13.78, 8.87}
```

Values of g for each data point

In[68]:=
```
gv = g /. s /. {T → tv, l → lv}
```

Out[68]=
```
{9.80943, 9.57289, 9.90786, 9.89191, 10.0207, 10.0334, 10.1961}
```

Average value of g

In[69]:=
```
ag = Mean[gv]
```

Out[69]=
```
9.91891
```

In[70]:=
```
std = StandardDeviation[gv]
```

Out[70]=
```
0.197018
```

Average value of g plus and minus standard deviation

In[71]:=
```
c1 = ag + std
c2 = ag - std
```

Out[71]= 10.1159

Out[72]= 9.72189

In[73]:=
```
t1 = (2 Pi) * Sqrt[l / ag] (*Period at average gravity*)
t2 = 2 Pi Sqrt[l / c1] (*Period at average gravity + standard deviation*)
t3 = 2 Pi Sqrt[l / c2] (*Period at average gravity - standard deviation*)
```

Out[73]= $1.99502\ \sqrt{l}$

Out[74]= $1.9755\ \sqrt{l}$

Out[75]= $2.01514\ \sqrt{l}$

In[76]:=
```
Show[ListPlot[d], Plot[{t1, t2, t3}, {l, 0, 80}]]
```

Out[76]=