Calculations for a tuned pipe.

The formulas

$$f = \frac{A}{L^2}$$

$$A = f * L^2$$

$$L = \sqrt{\frac{A}{f}}$$

Where:
f is frequency in Hz
L is length of pipe in mm
A is a constant derived from the inner and outer diameter of the pipe and how fast sound travels in the material the pipe is made of. In other words, beyond the scope of discussion here.

To establish A

Go to your local hardware or home improvement store and purchase a long length of pipe. Cut a section of the pipe to a known length, such as 200mm. Mount the cut section on the test stand and strike with a mallet measuring the frequency of the resulting sound.

```
measuredLength = UnitConvert[200 mm, "Millimeters"] // Normal
```

```
measuredFrequency = UnitConvert[2257 Hz, "Hertz"] // Normal
```

Out[ ]=

200 mm

Out[ ]=

2257 Hz

In[•]:=
```
A = measuredFrequency * measuredLength^2
```

Out[•]=
$$90\,280\,000\ \text{mm}^2\,\text{Hz}$$

Calculating the length of pipes for the notes

So now we can use the calculated value for A to compute the length of pipe to cut for a specific note. FROM THE SAME PICE OF PIPE. If you use another piece of pipe, you must recalculate A, for the new pipe.

So, in this example to calculate the length of pipe for the note G_3 we first need to find the frequency for the note.

In[•]:=
```
cutPipeLength1 = Sqrt[A / UnitConvert[196. Hz, "Hertz"]] // Normal
```

```
cutPipeLength2 = Sqrt[A / UnitConvert[329.36 Hz, "Hertz"]] // Normal
```

```
cutPipeLength3 = Sqrt[A / UnitConvert[261.4 Hz, "Hertz"]] // Normal
```

Out[•]=
678.684 mm

Out[•]=
523.553 mm

Out[•]=
587.683 mm

In[•]:=

```
UnitConvert [cutPipeLength1, "Feet"]
UnitConvert [cutPipeLength2, "Feet"]
UnitConvert [cutPipeLength3, "Feet"]
```

Out[•]=

2.22665 ft

Out[•]=

1.71769 ft

Out[•]=

1.92809 ft