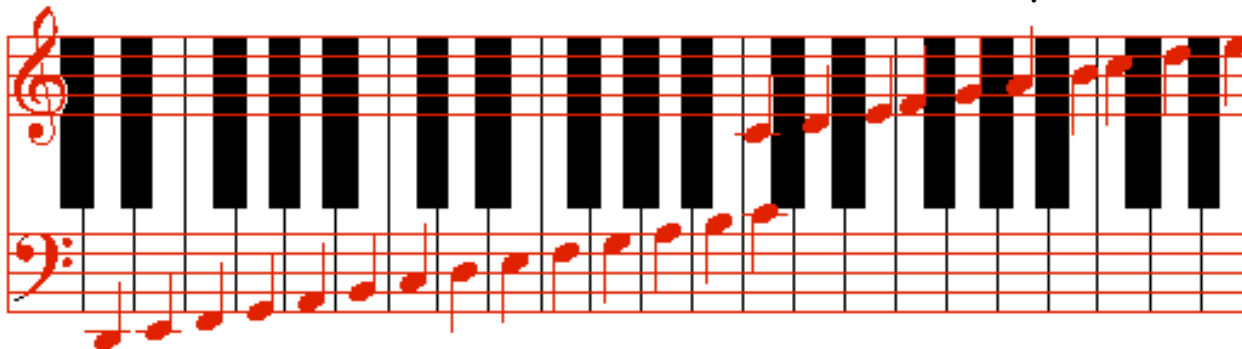


Is the Musical Scale and Arithmetic or Geometric Sequence?



The Frequencies in Hertz (vibrations per second) of the notes in the scale produced by a piano for A below middle C to A above middle C are:

A	440.000
G#	415.305
G	391.995
F#	369.994
F	349.228
E	329.629
D#	311.127
D	293.665
C#	277.183
C	261.626
B	246.942
A#	233.082
A	220.000

Do these frequencies form arithmetic or geometric sequences?

What is the common difference (if arithmetic) or ratio (if geometric)?

Does this constant have any meaning related to musical scales?

Notice that the frequency of A 440 is exactly twice that of A 220. This is no mere coincidence. For any two notes that are an octave apart, the ratio of the frequency of the high note to the frequency of the low note is always 2:1. Since there are 12 pitches in all the notes between A 220 and A 440, the sequences of pitches are either arithmetic ($d = (440-220)/12$) or geometric ($r = \sqrt[12]{2}$).

The Acoustical Society of America (<http://asa.aip.org/sound.html>) offers an Auditory Demonstrations CD prepared at the Institute for Perception Research (IPR) The Netherlands. Among the demonstrations is a musical scale with pitches based on an arithmetic sequence, and a musical scale with pitches based on a geometric sequence. The demo is called "Logarithmic and linear frequency scales." If you are still not sure whether the scale is arithmetic or geometric, listening to the demo will help you decide!