

**THE
MATHEMATICS OF
MUSIC |**

**THE MUSIC OF
MATHEMATICS**

**"Music is a secret arithmetical
indulges in it does not realize that**

**-Gottfried Leibniz 1646-1716,
contemporary of J. S. Bach.**

**exercise and the person who
he is manipulating numbers."**

an inventor of the calculus and a

As in music, the dominant themes in math repetition. Musical pitches follow a measures are divided into wholes, halves, ratios. Each skip of an octave in pitch is a

are pattern, symmetry, structure, and mathematical pattern of ratios. Musical quarters, and eighths. Rhythms mesh in doubling of frequency.

Symmetry

Many musical compositions show symmetry theme (short melody) is repeated many the piece. When the theme is repeated it slide or translation) or it may be played upside down (another kind of reflection). twice as slowly or shrunk so that it goes "Row, Row Your Boat" as a round you have

J. S. Bach's Musical Offering is probably symmetry in music.

and Music

in their structure. In many musical forms a times, often with small changes, throughout may simply start later than the original (a backwards (a flip or reflection), or played The theme may be stretched so that it goes twice as fast. If you have ever sung "Row, used symmetry in your music.

the most famous example of mathematical

The Crab Canon from The

Musical Offering (as Bach wrote it)



**Can you figure out what symmetry he used
in writing this piece of music?**

