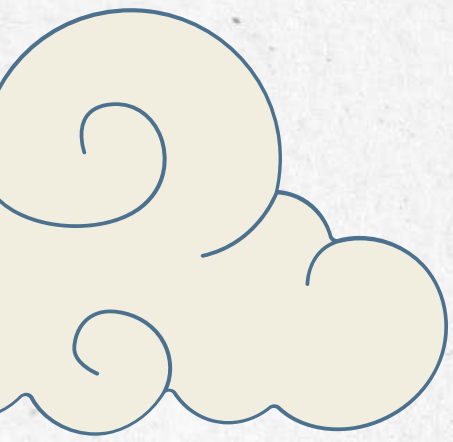


Chinese Traditional music

Applications of patterns and physics



Music as the sound of numbers

Pythagoras: Numbers are the essence of everything.

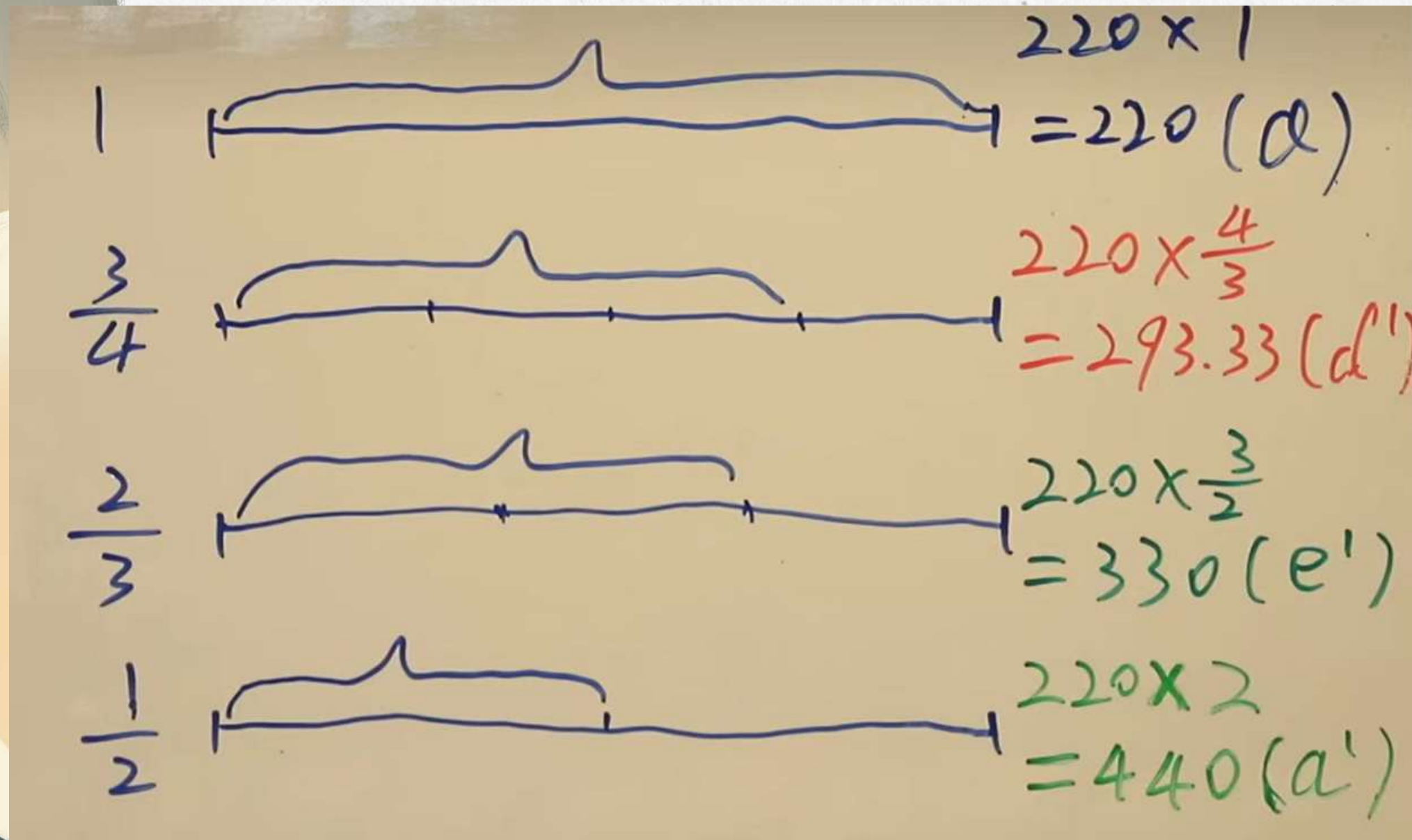
2:1 ratio makes an octave, 3:2 makes a fifth, 4:3 makes a fourth.

He proposed the Harmony of the Spheres and **Pythagorean tuning system**.

Ancient China reached a very similar understanding through a different path — the **Sanfen Sunyi system**, literally meaning the “Three-part losses and gains” system.



Basic calculation principle



Octave: $\frac{2}{1}$

Fifth: $\frac{3}{2}$

Fourth: $\frac{4}{3}$

->Example:

Fifth+Fourth: $\frac{3}{2} \times \frac{4}{3} = \frac{2}{1}$ (octave)

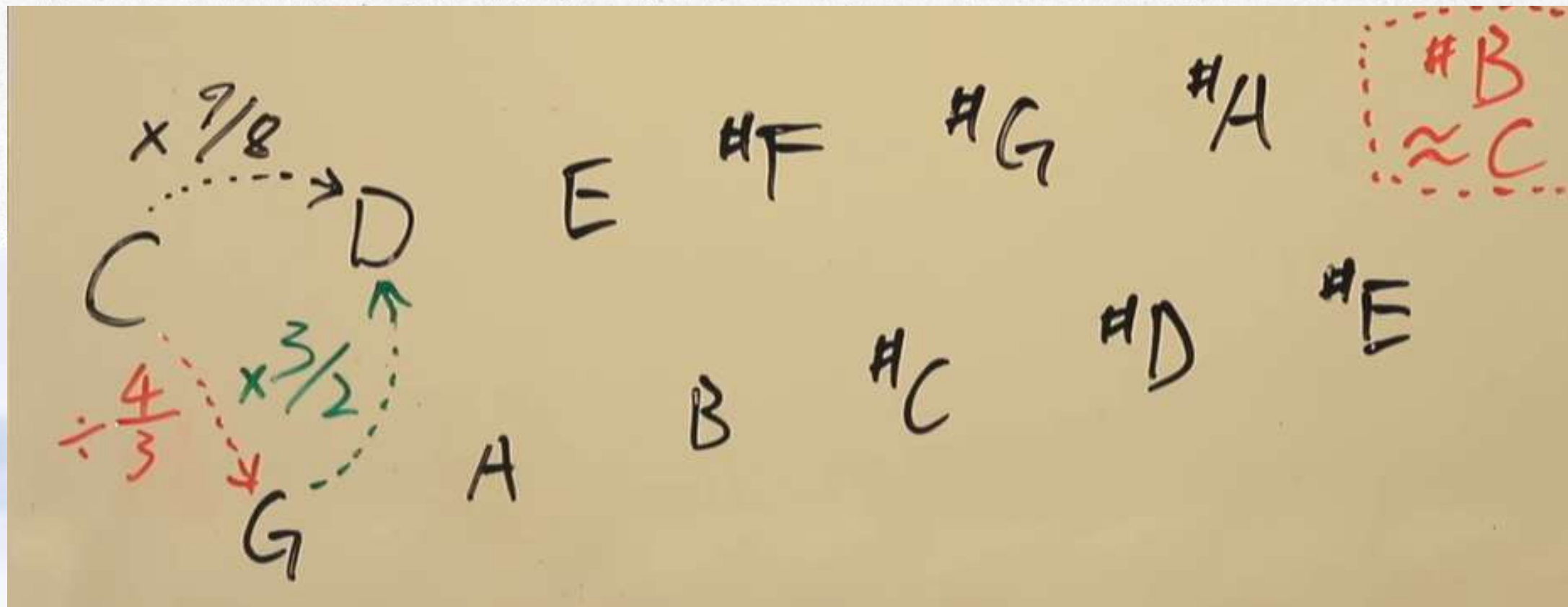
Second=Fourth-Fifth: $\frac{4}{3} - \frac{3}{2} = \frac{1}{6}$

Third=Second+Second: $\frac{1}{6} + \frac{1}{6} = \frac{2}{6} = \frac{1}{3}$

Take Pythagorean tuning system as an example,
integers from 1-4 can form perfect harmony



Sanfen Sunyi system("Three-part losses and gains" system)



C->G: decrease fourth(losses-divide)

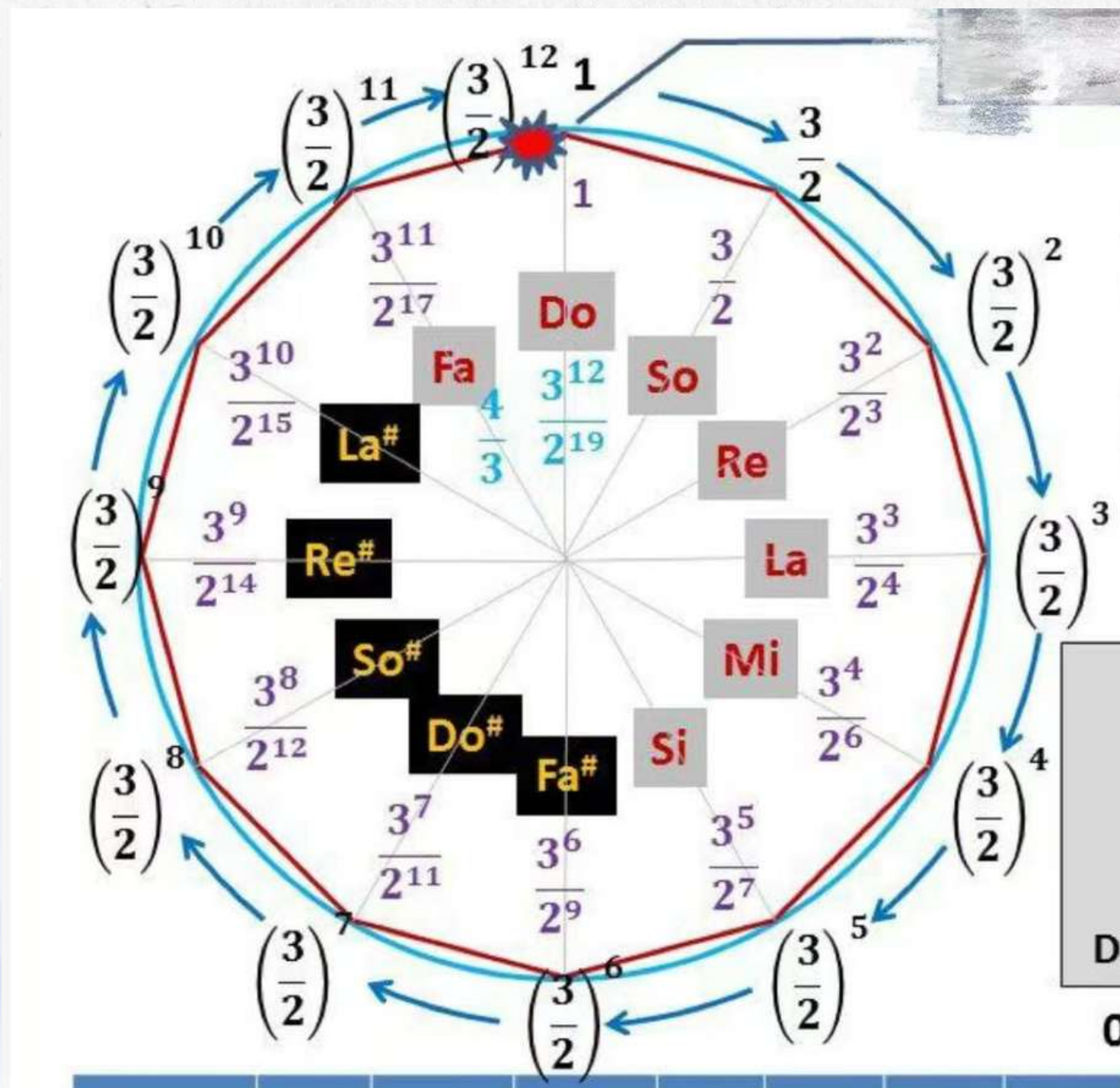
G->D:increase fifth(gains-multiply)

Combine:

C->D:increase second

That's how we create the whole set of intervals using Sanfen Sunyi system.

Noted: #B and C is the same note on piano, but seen a slight deviation in Sanfen Sunyi.



There's a similarity in Sansheng Sunyi System and the Golden Ratio. Sansheng Sunyi System uses a ratio of $\frac{3}{2}$ to create the cycle. One thing different is the inaccuracy (compared to 0.618...) leads to a broken cycle as the last note has a small deviation.

Source: <https://zhuanlan.zhihu.com/p/490255399>

Golden Ratio in other Chinese traditional music

“起承转合” (Introduction-Development-Transition-Resolution)

Many pieces in traditional Chinese music put the transition/peak at $\frac{3}{4}$ position.



Flowing Water, classic ancient Chinese guqin masterpiece, perfect example of Golden Ratio in music

Sources

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