# SOLVITMEDIA MEMO

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Subject:     Relationship between balance and volume

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## Mathmatical description of the relationship between balance and physical volume in SoundIt[®]

Denotation of Volume, $V = (V_L , V_R)$, where $V_L$ is the left volume and $V_R$ is the right one.

For V,   it holds the following:

1. $V_L^2 + V_R^2 = R^2$, where R is constant. That is,   Volume V can be thought that it goes through real-imaginary coordinate with radious of R.

2. Denoting the angle between   $V_L$-axis, $(V_L , 0)$ and volume vector V, $(V_L , V_R)$ as $\theta$,
$$V_L = X(\theta) \quad \text{and} \quad V_R = Y(\theta),$$ where X and Y are functions on angle $\theta$.

3. [Boundary condition] $V_L$ and $V_R$ exist between 0 and R, which means that  $\theta$ ranges from 0 to $\pi/2$.

Thinking from the conditions above, we can choose the angle $\theta$  as balance variable so that we can calcurate new Volume V´ when given new $\theta´$ :

$$V_L´ = R \cos \theta´ \text{ and } V_R´ = R \sin \theta´ \qquad \text{------------------------ (1)}$$

Reversly, we can also determine the angle  $\theta$  from given vector, V.

$$\theta = tan^{-1}(V_R/V_L) \qquad \text{------------------------ (2)}$$

VR

VL

**65535**