

การใช้ Computer graphics
สร้างงานศิลปะ เพื่อแสดงความ
สวยงามของคณิตศาสตร์

Computer Graphics



สร้างข้อมูล

รูปทรง

- สี่เหลี่ยมสี่แฉก ขนาด 3x4 ซม.
- ทรงกลมสี่ขวາ เส้นผ่านศูนย์กลาง 2 ซม.

การจัดวาง

- วงกลมอยู่ข้างสี่เหลี่ยม
- สามเหลี่ยมอยู่กลางภาพ
- ทรงกลมอยู่บนลูกบาศก์

Projection

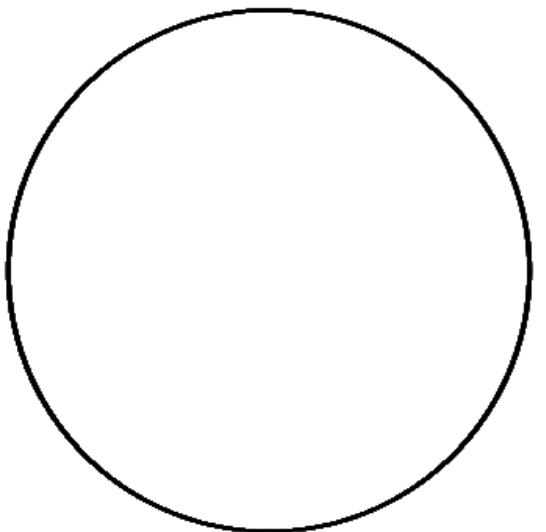


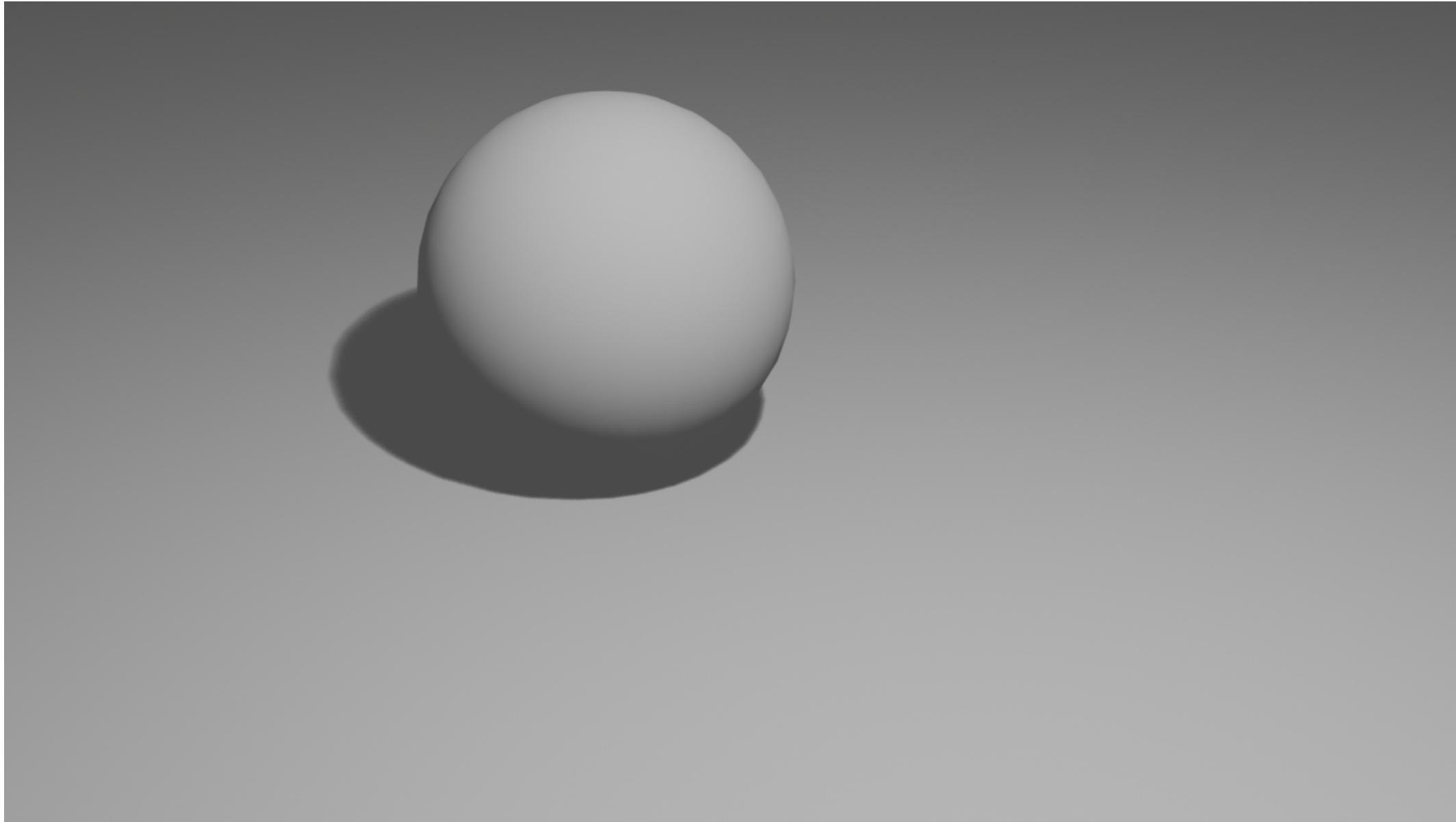
Projection



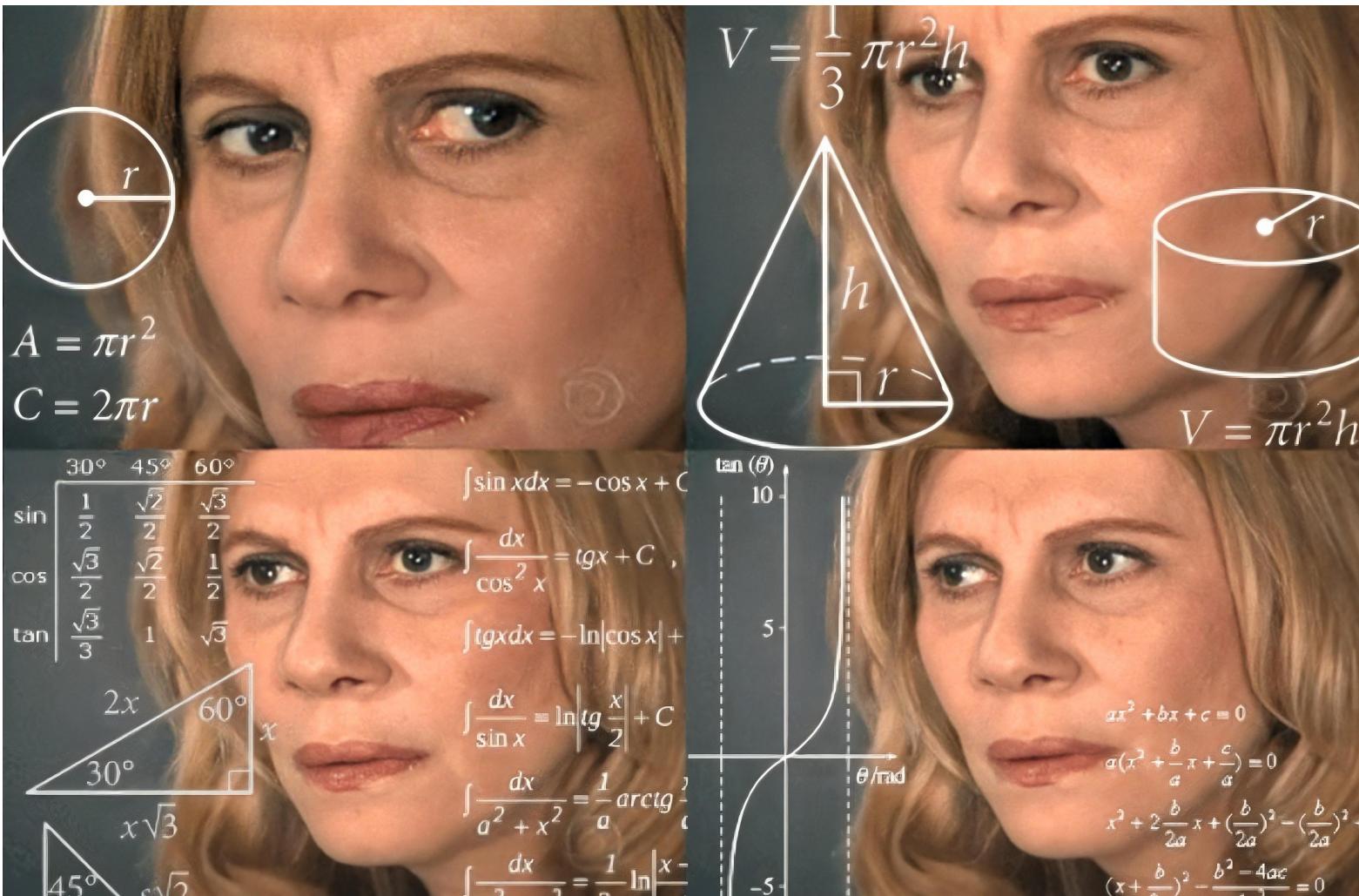


Shading





Math



$$p(t) = \vec{ray}_{origin} + \vec{ray}_{direction} \cdot t$$

$$dencity(\vec{v}) = \min_{i,j \in [-1,0,1]} \left(|\vec{v} - rand3 \left(\lfloor \vec{v} \rfloor + \begin{bmatrix} i \\ j \end{bmatrix} \right)| \right)$$

$$color(\vec{v}) = |\vec{v}| \cdot color_1 + (1 - |\vec{v}|) \cdot color_2$$

$$FinalColor = \int_0^L color(p(t)) \cdot dencity(p(t)) \cdot dt$$

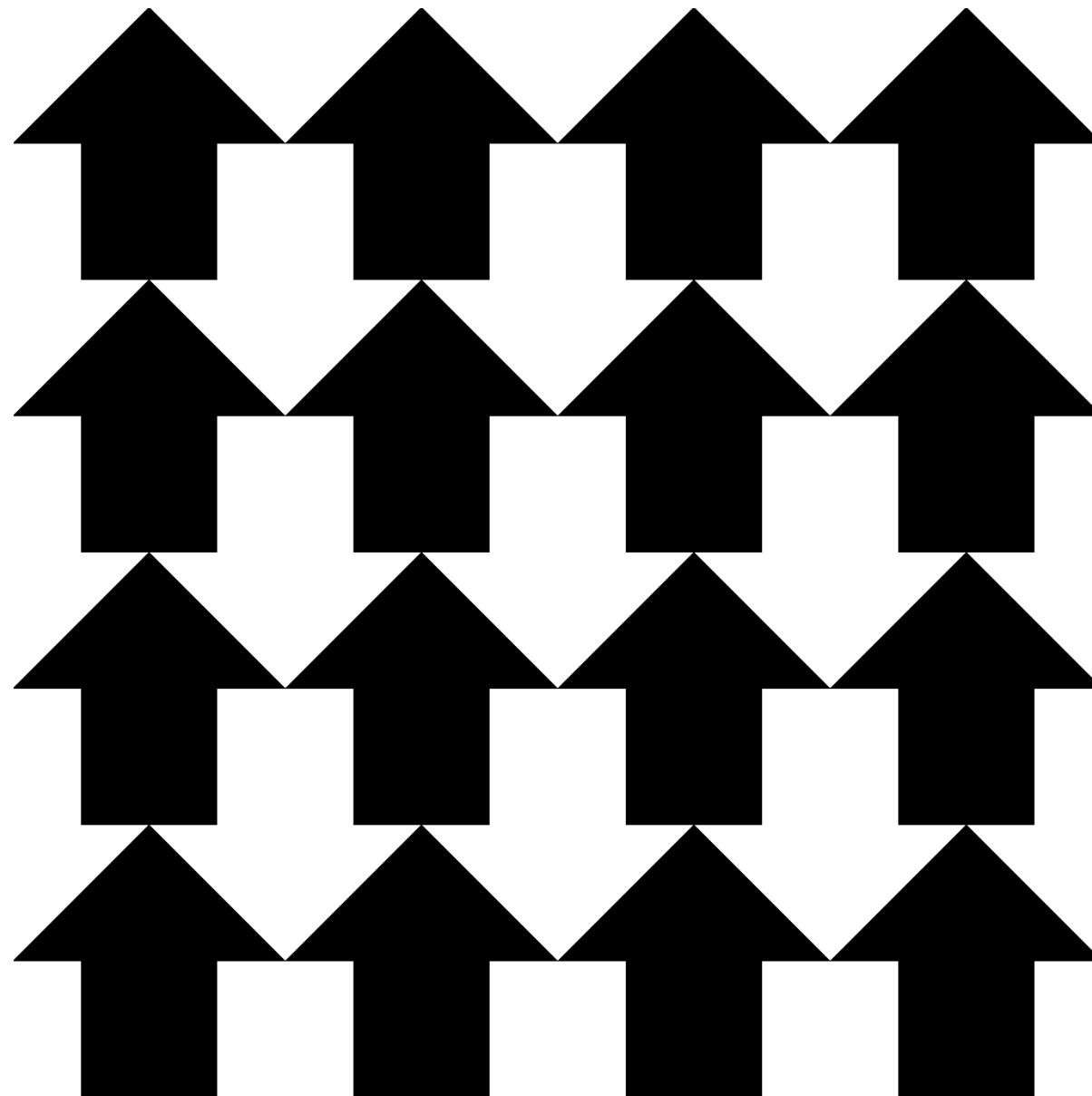
$$a^n = \underbrace{a \times a \times a \times \dots \times a}_n$$

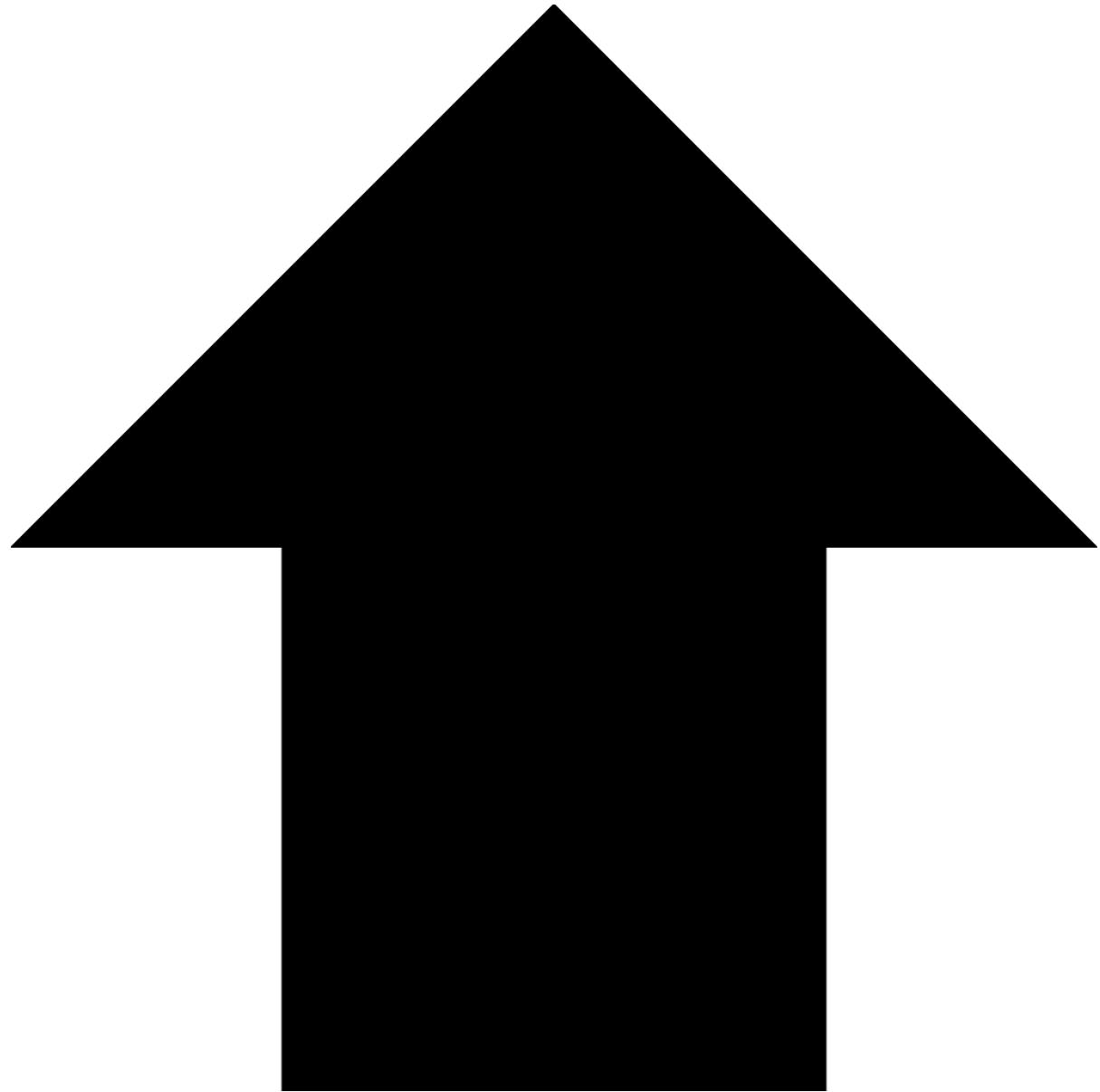
$$4^2 = 4 \times 4$$

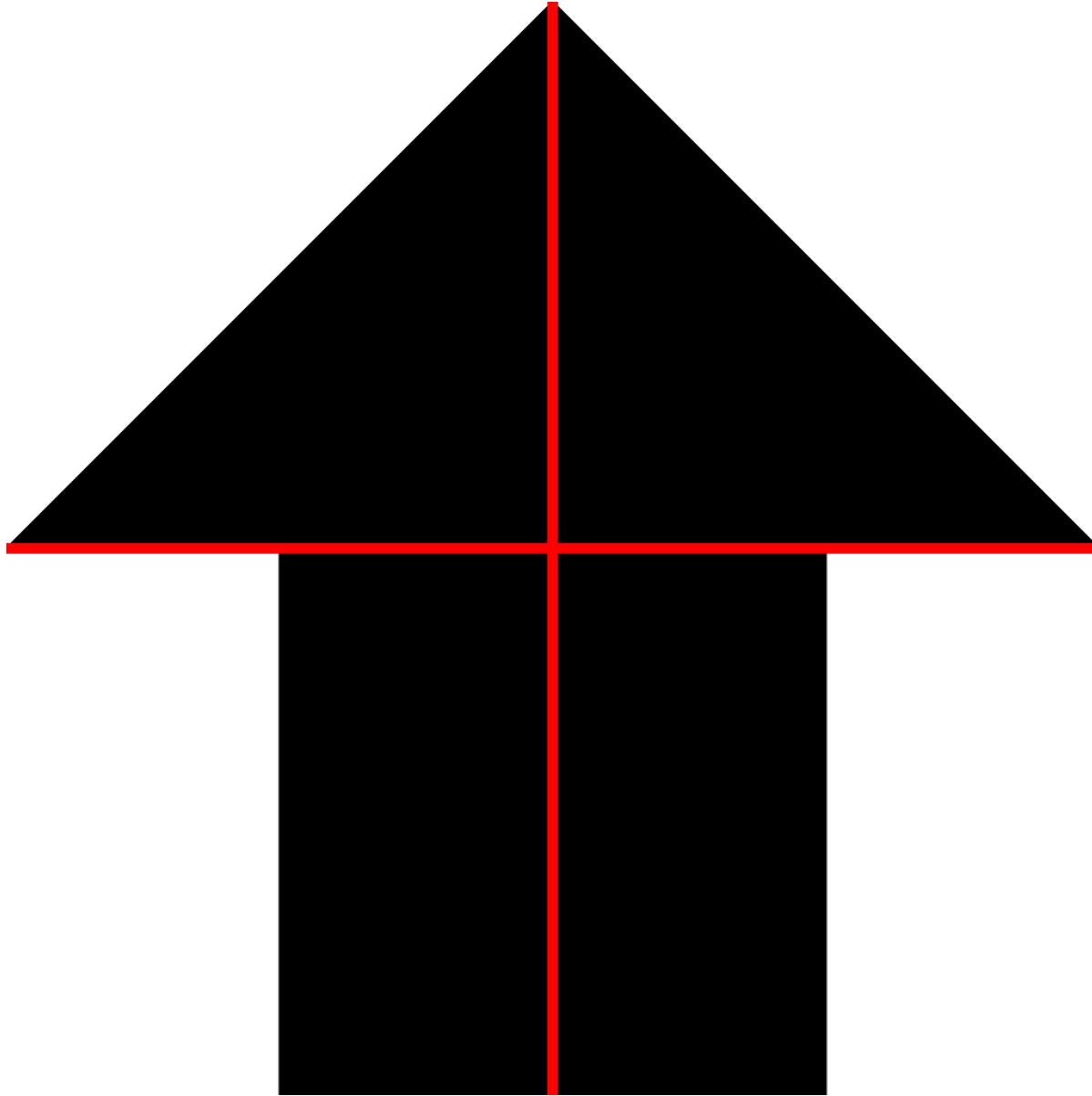
$$a \times b = \underbrace{a + a + a + \dots + a}_b$$

$$4 \times 4 = 4 + 4 + 4 + 4$$

แล้วมันเชื่อมโยงกับ Computer
Graphics อย่างไร

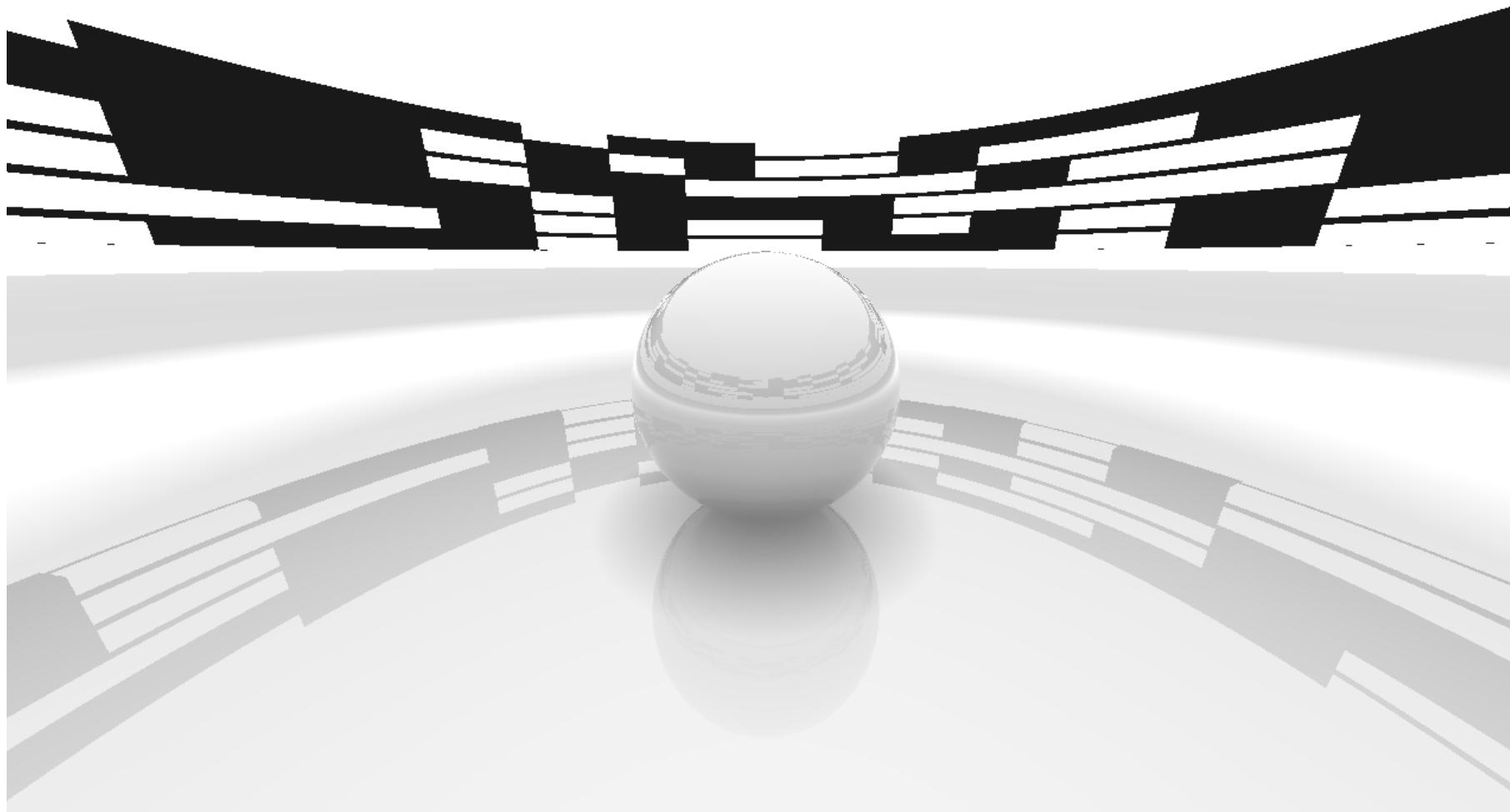






ทำไม้ถิงเลือกทำหัวข้อนี้

Reflection of Randomness

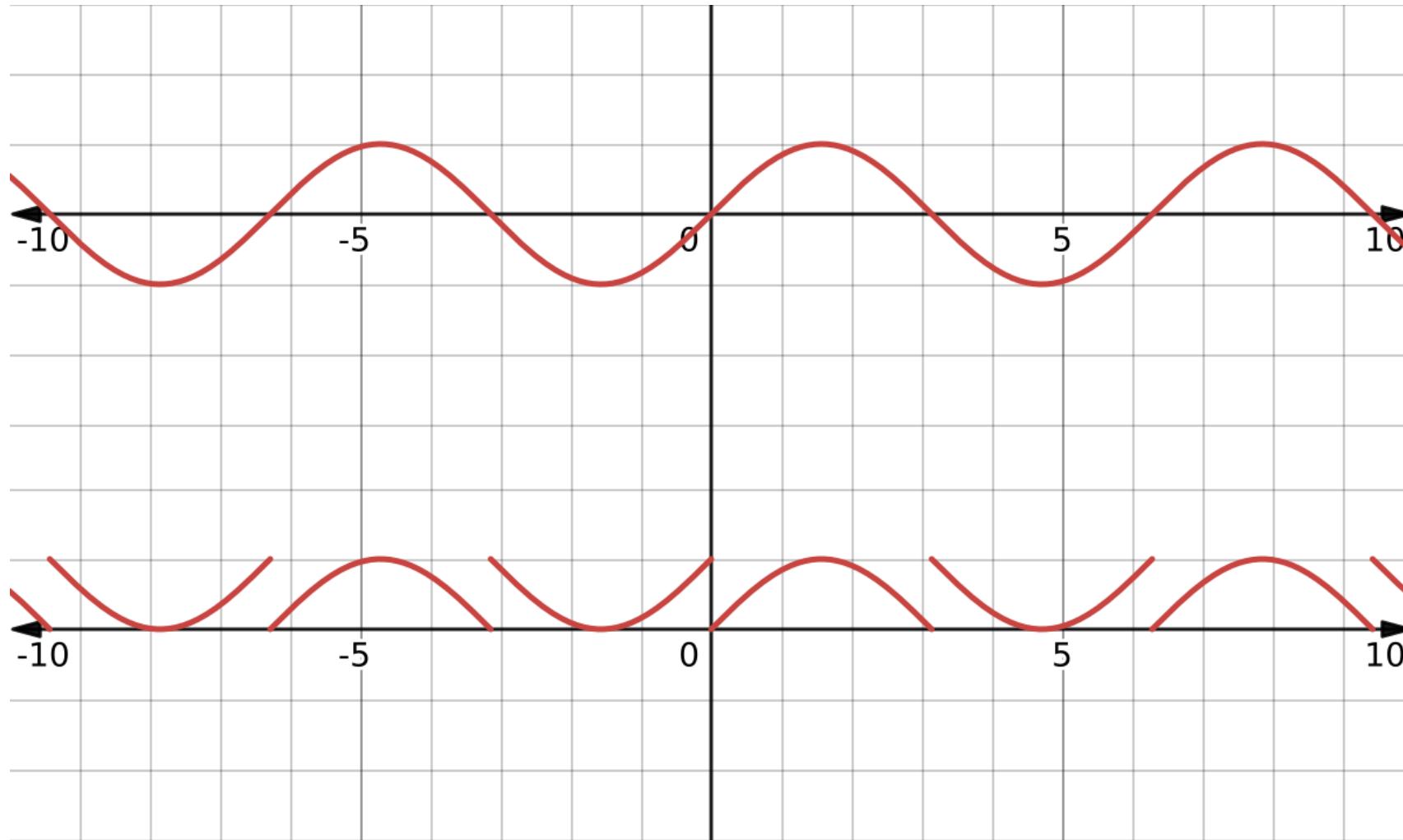


សំណុំ

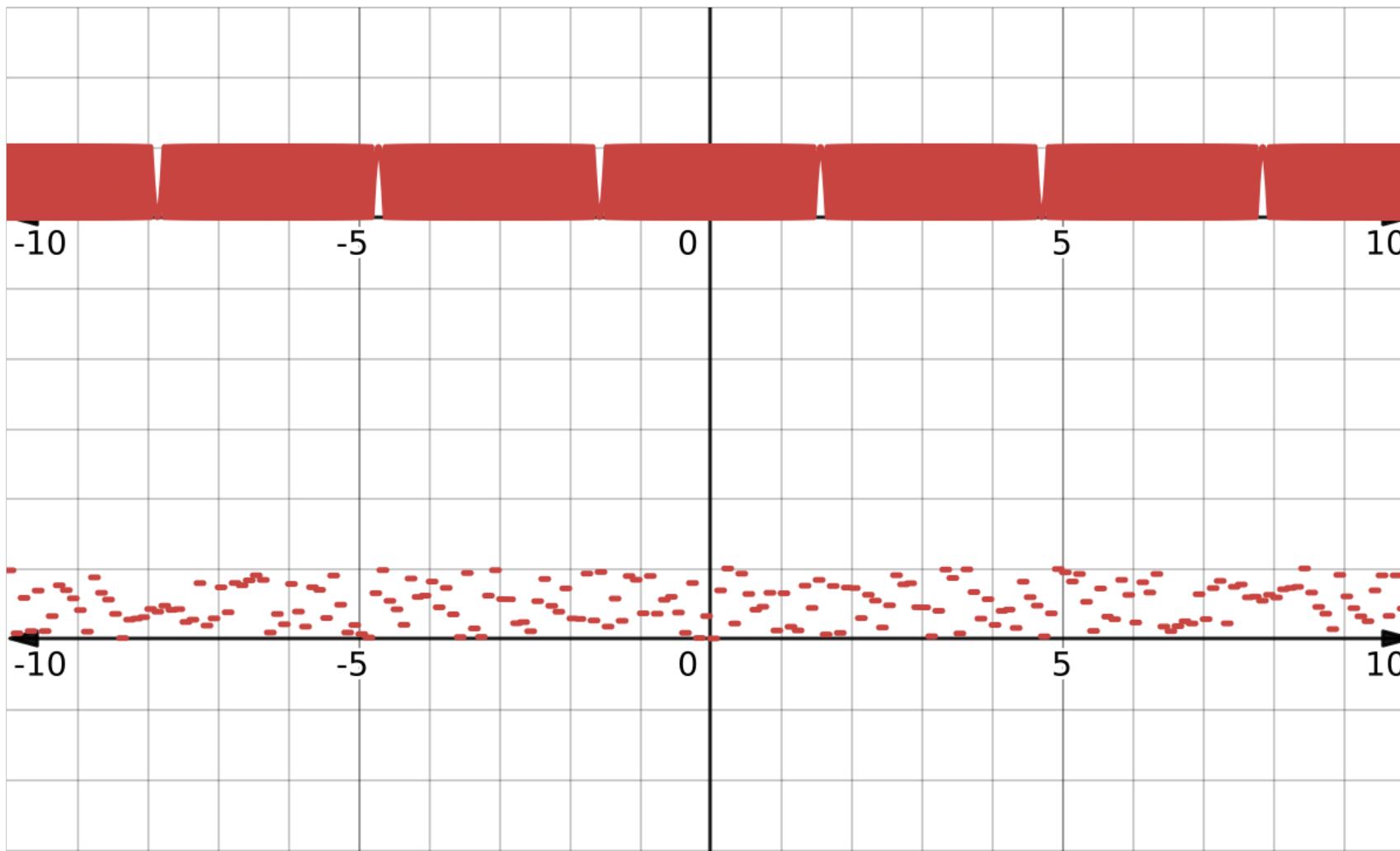


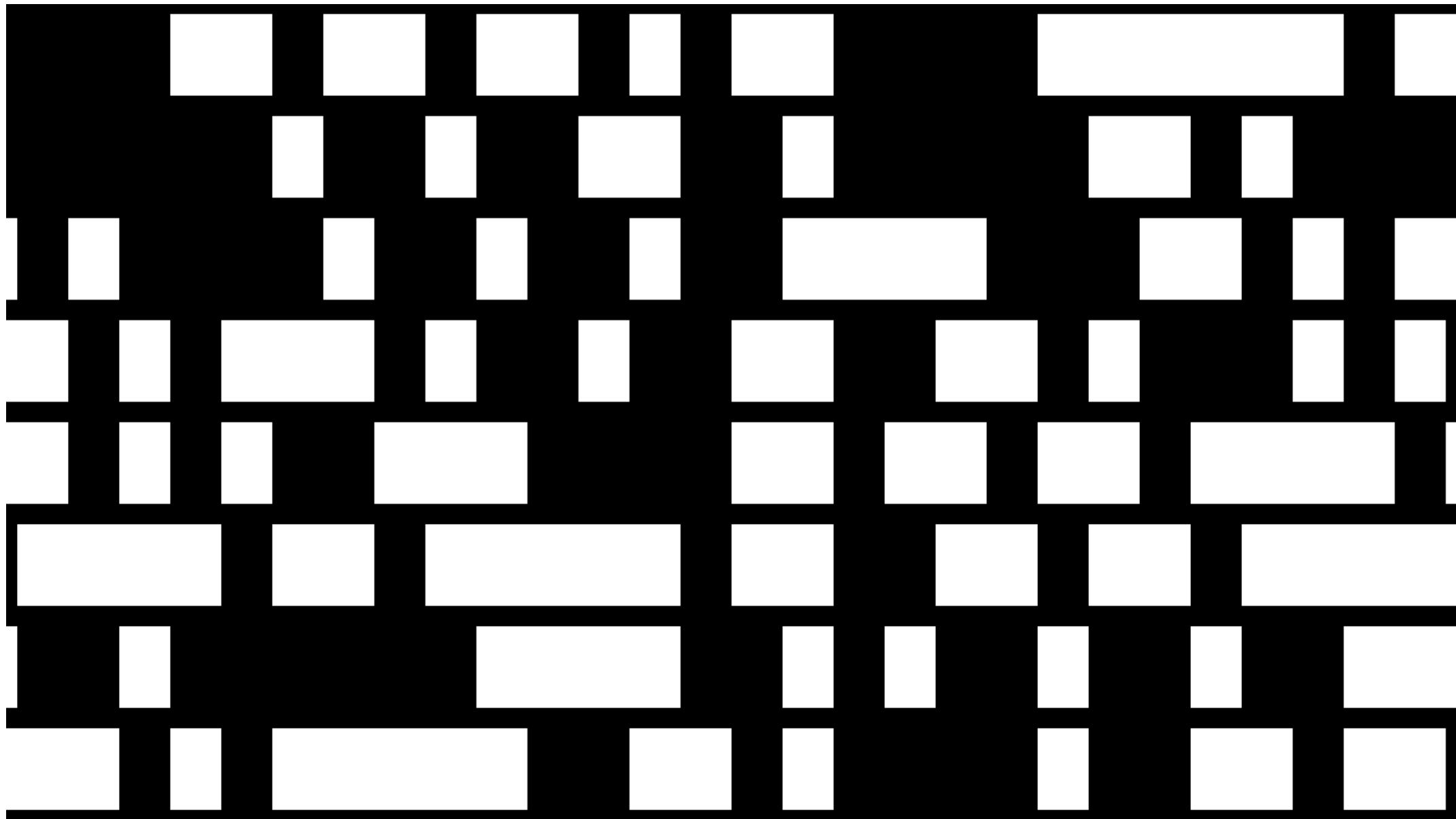
```
fract( big_number * sin( x ) )
```

$\sin(x)$ (บน), $\text{fract}(\sin(x))$ (ล่าง)

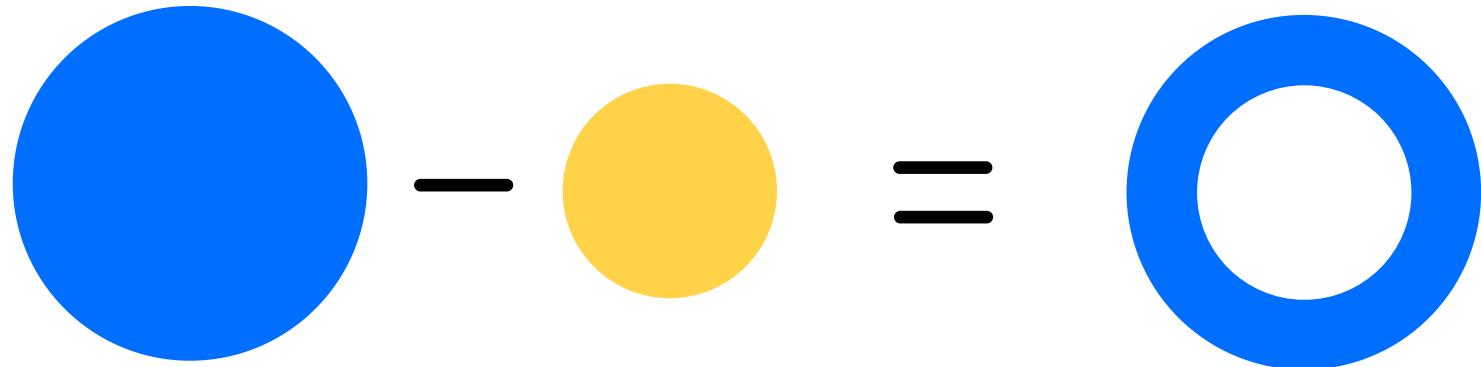


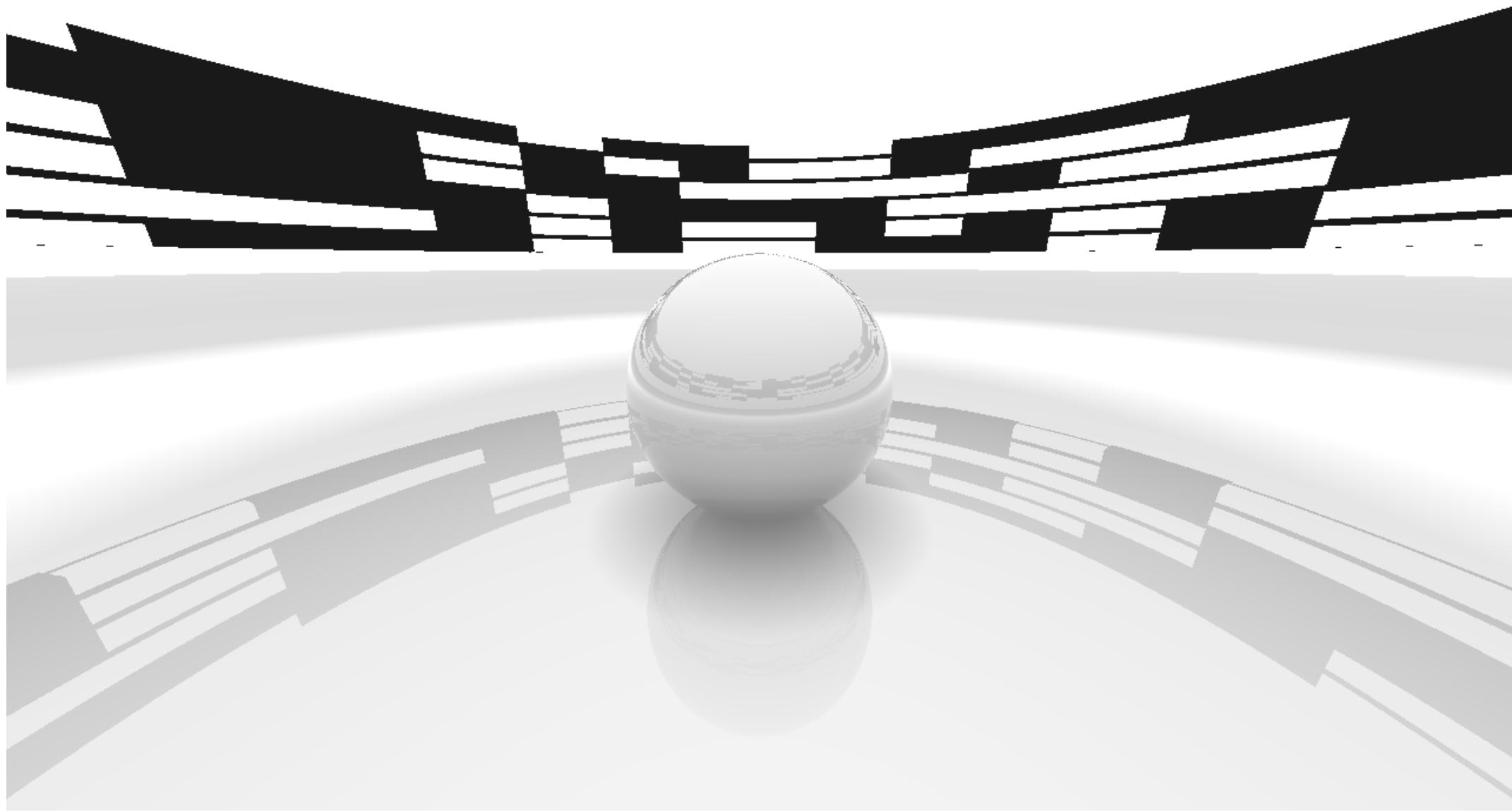
`fract(big_number * sin(x))`





ring



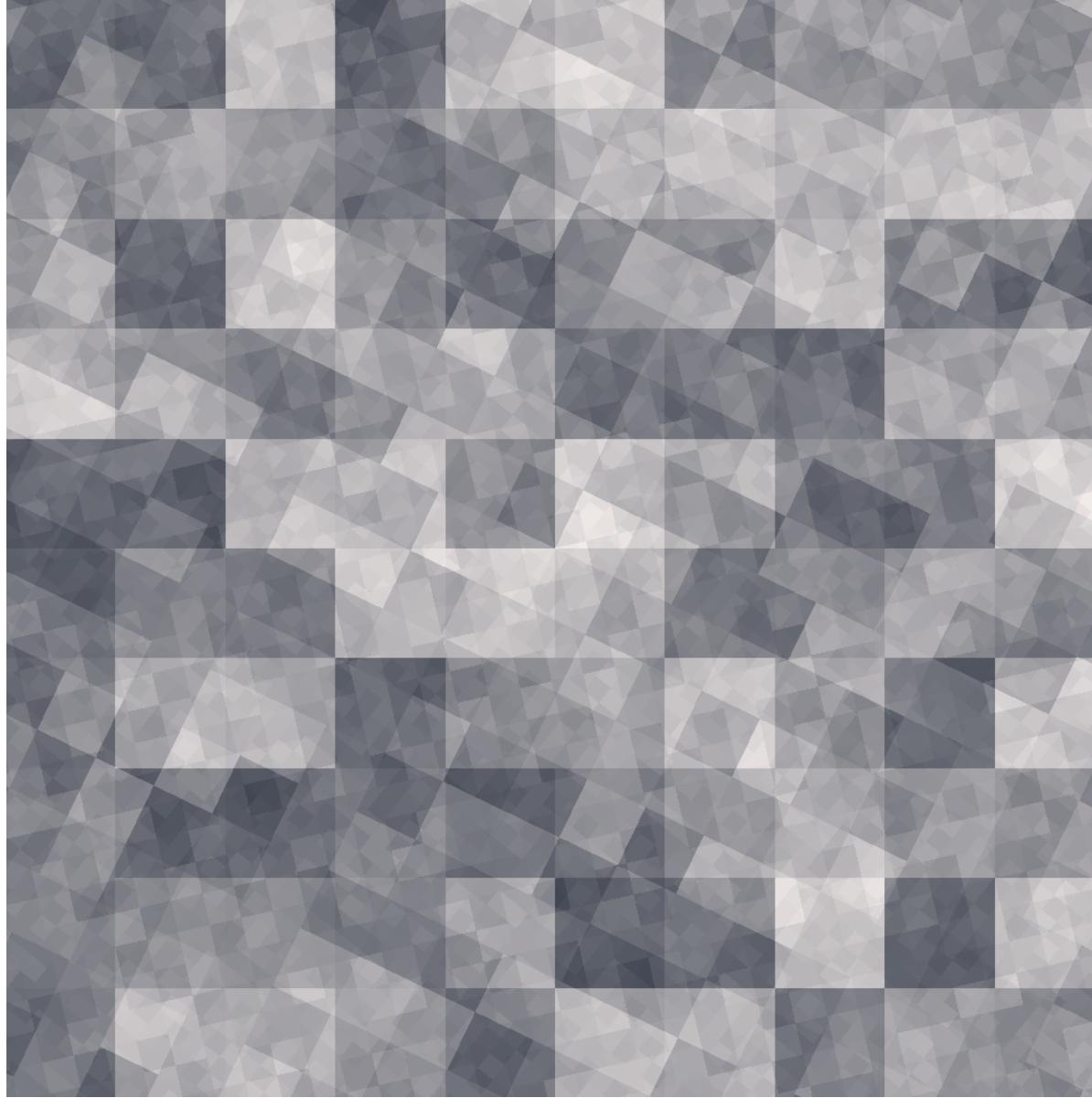


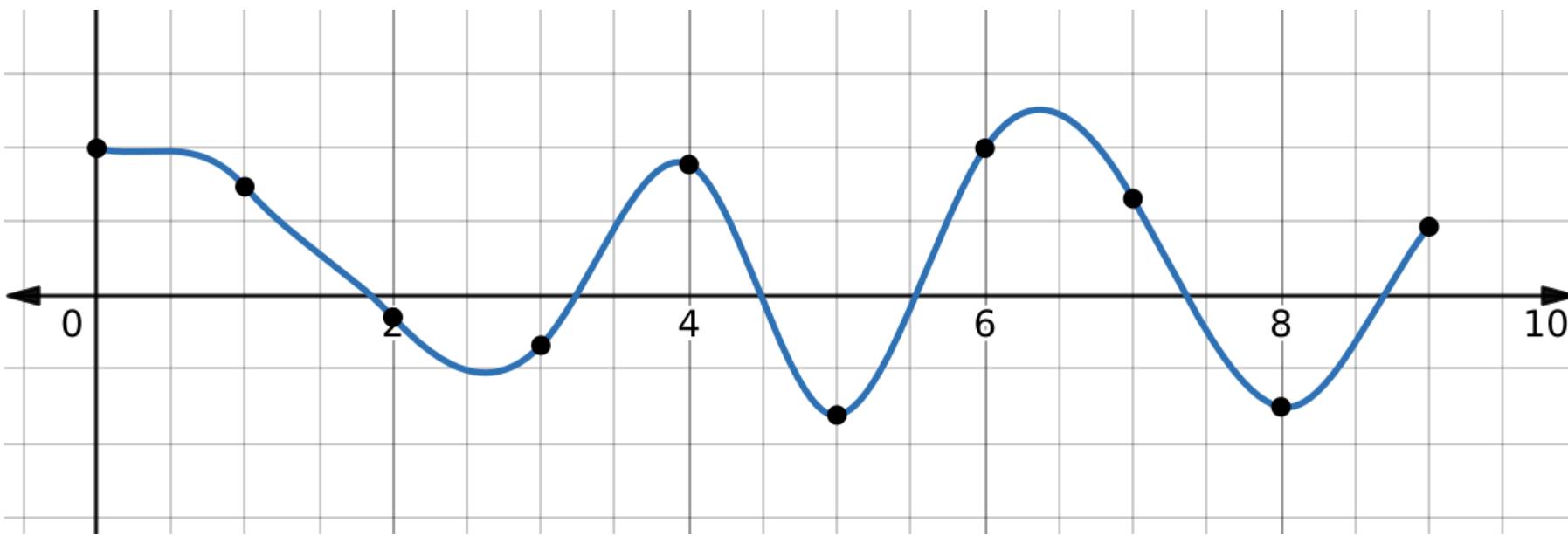
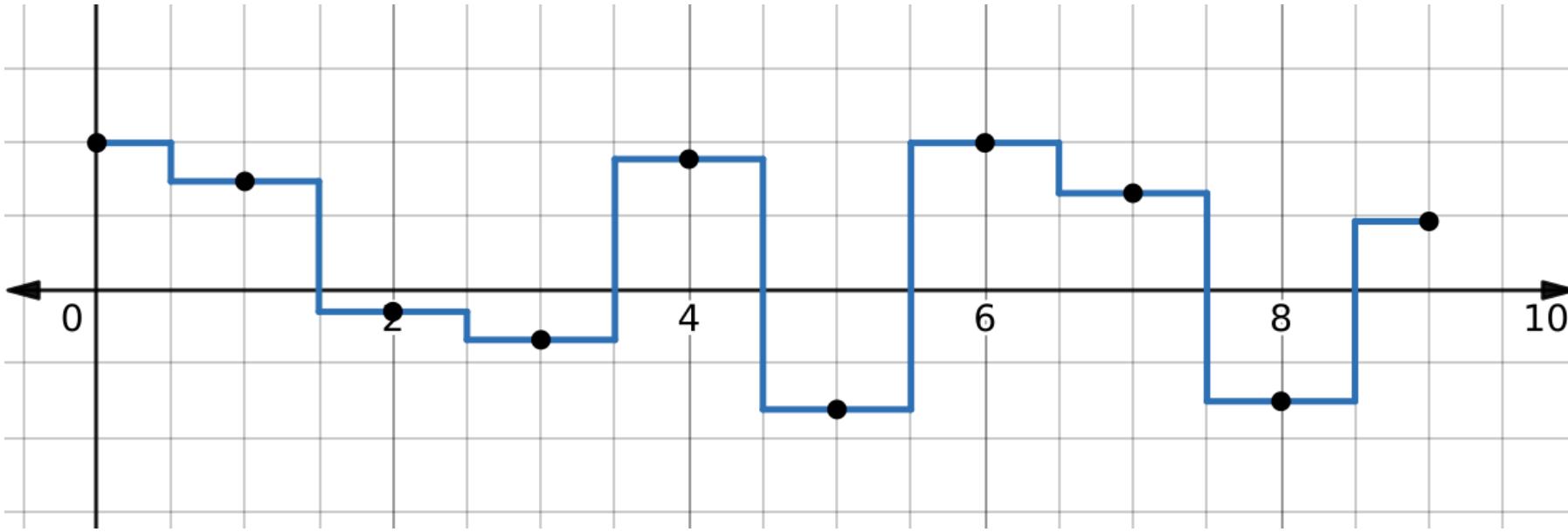
Leaves Shadow

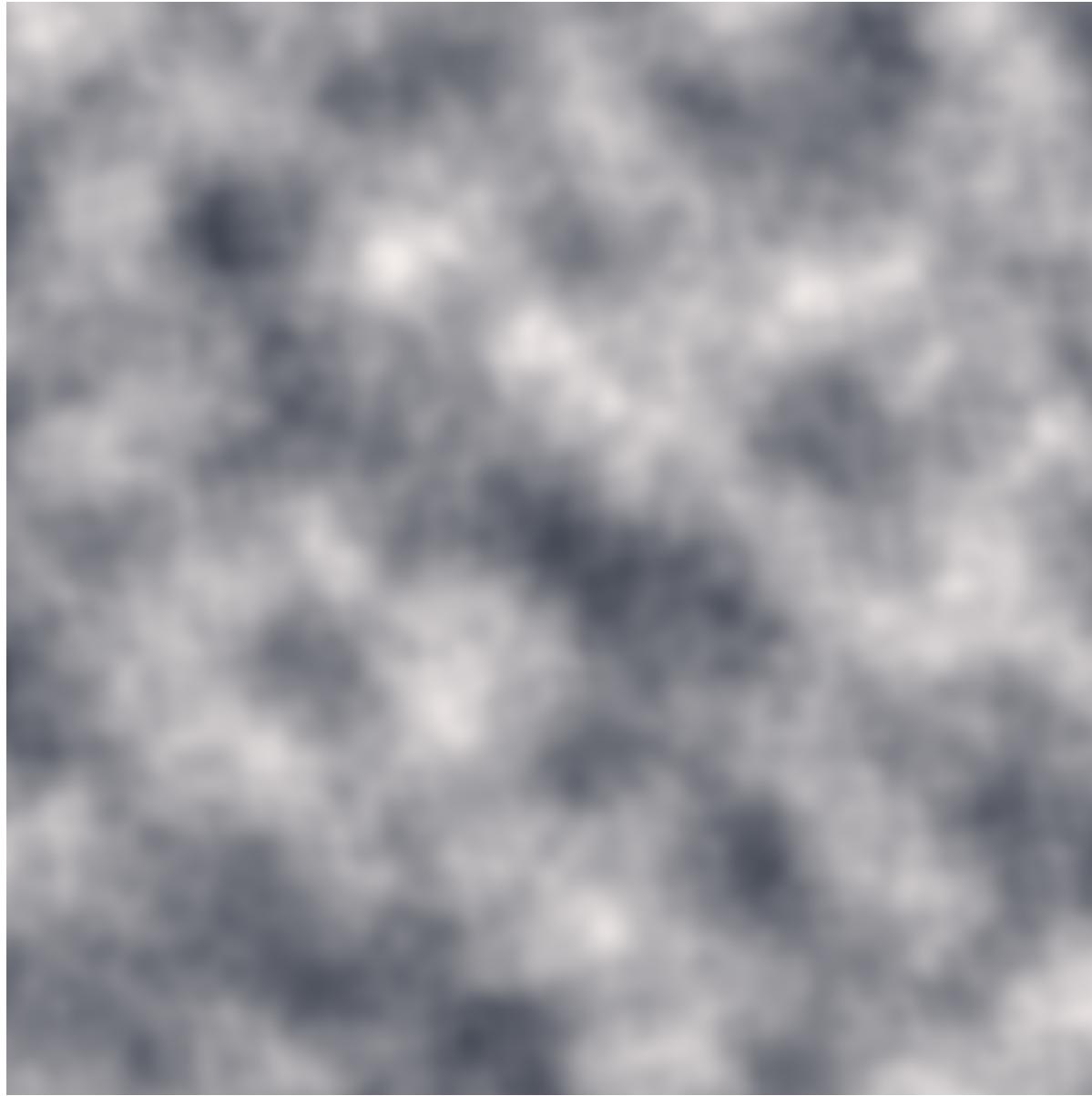


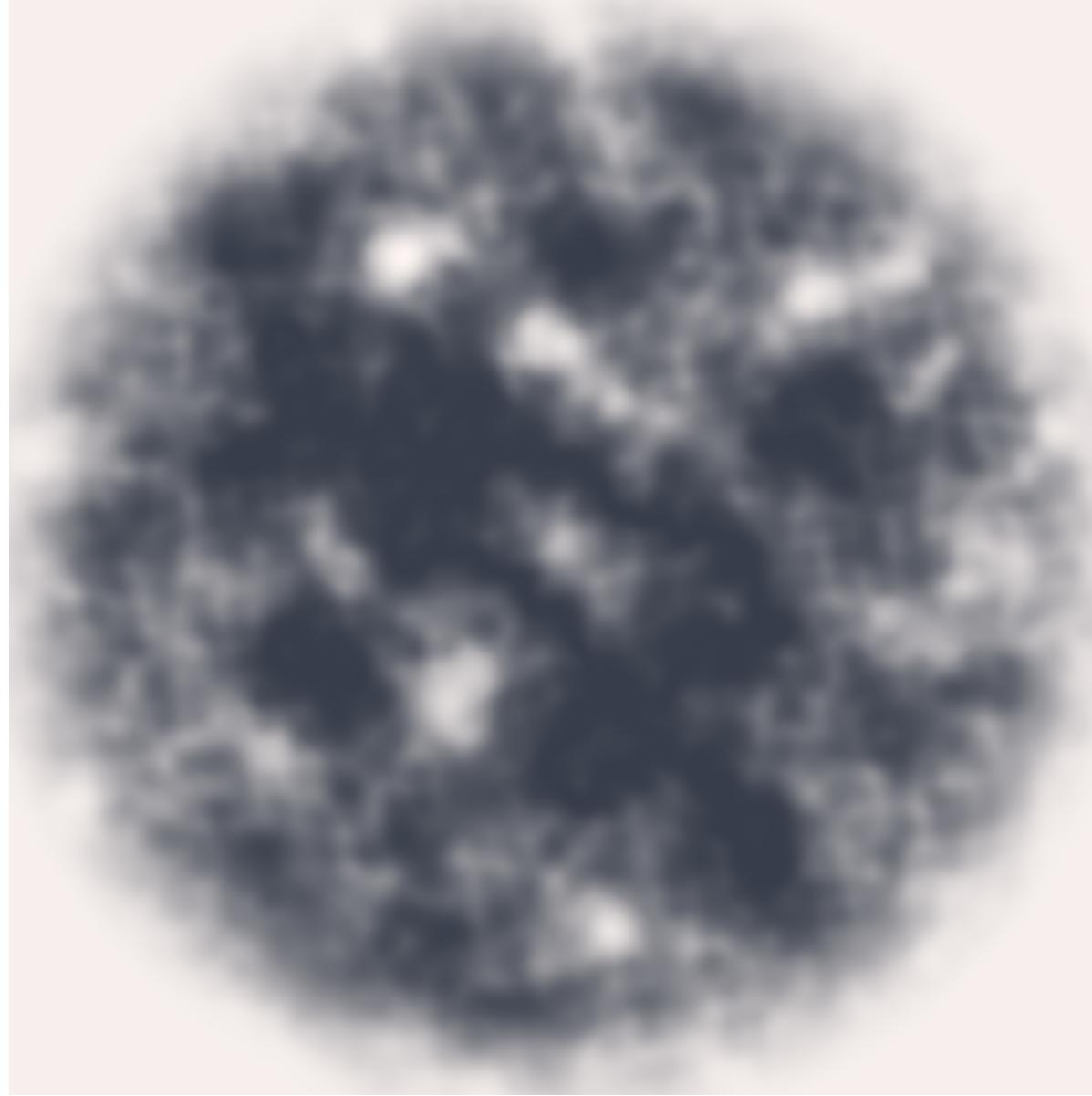
Fractional Brownian motion

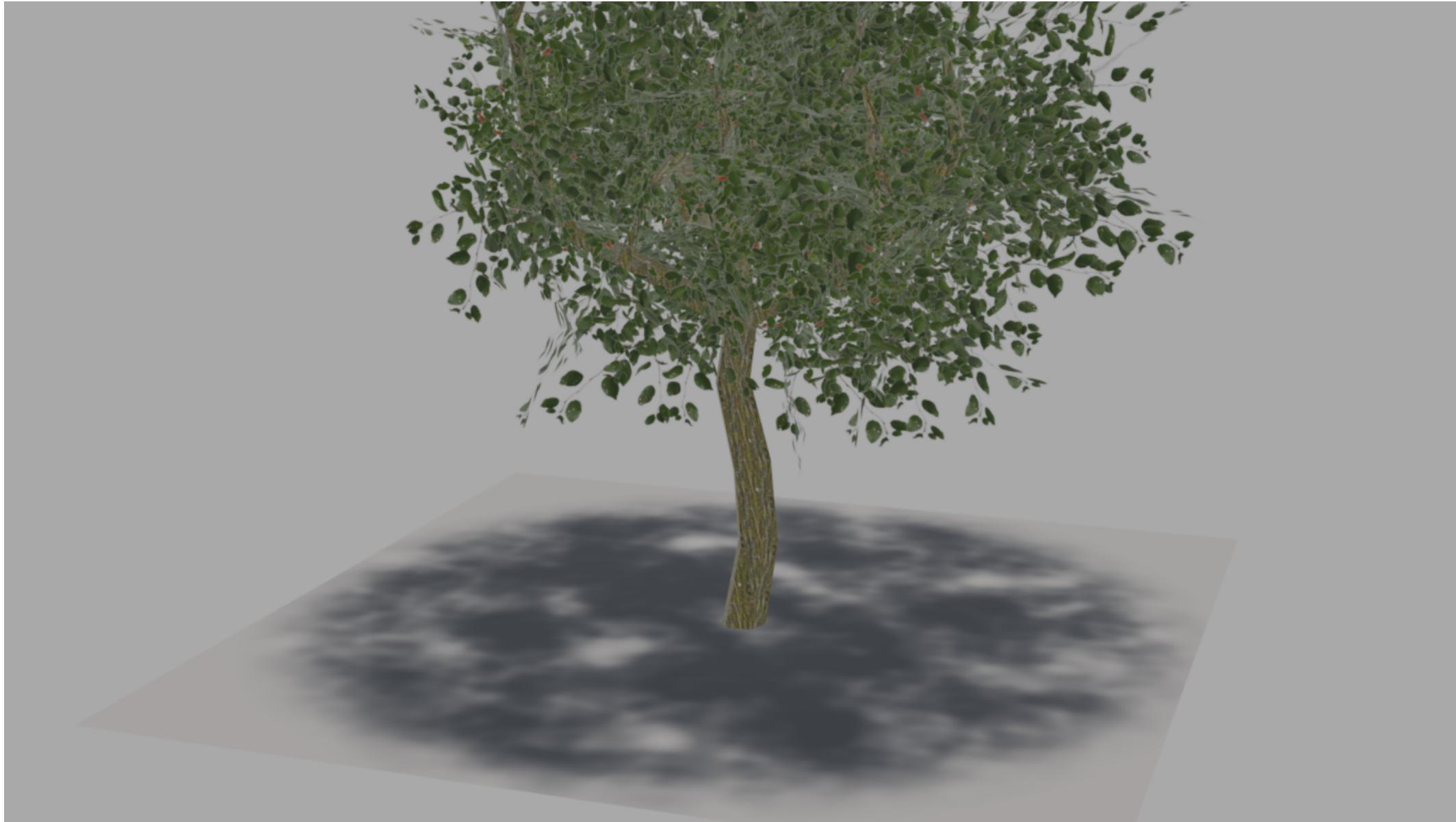
- คล้ายๆ Brownian motion แต่ควบคุมได้มากกว่า
- ทำง่าย แค่เอา noise ธรรมดามาซ่อนกัน



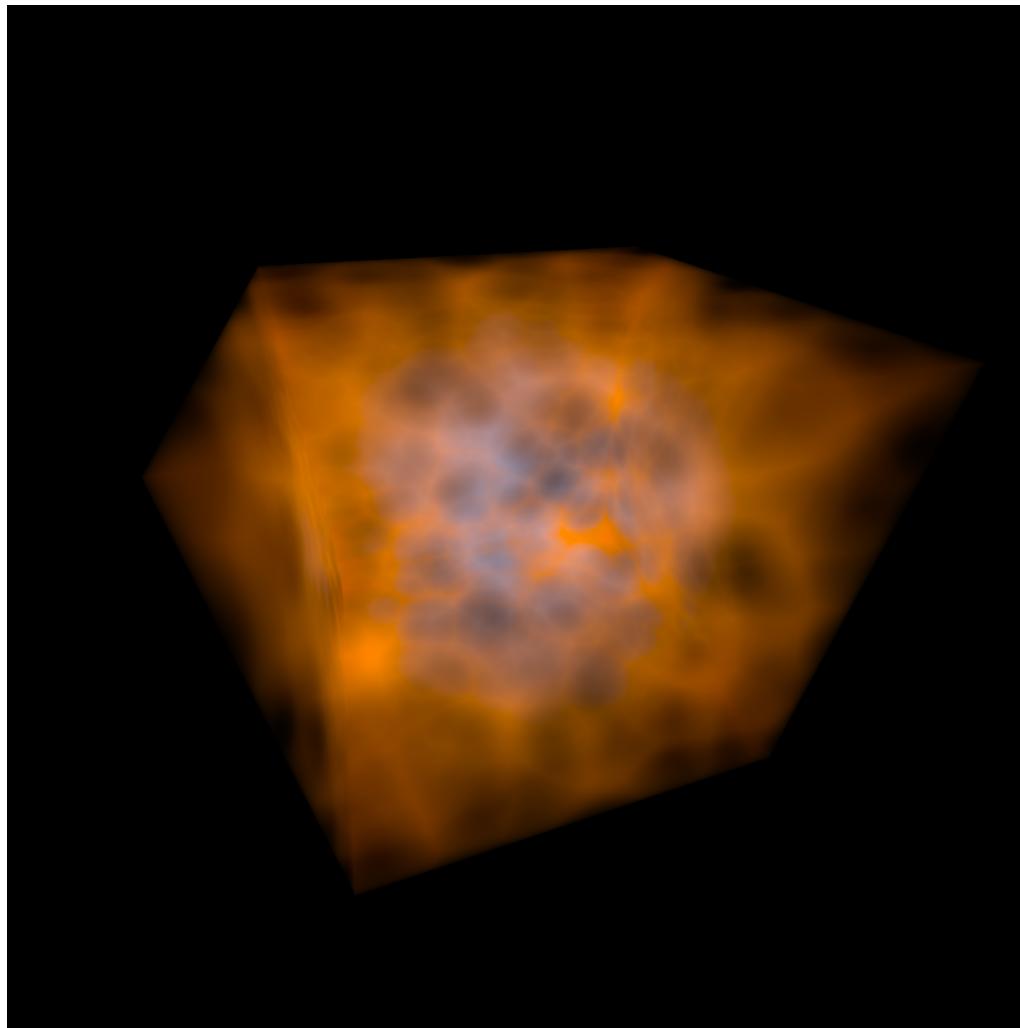








Fire in a cube



Volumetric Rendering









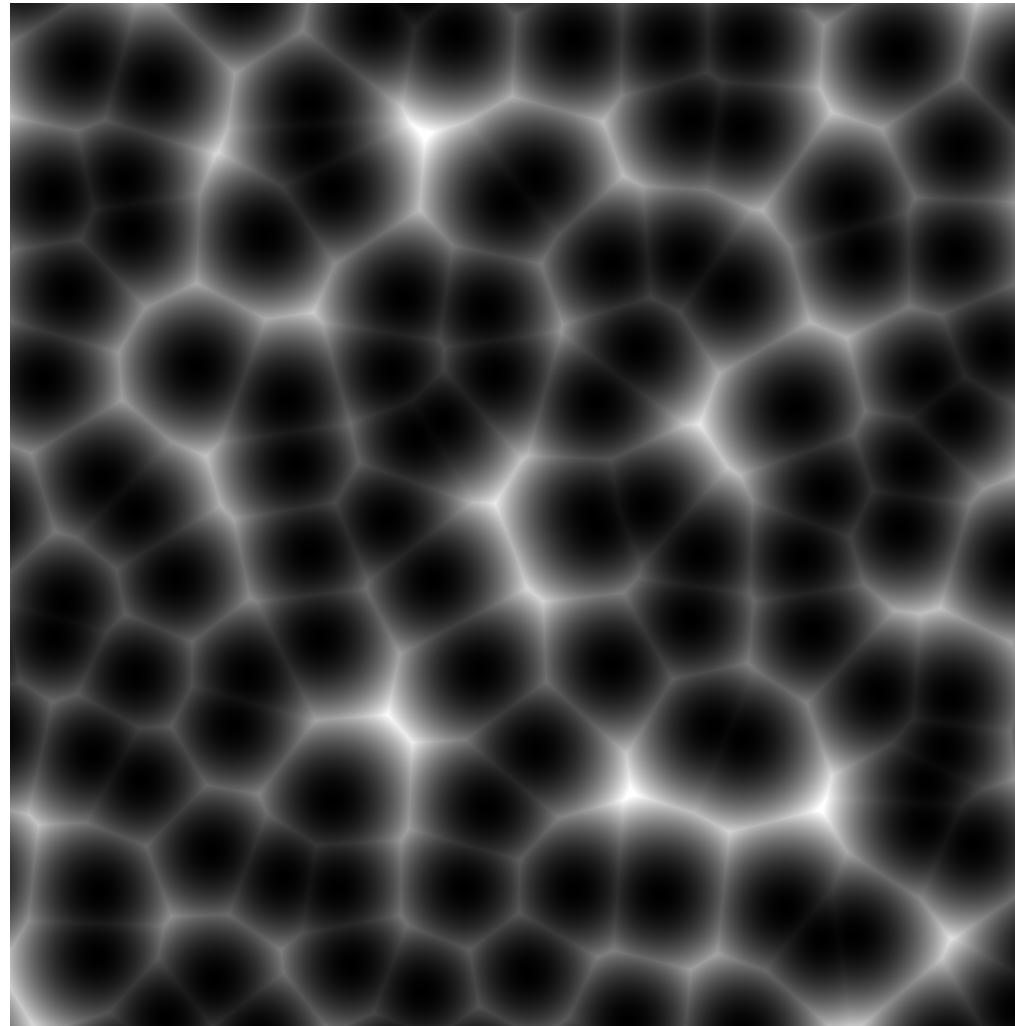
$$p(t) = \vec{ray}_{origin} + \vec{ray}_{direction} \cdot t$$

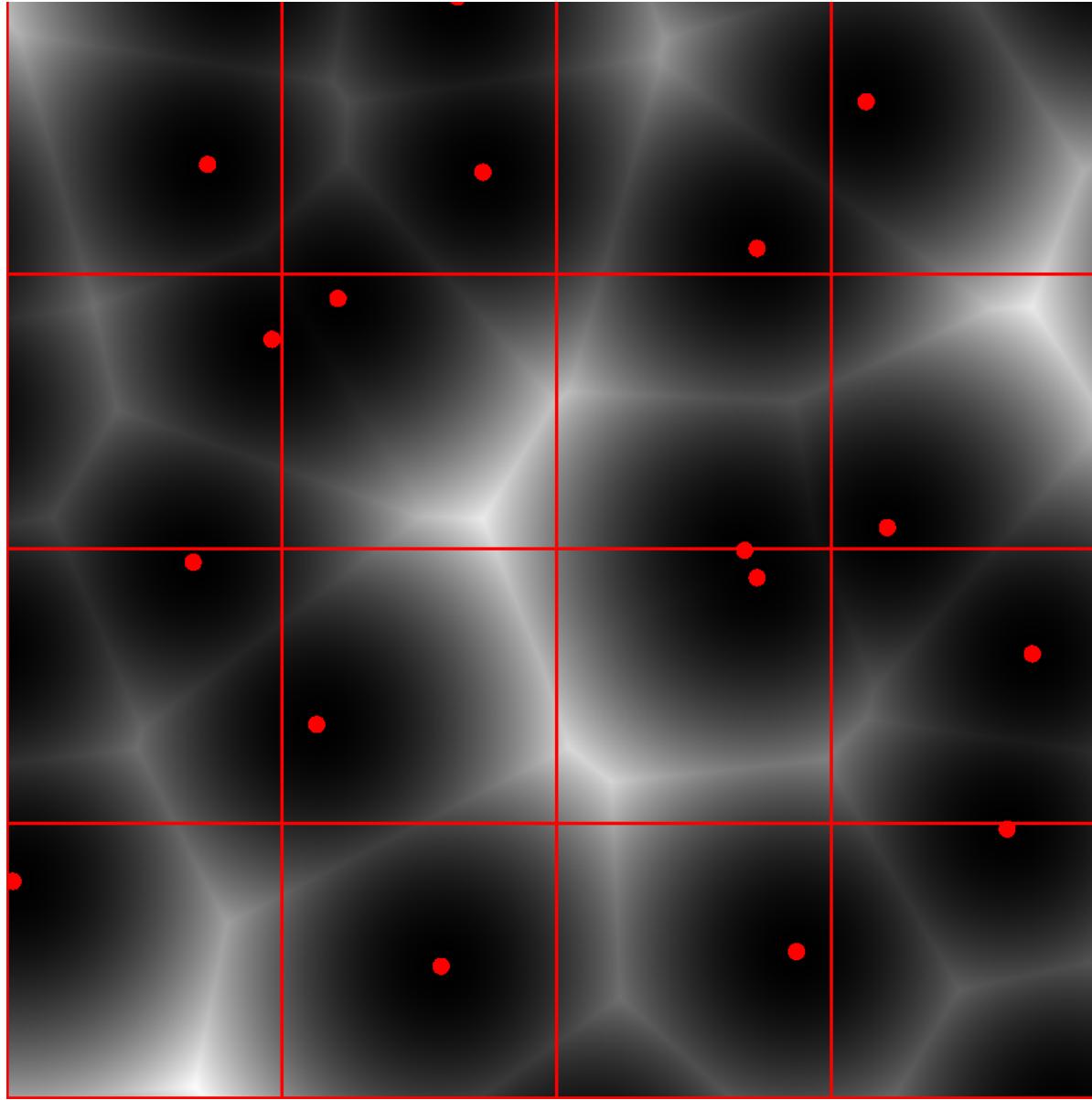
$$dencity(\vec{v}) = \min_{i,j \in [-1,0,1]} \left(|\vec{v} - rand3 \left(\lfloor \vec{v} \rfloor + \begin{bmatrix} i \\ j \end{bmatrix} \right)| \right)$$

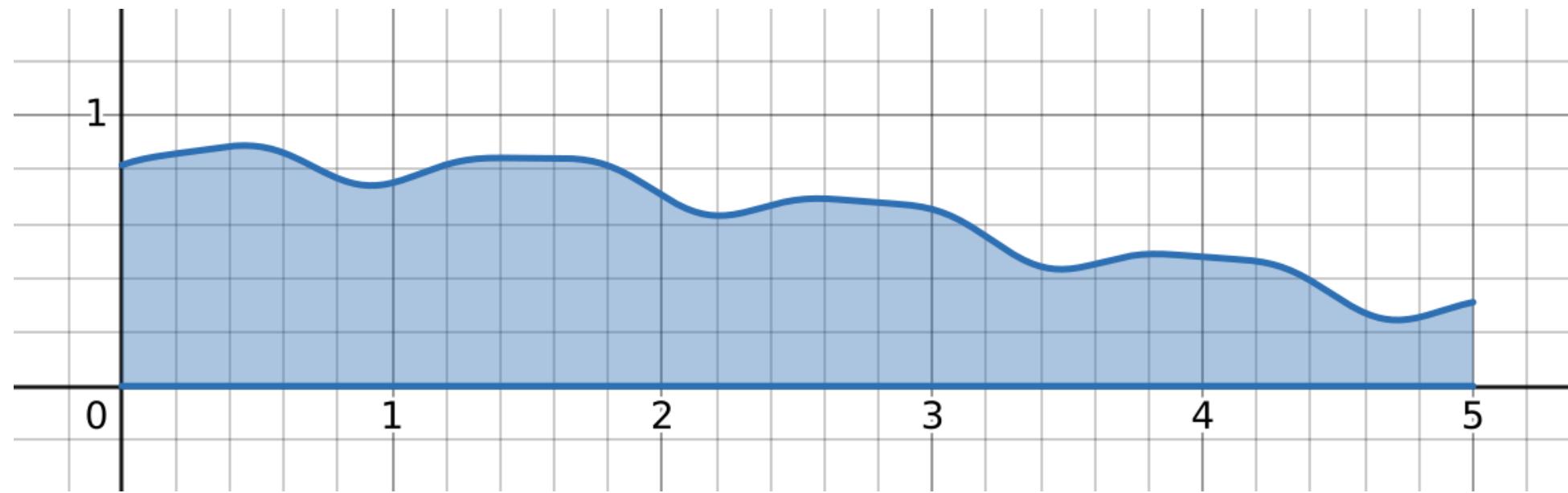
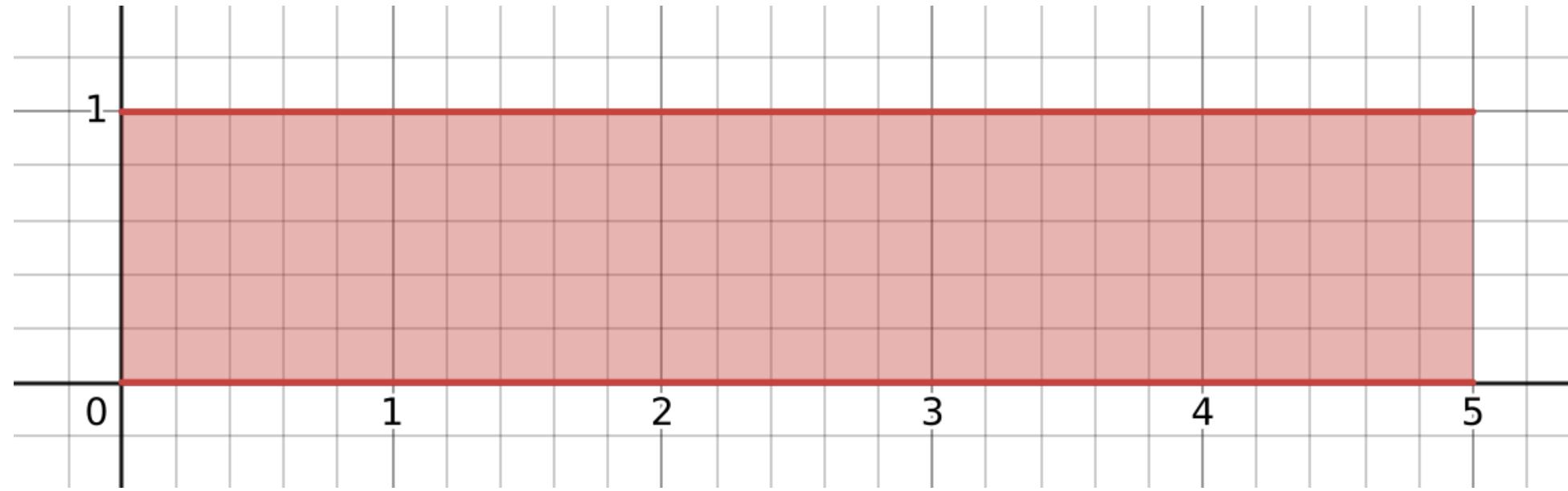
$$color(\vec{v}) = |\vec{v}| \cdot color_1 + (1 - |\vec{v}|) \cdot color_2$$

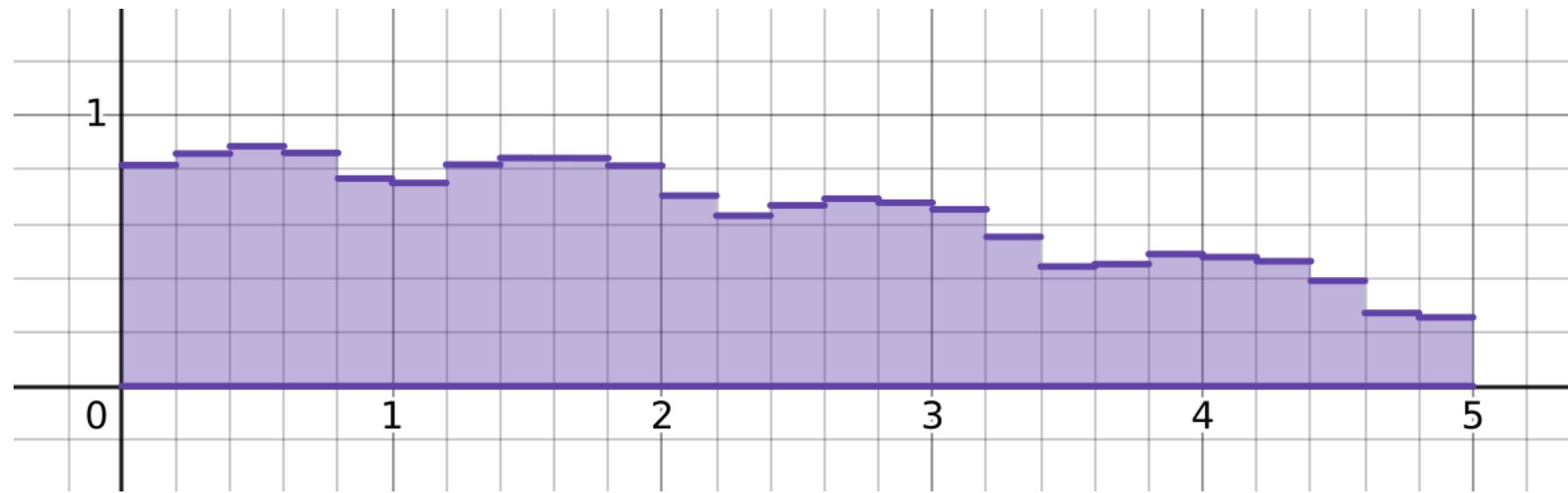
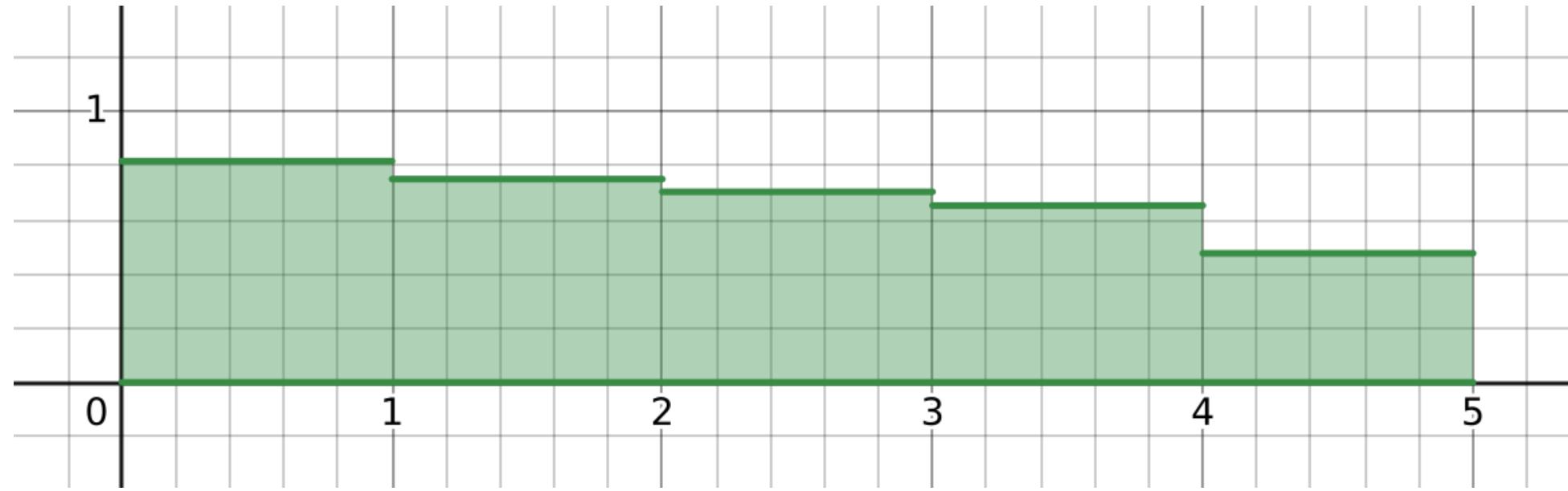
$$FinalColor = \int_0^L color(p(t)) \cdot dencity(p(t)) \cdot dt$$

voronoi diagram

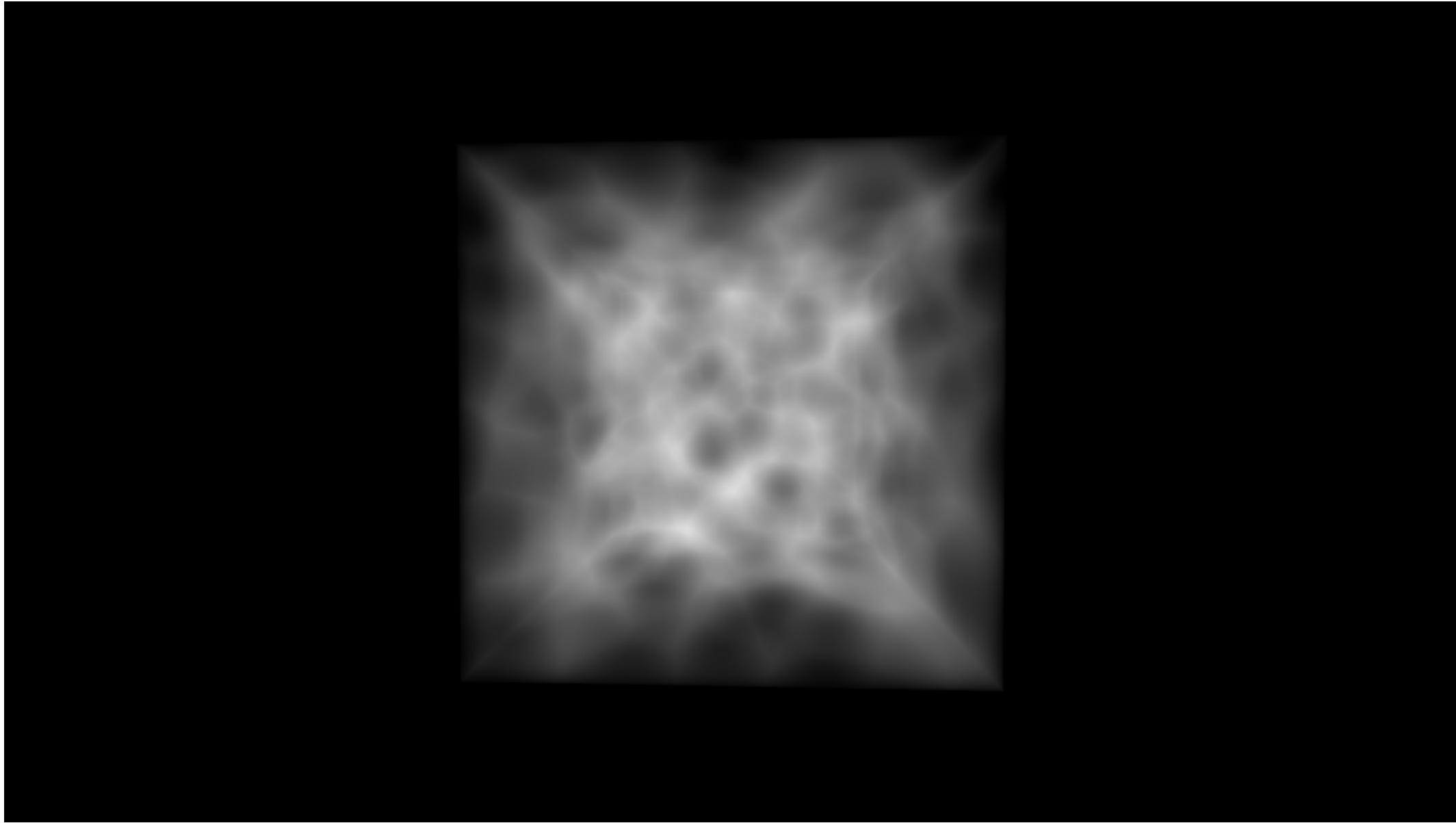


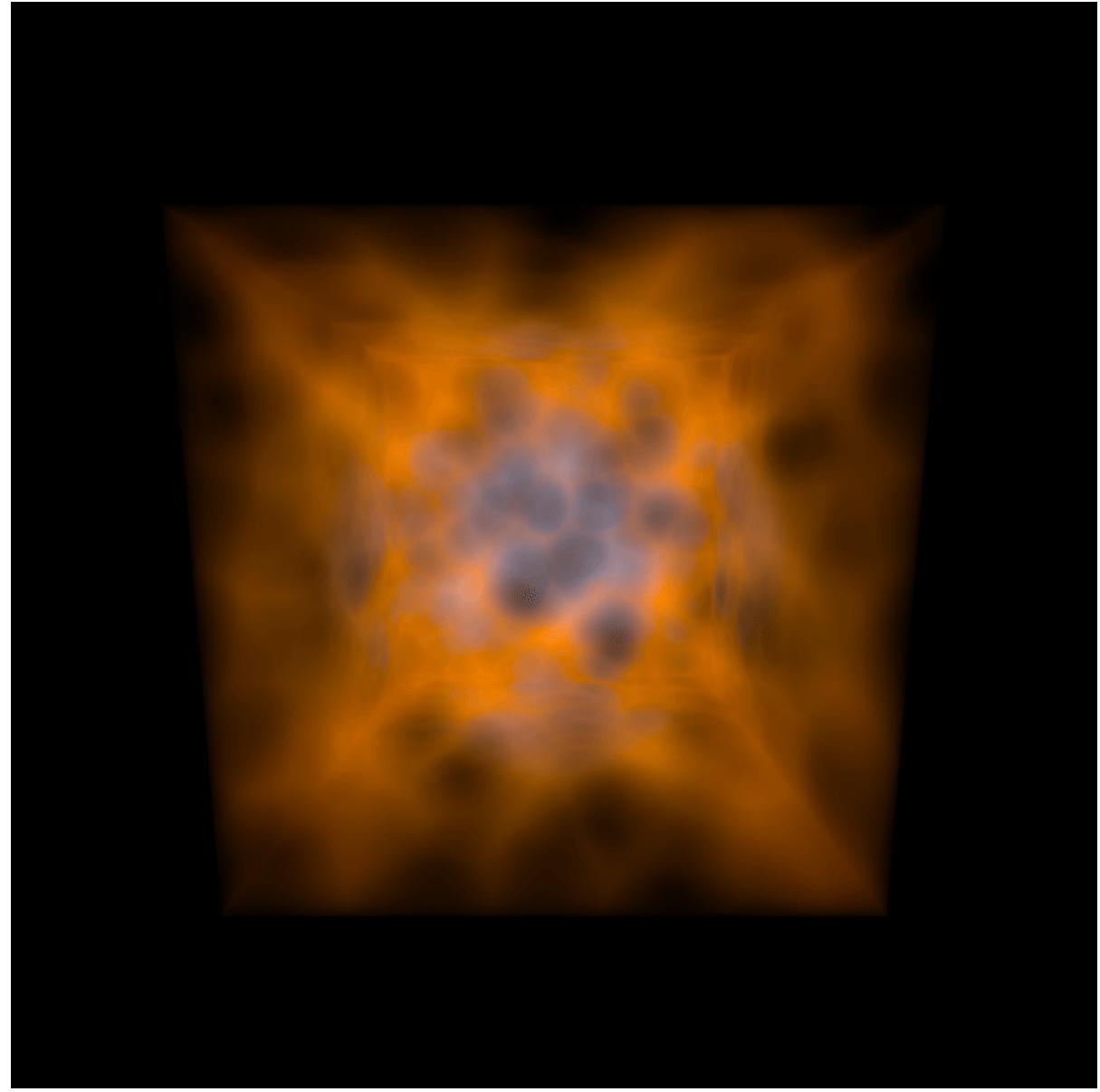






$$FinalColor = \int_0^L color(p(t)) \cdot density(p(t)) \cdot dt$$
$$FinalColor = \sum_{steps} color(p(t)) \cdot density(p(t)) \cdot dt$$





ประสบการณ์

?