

# SURFACE AREAS & VOLUMES

THE GEOMETRY OF SPACE

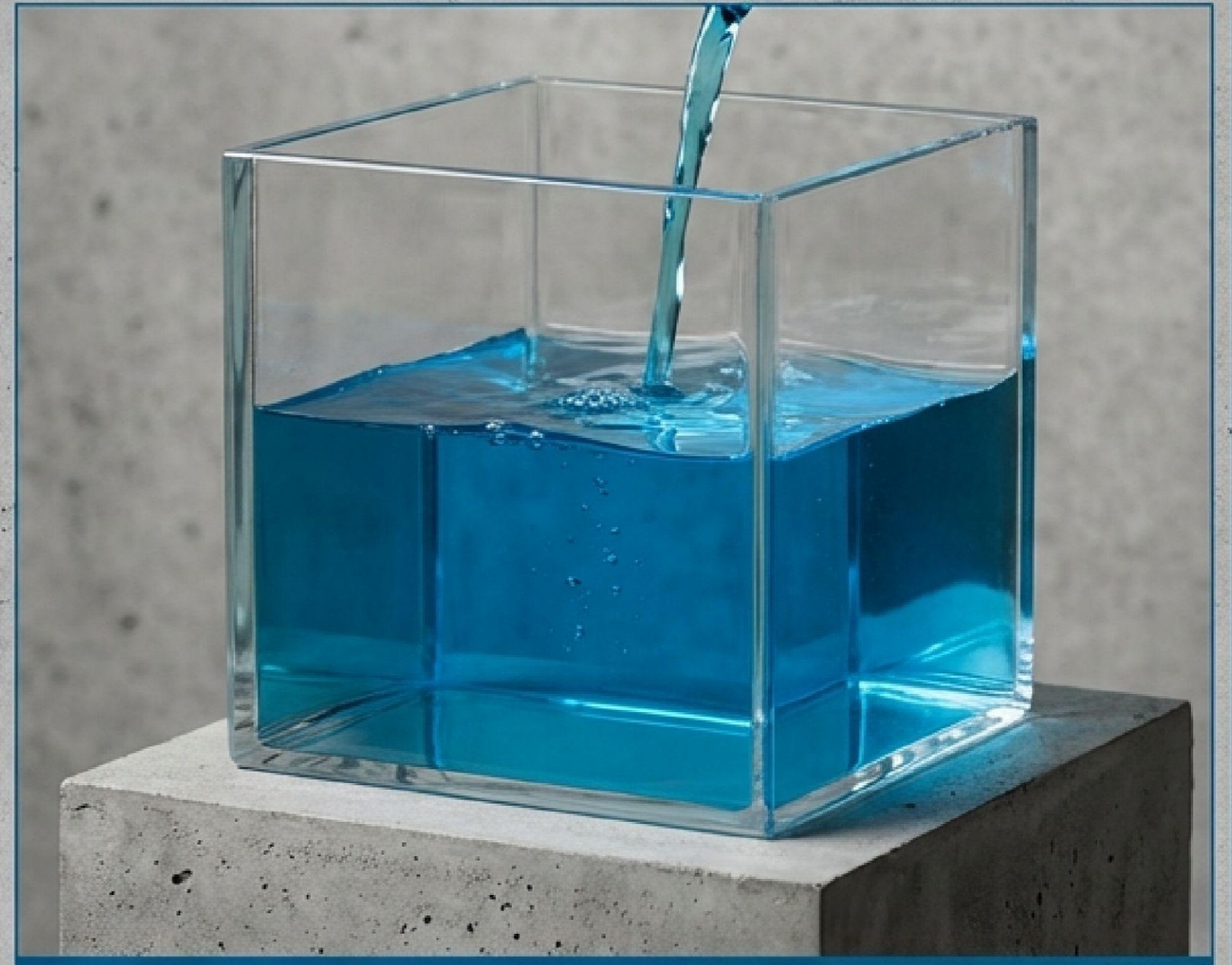
# THE CORE DUALITY

## THE SKIN



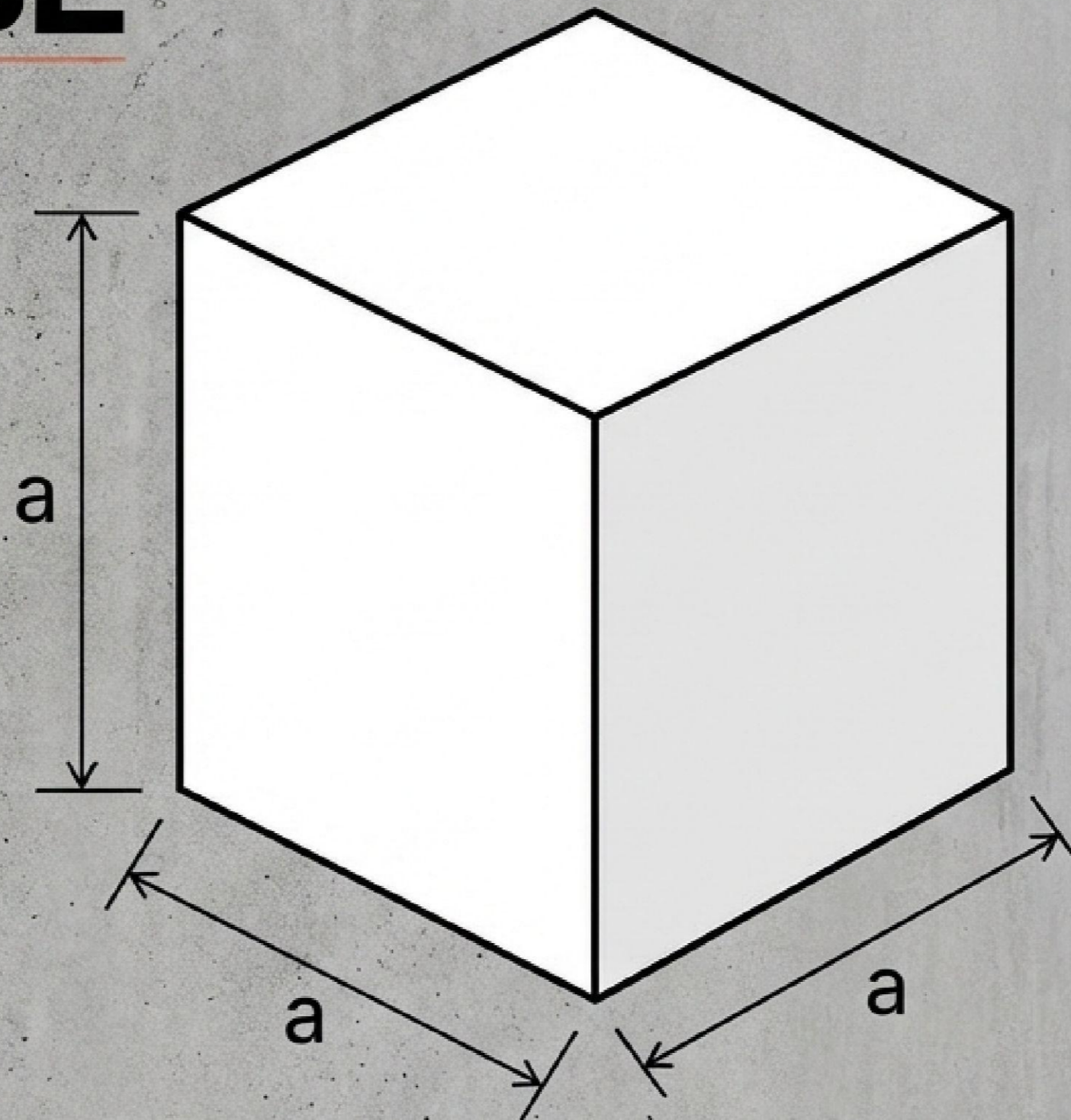
Surface Area. The boundary measurement.  
Painting & Covering.

## THE SPACE



Volume. The capacity measurement.  
Storage & Filling.

# THE CUBE



## Perfect Symmetry

$$\text{Total Surface Area (TSA)} = 6a^2$$

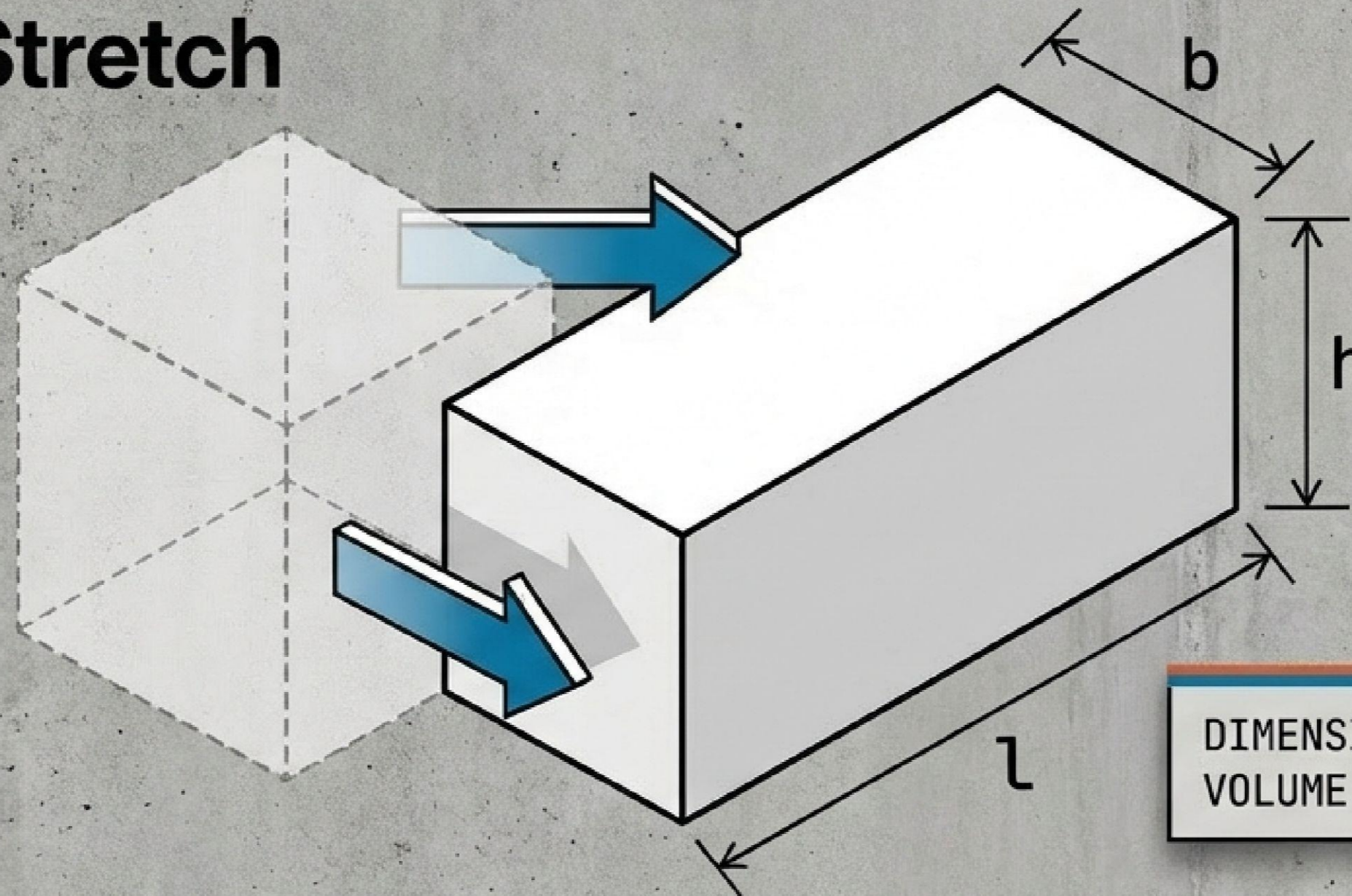
$$\text{Lateral Surface Area (LSA)} = 4a^2$$

$$\text{Volume} = a^3$$

DATA_INPUT:	side $a = 4$ cm
CALC_TSA:	$96$ cm <sup>2</sup>
CALC_VOL:	$64$ cm <sup>3</sup>

# THE CUBOID

## The Linear Stretch



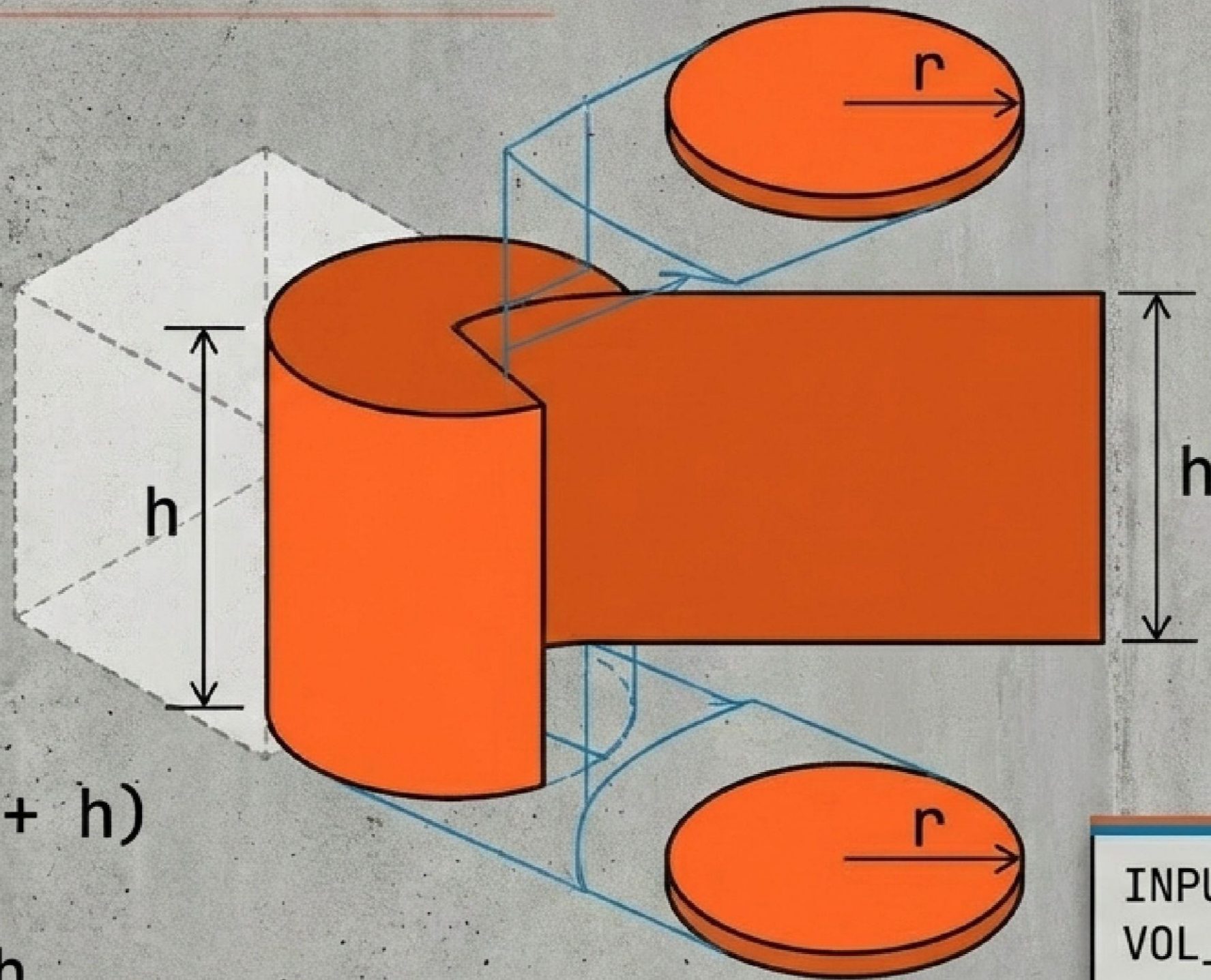
DIMENSIONS:  $5 \times 4 \times 3$  cm  
VOLUME:  $60 \text{ cm}^3$

$$\text{TSA} = 2(lb + bh + hl)$$

$$\text{LSA} = 2h(l + b)$$

$$\text{Volume} = l \times b \times h$$

# THE CYLINDER



$$CSA = 2\pi rh$$

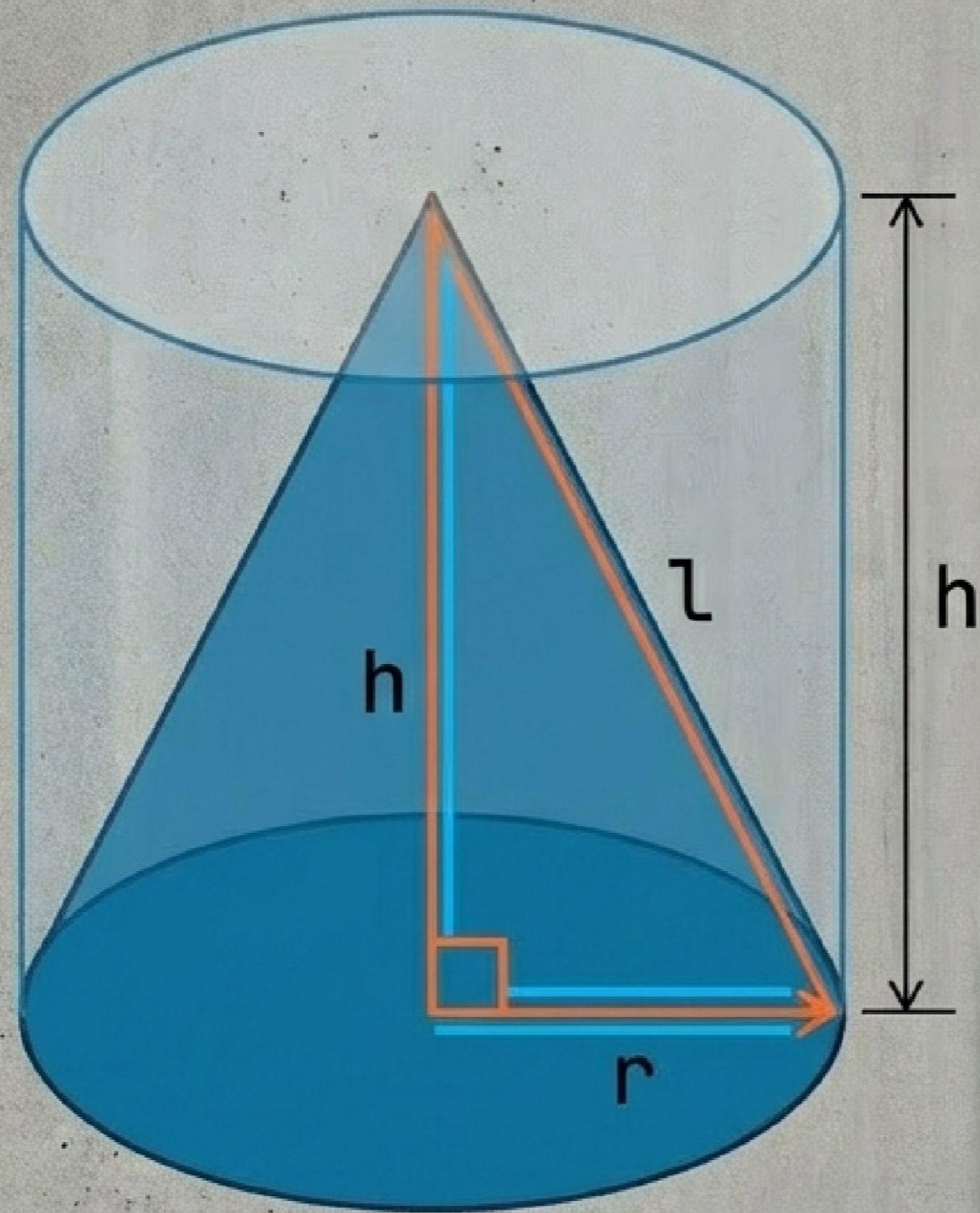
$$TSA = 2\pi r(r + h)$$

$$Volume = \pi r^2 h$$

INPUT:  $r=7, h=10$   
VOL\_OUTPUT:  $1540 \text{ cm}^3$

# THE CONE

## The Conic Section



$$\text{Slant Height } (l) = \sqrt{r^2 + h^2}$$

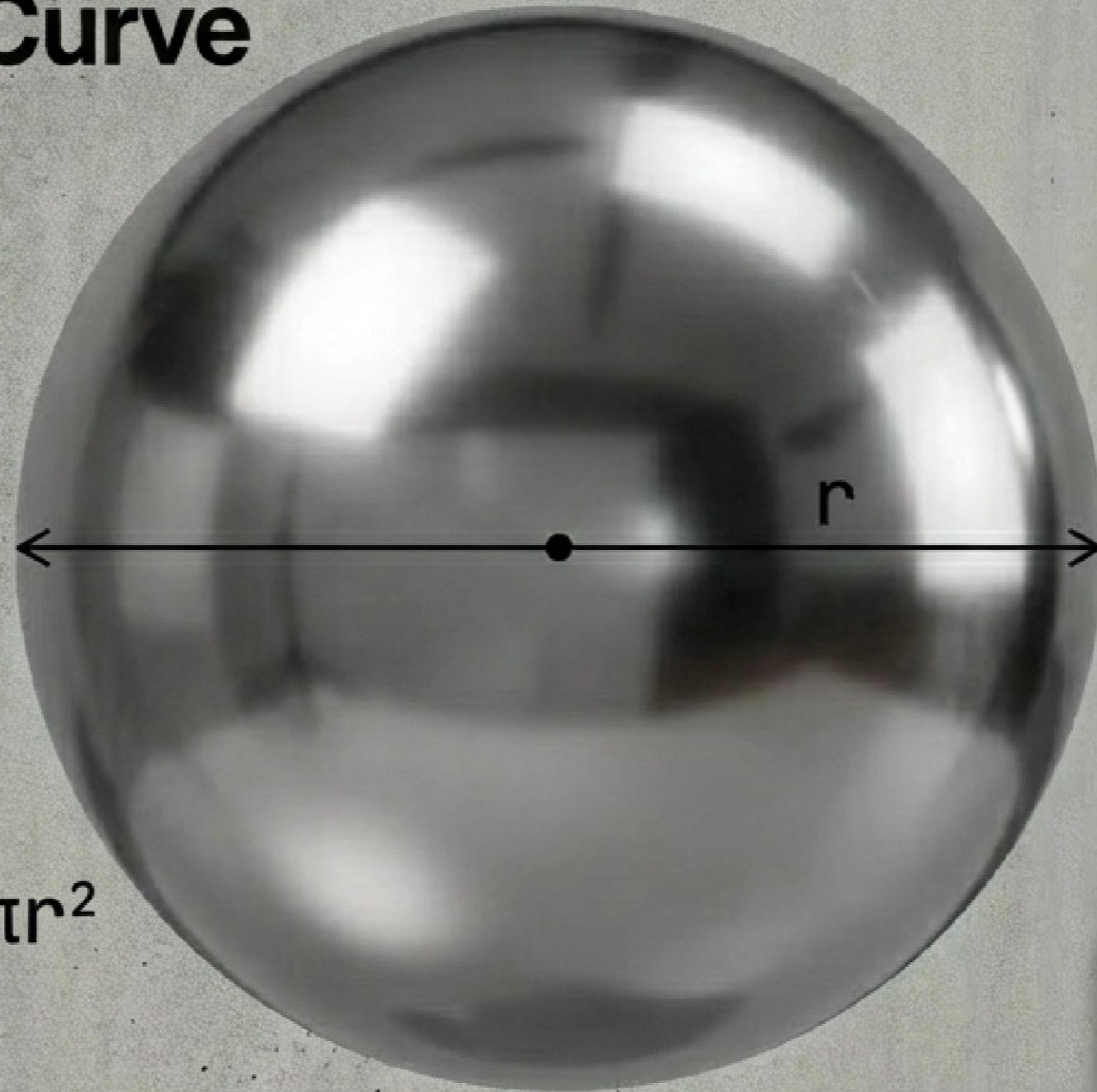
$$\text{CSA} = \pi r l$$

$$\text{Volume} = \frac{1}{3} \pi r^2 h$$

INPUT:	r=3, h=4
DERIVED_SLANT:	5
VOL_OUTPUT:	12π cm <sup>3</sup>

# THE SPHERE

## Nature's Perfect Curve



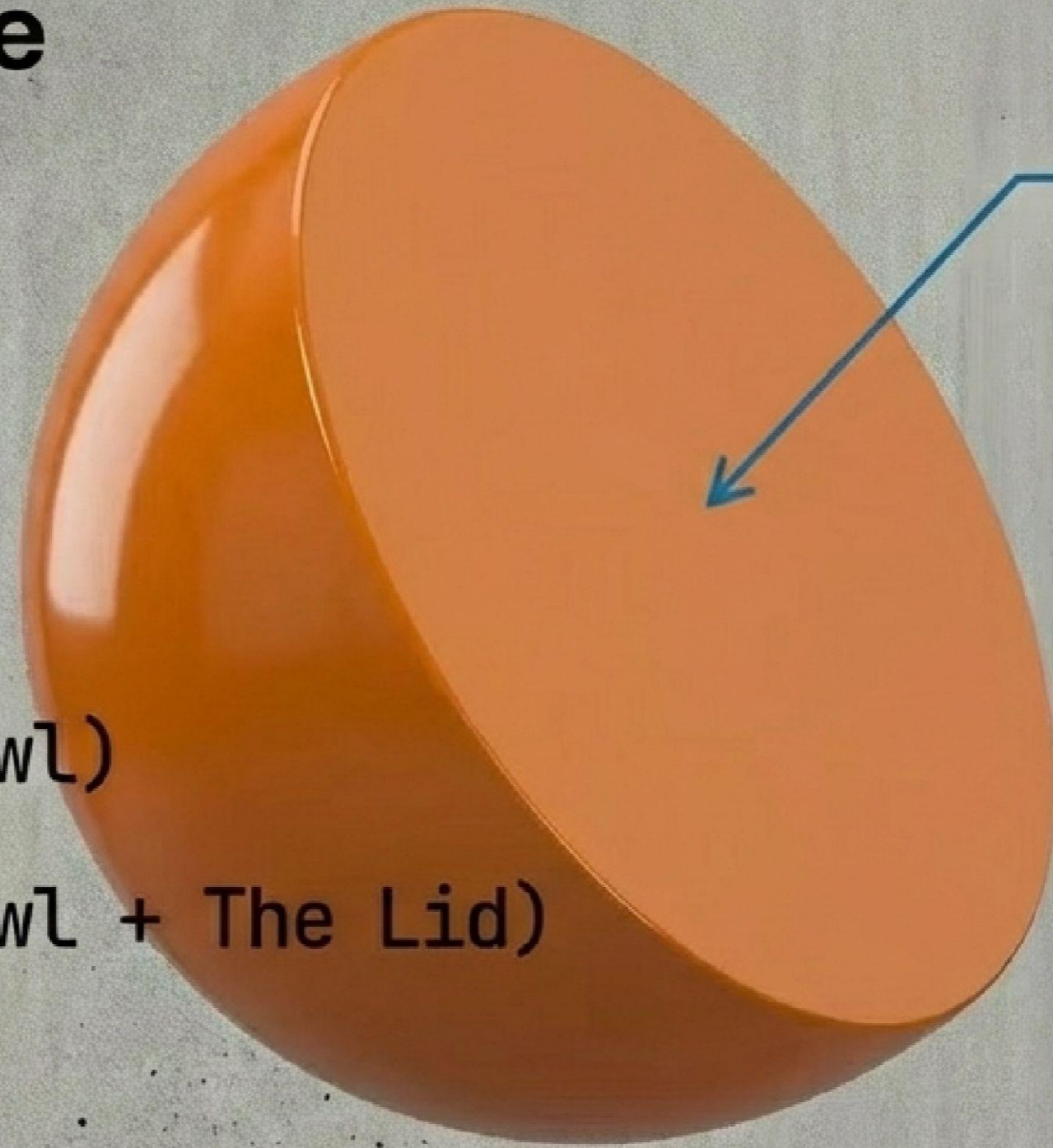
$$\text{Surface Area} = 4\pi r^2$$

$$\text{Volume} = \frac{4}{3} \pi r^3$$

INPUT:	$r=7 \text{ cm}$
AREA_CALC:	$616 \text{ cm}^2$

# THE HEMISPHERE

## The Sliced Sphere



The Third  $\pi r^2$

$$\text{CSA} = 2\pi r^2 \text{ (The Bowl)}$$

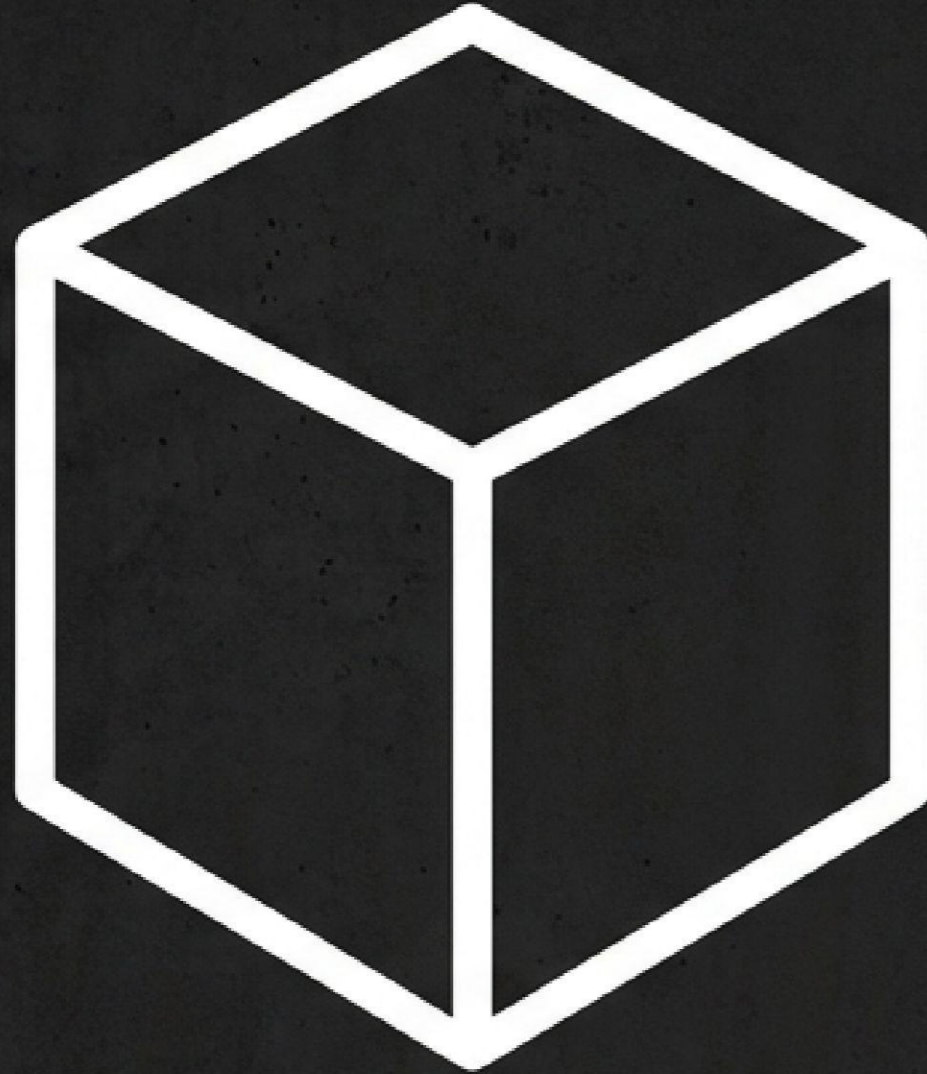
$$\text{TSA} = 3\pi r^2 \text{ (The Bowl + The Lid)}$$

$$\text{Volume} = \frac{2}{3} \pi r^3$$

# TEST YOUR SPATIAL INTELLIGENCE

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INTERACTIVE KNOWLEDGE CHECK



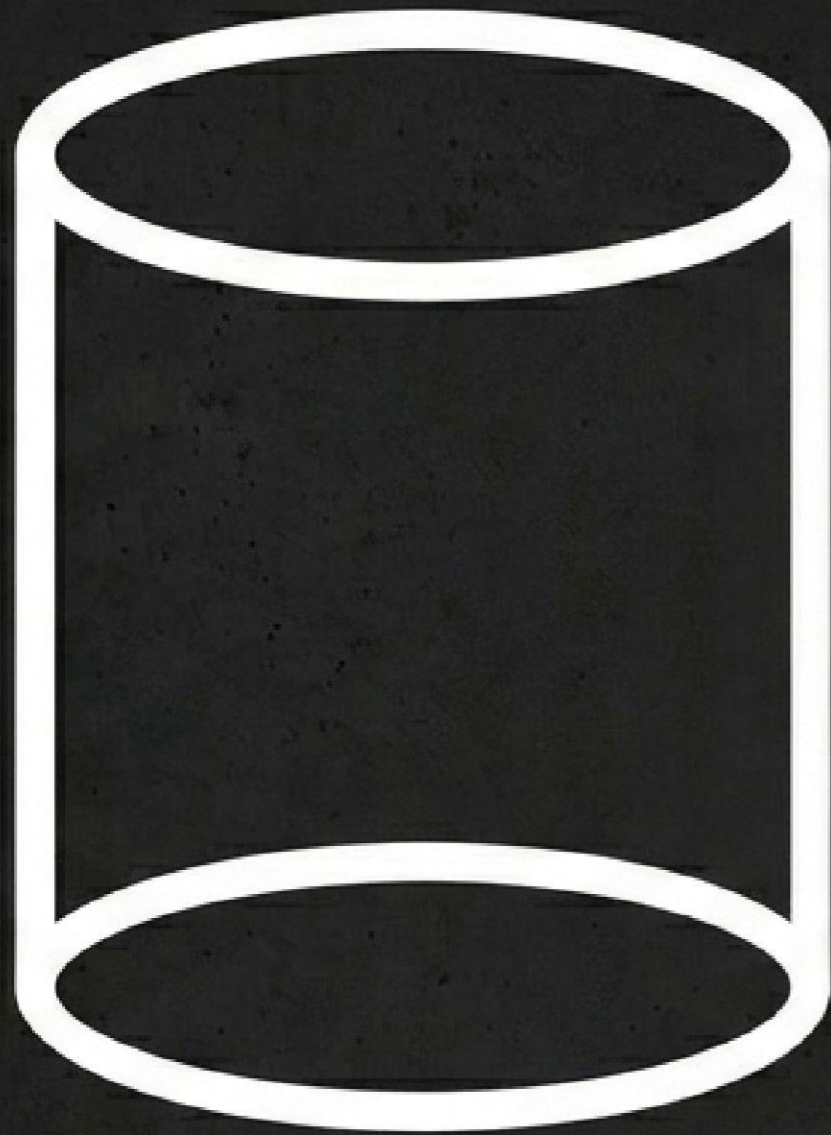
**Q1: The formula for the volume of a cube is:**

A)  $6a^2$

B)  $a^3$

C)  $4a^2$

D)  $2a^3$



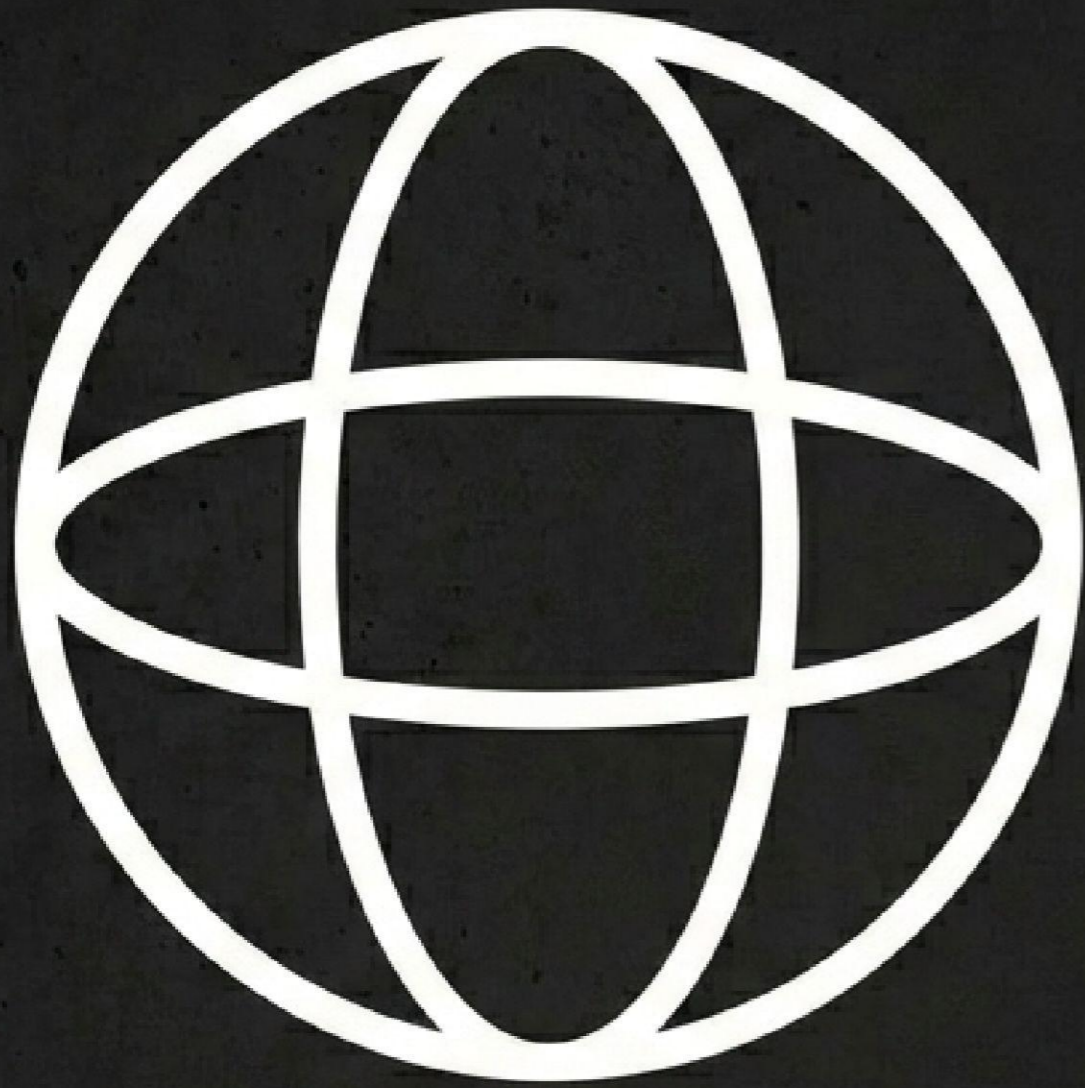
**Q2: The curved surface area of a cylinder is:**

A)  $\pi r^2$

B)  $2\pi r^2$

C)  $2\pi r h$

D)  $\pi r h$



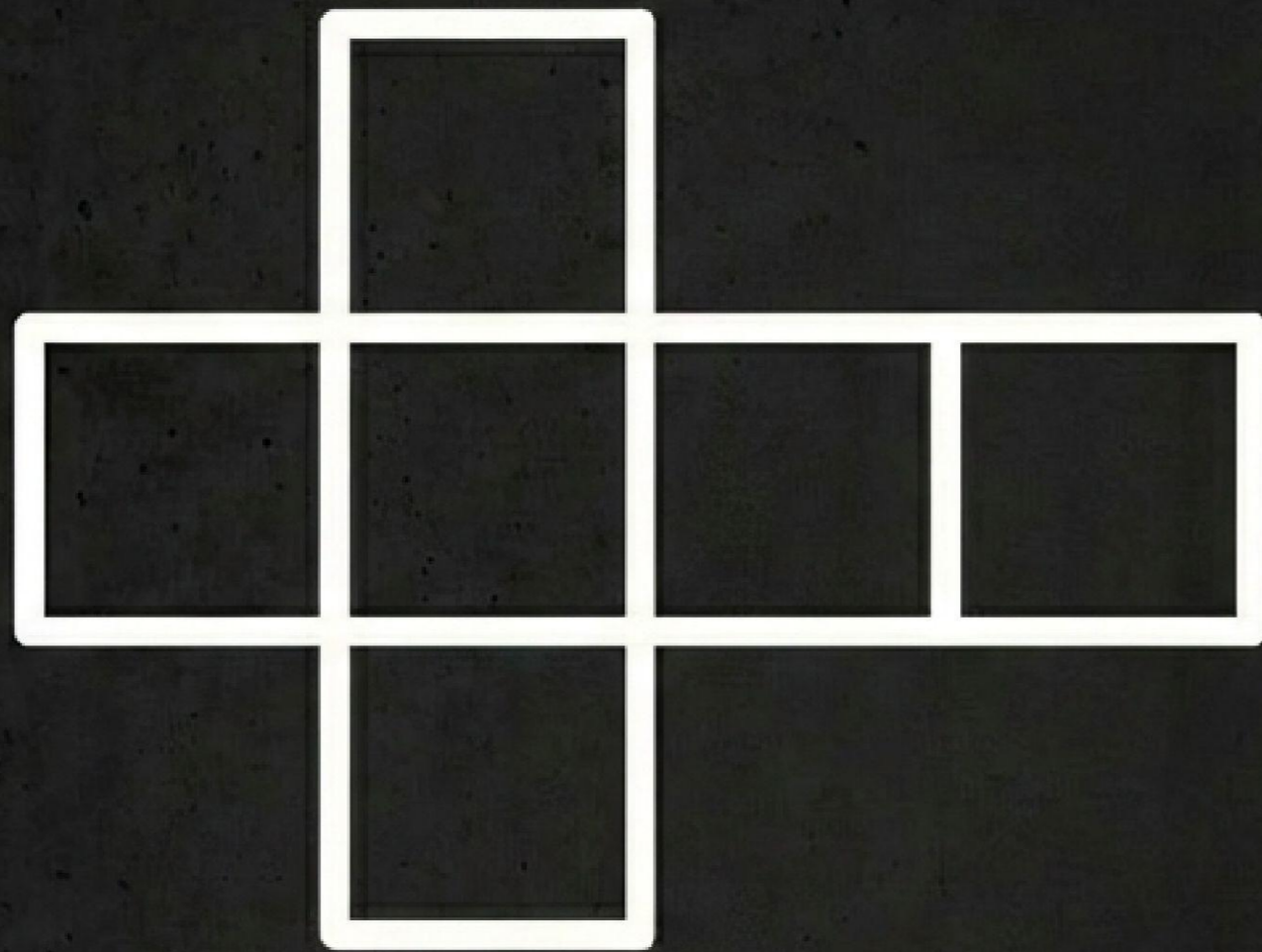
**Q3: The volume of a sphere is:**

A)  $4\pi r^2$

B)  $3\pi r^3$

C)  $\frac{4}{3}\pi r^3$

D)  $\frac{2}{2}\pi r^3$



**Q4: The Total Surface Area (TSA) of a cube with side 'a' is**


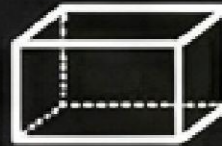




A)  $4a^2$

B)  $a^2$

C)  $6a^2$

D)  $2a^2$

# THE ARCHITECT'S CHEAT SHEET

SHAPE	TSA (Total Area)	CSA/LSA (Curved/Lat)	VOLUME
 Cube	$6a^2$	$4a^2$	$a^3$
 Cuboid	$2(lb+bh+hl)$	$2h(l+b)$	$l \times b \times h$
 Cylinder	$2\pi r(r+h)$	$2\pi rh$	$\pi r^2 h$
 Cone	$\pi r(l+r)$	$\pi rl$	$\frac{1}{3}\pi r^2 h$
 Sphere	$4\pi r^2$	-	$\frac{4}{3}\pi r^3$
 Hemisphere	$3\pi r^2$	$2\pi r^2$	$\frac{2}{3}\pi r^3$

A photograph of three geometric objects: a wooden cone, a concrete cube, and a metal sphere, arranged on a dark, reflective surface. The scene is lit from the side, creating strong shadows and highlights. The text "MEASURE THE WORLD." is overlaid in large, white, bold, sans-serif font across the center of the image.

# MEASURE THE WORLD.

From construction to storage, these are the tools we use to define our reality.