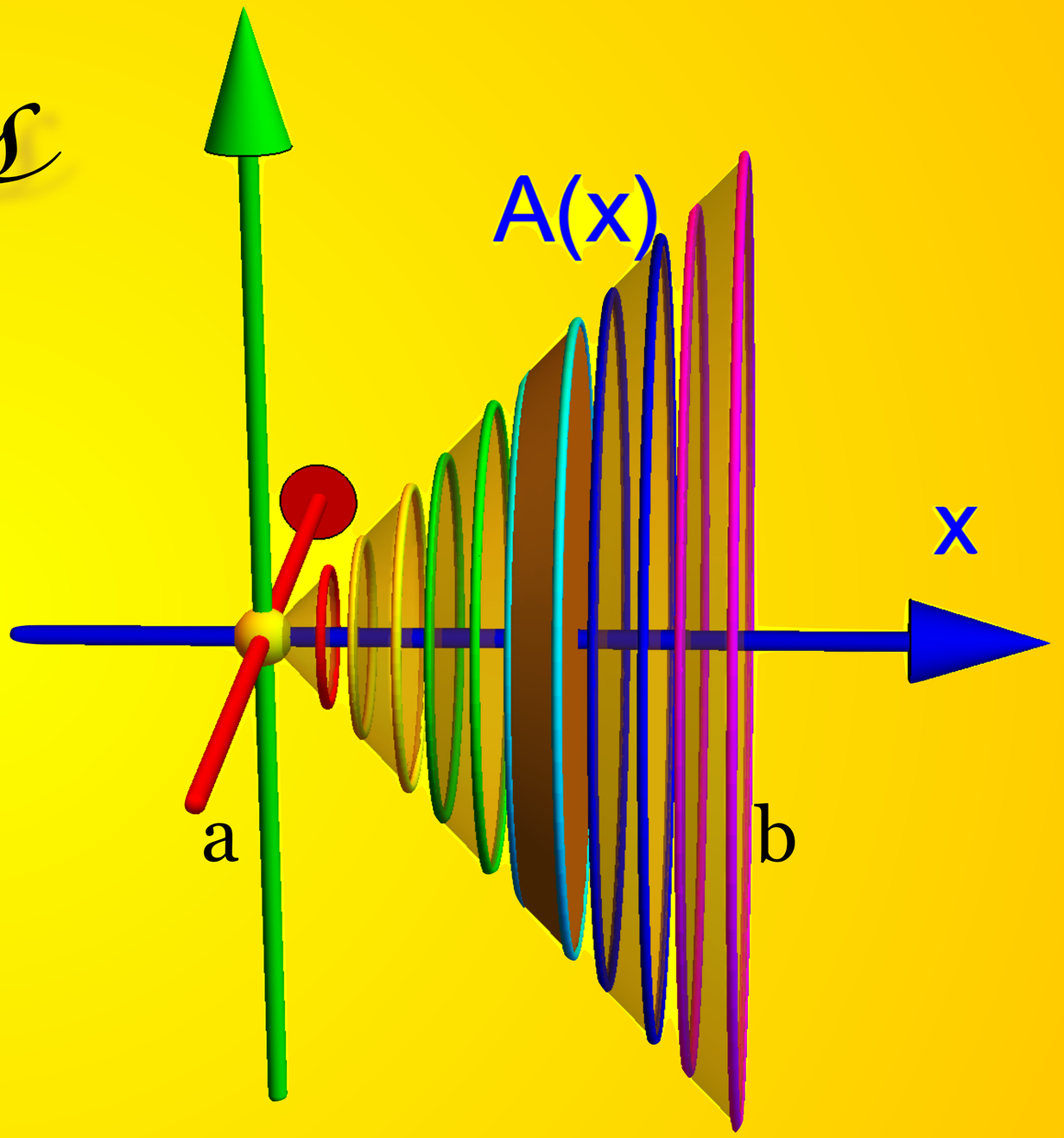
21 Volumes

Volume if A(x)
is area of slice.

$$V = \int_a^b A(x)dx$$



PLAN

1. Poll

2. Archimedes Formula

3. Cone, Paraboloid, Sphere, Lemon

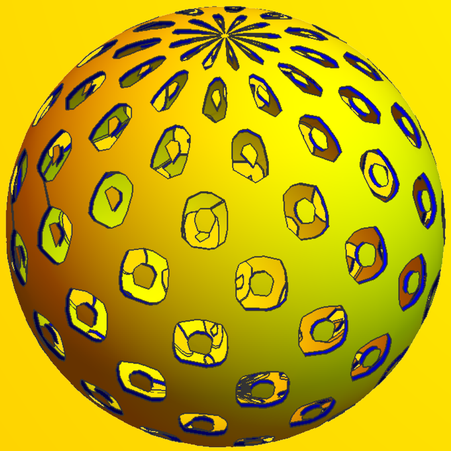
4. Sapace X SN10

5.Pappus Torus

6.Jam

POLL

Which formula is the volume of the sphere?



A $4\pi r^3$

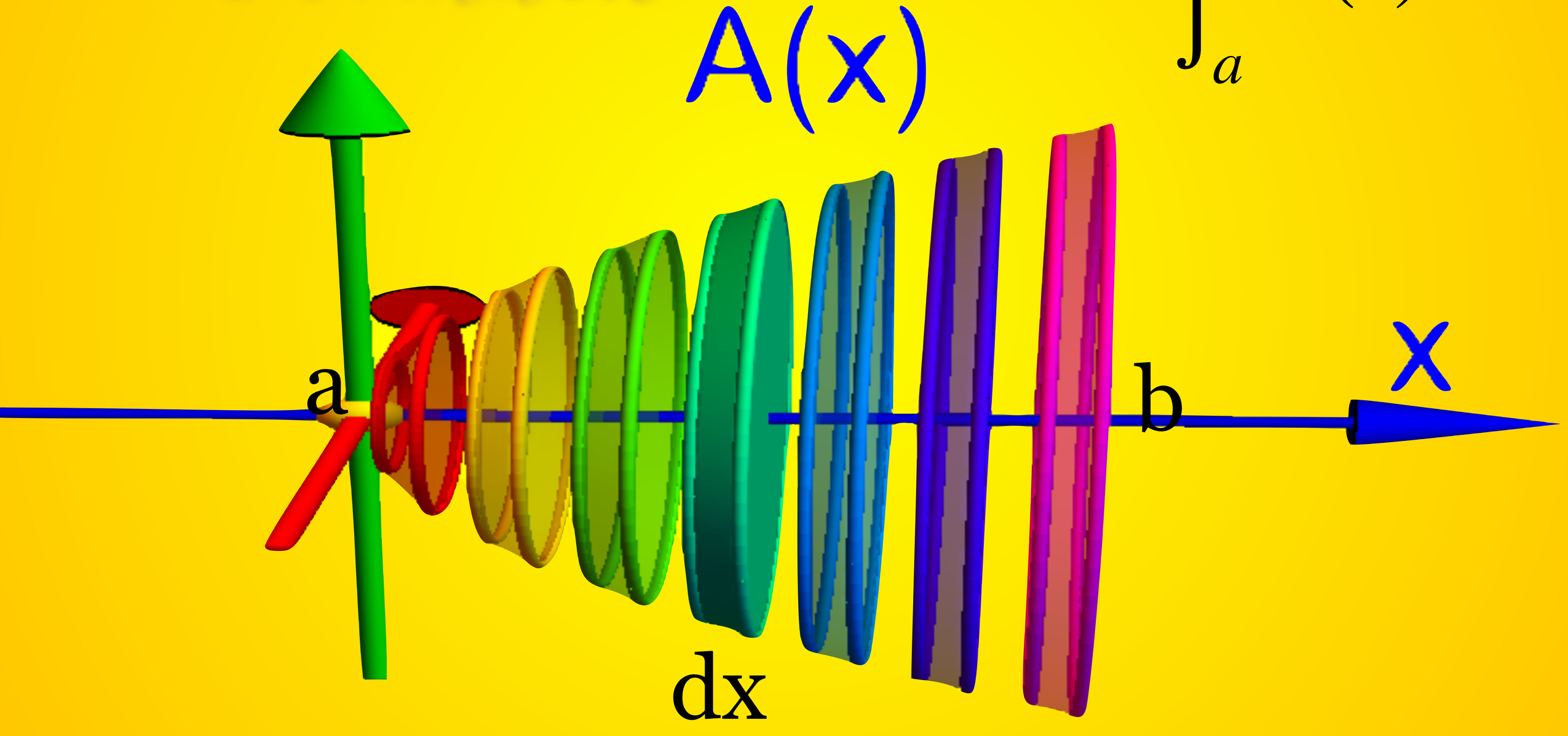
B $4\pi r^3/3$

C πr^3

D r^3

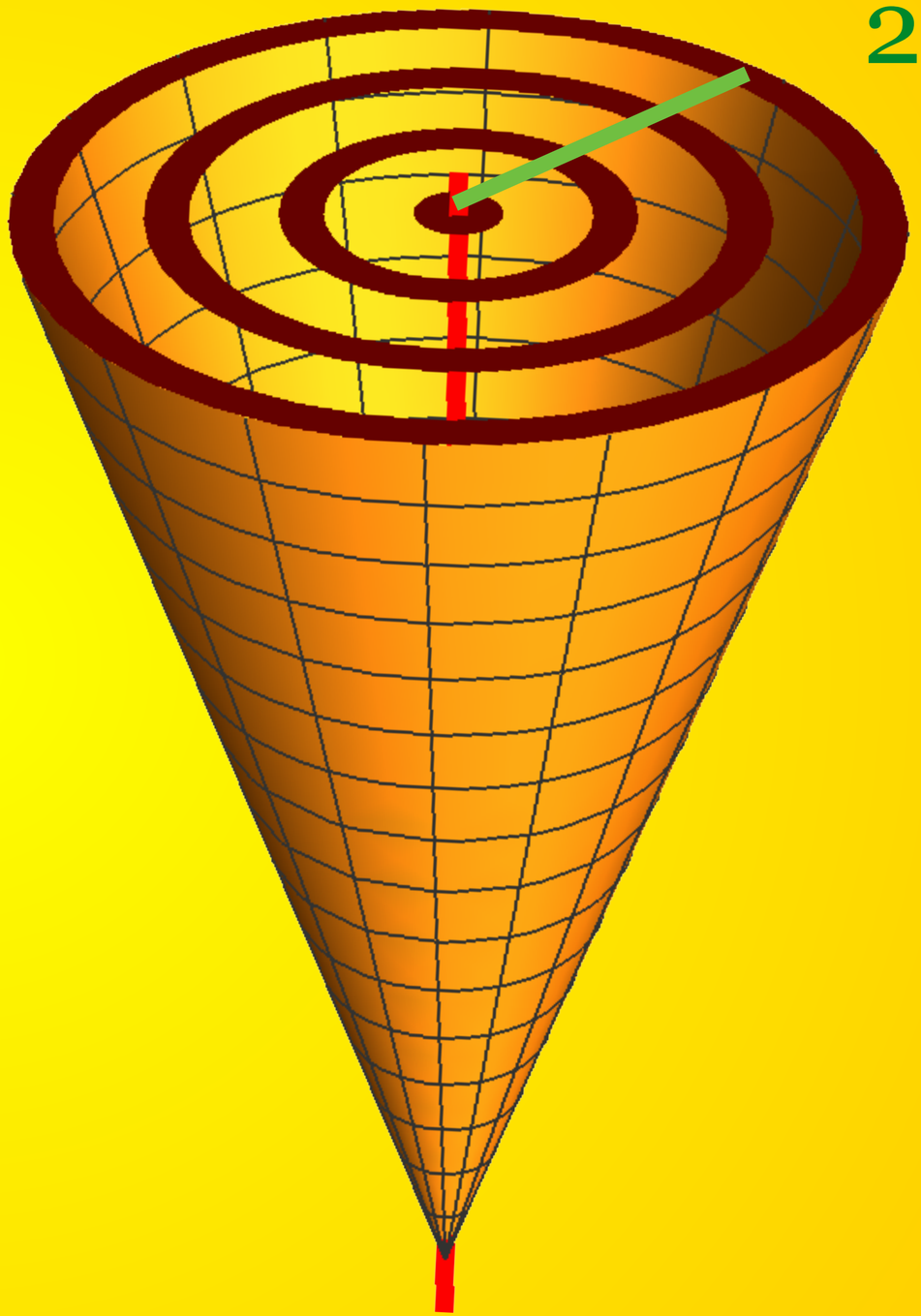
Formula

$$V = \int_a^b A(x)dx$$



Cone

Assume a cone has height 8 and base radius 2. What is the volume?

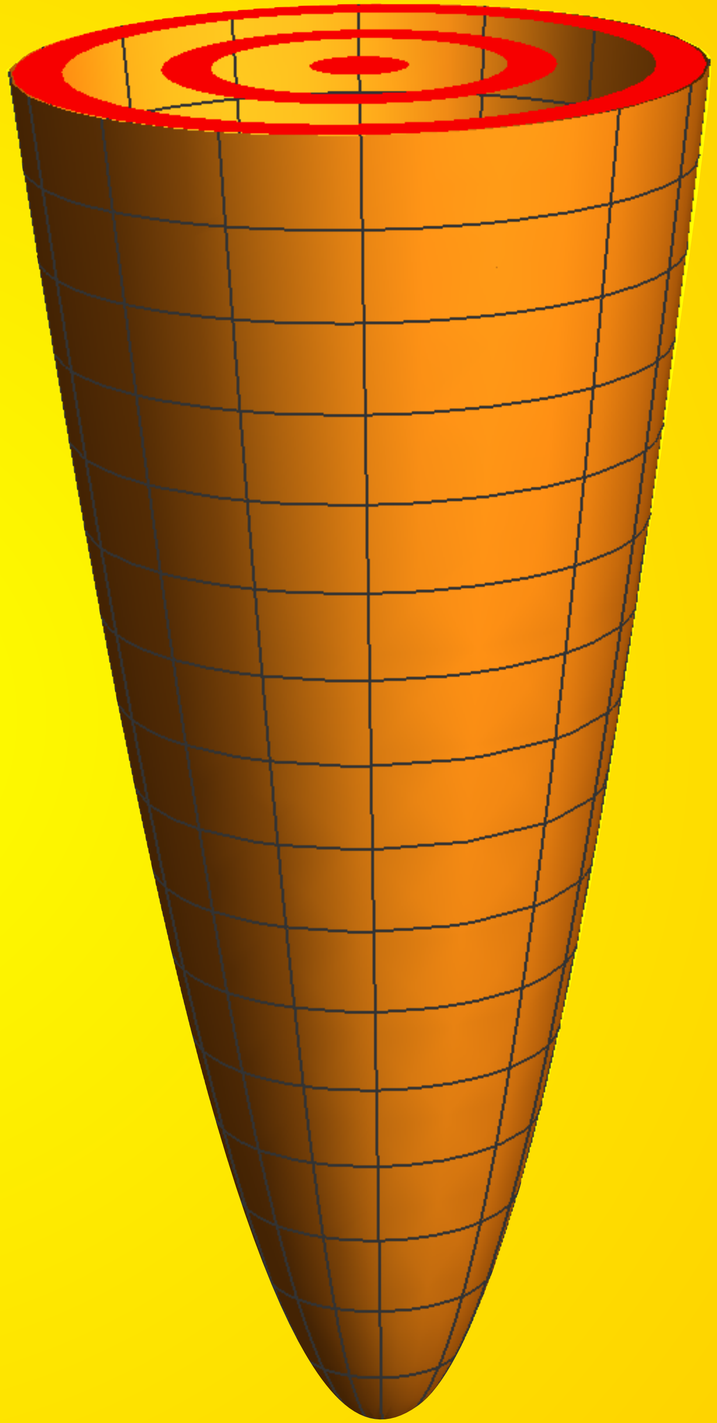


Paraboloid

Assume

$$r(x) = \sqrt{x/9}$$

Find the volume.

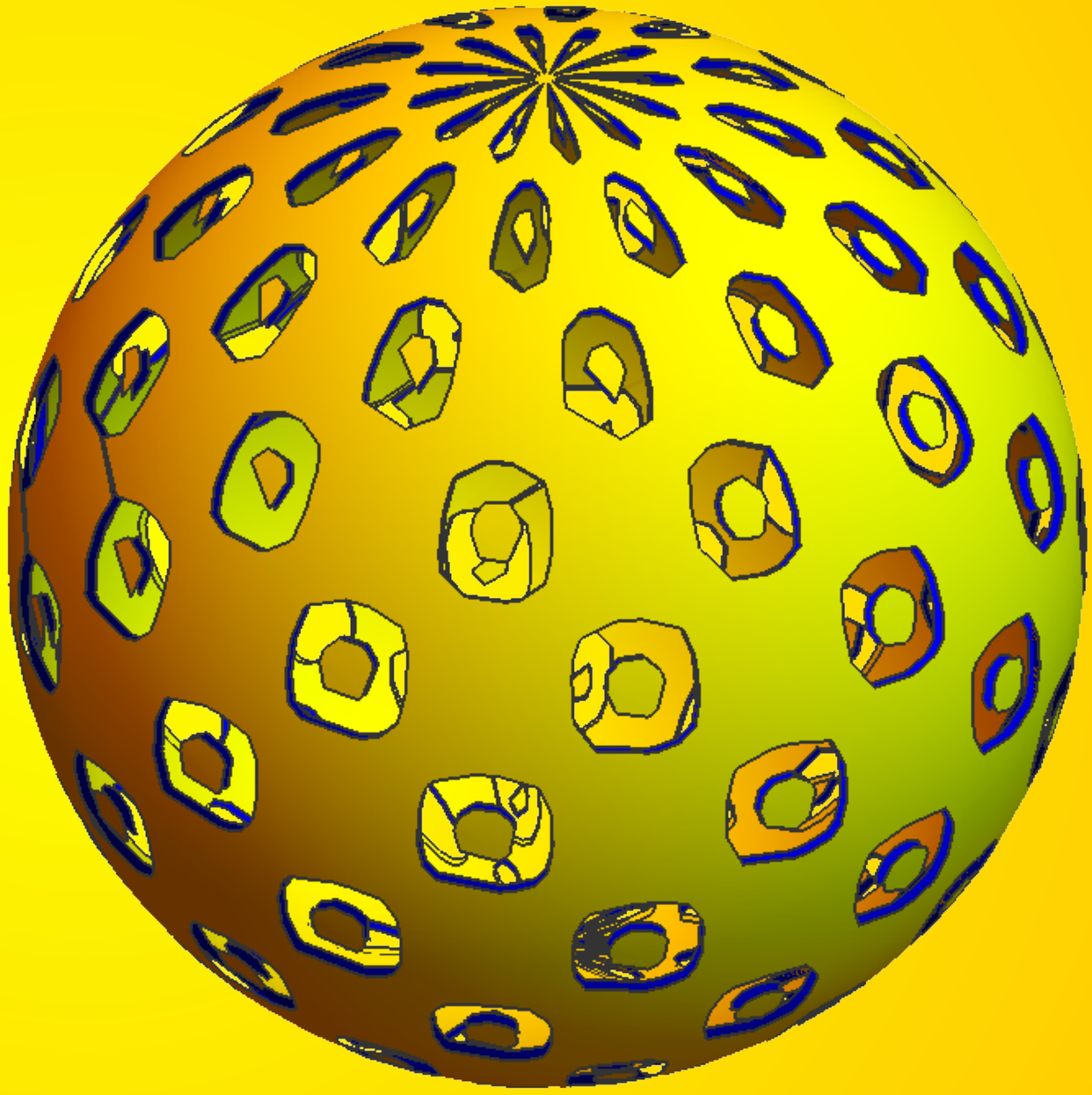


Sphere

We have

$$r(x) = \sqrt{1 - x^2}$$

What is the volume?



Hyperboloid

At point x the radius of the disc is r.

Assume $r^2 - x^2 = 1$ and |x|<2. Draw the situation and Find the volume.

Lemon

Draw the region

$$r(x) = \sin(x)$$

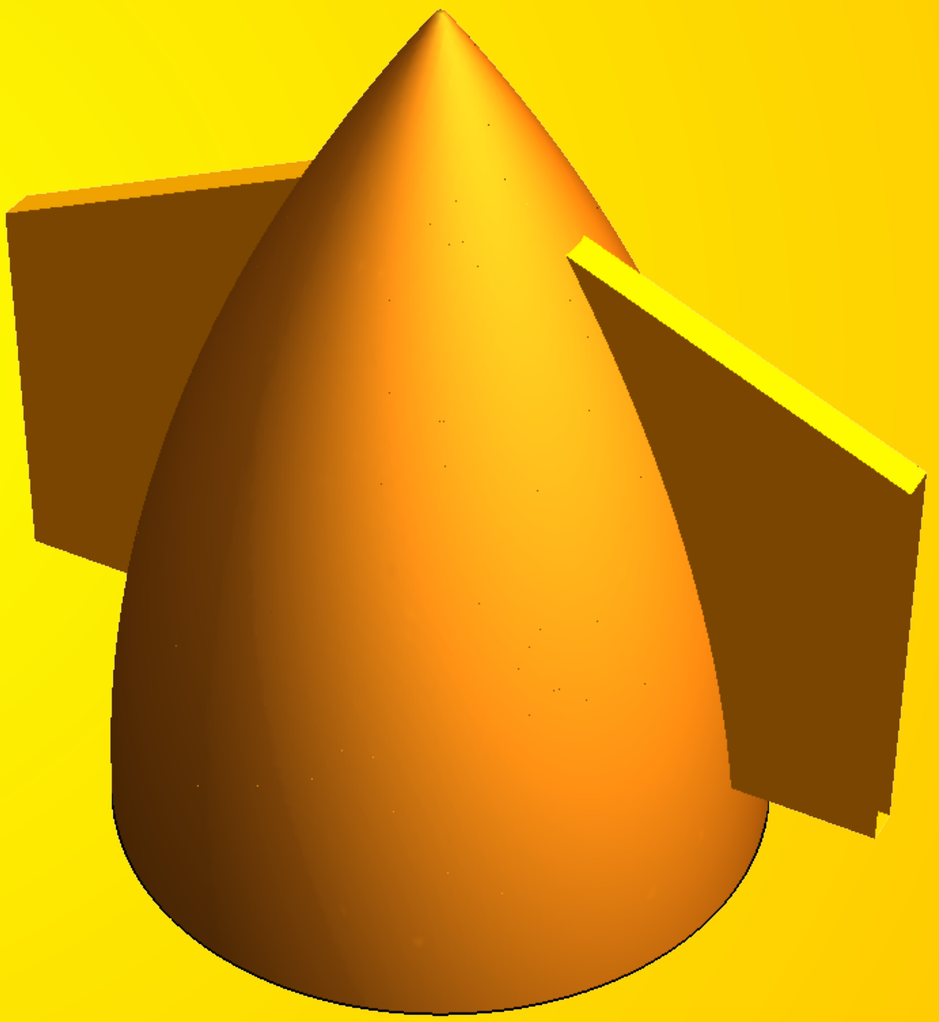
with $0 \leq x \leq \pi$

and compute the volume

Space X

Homework

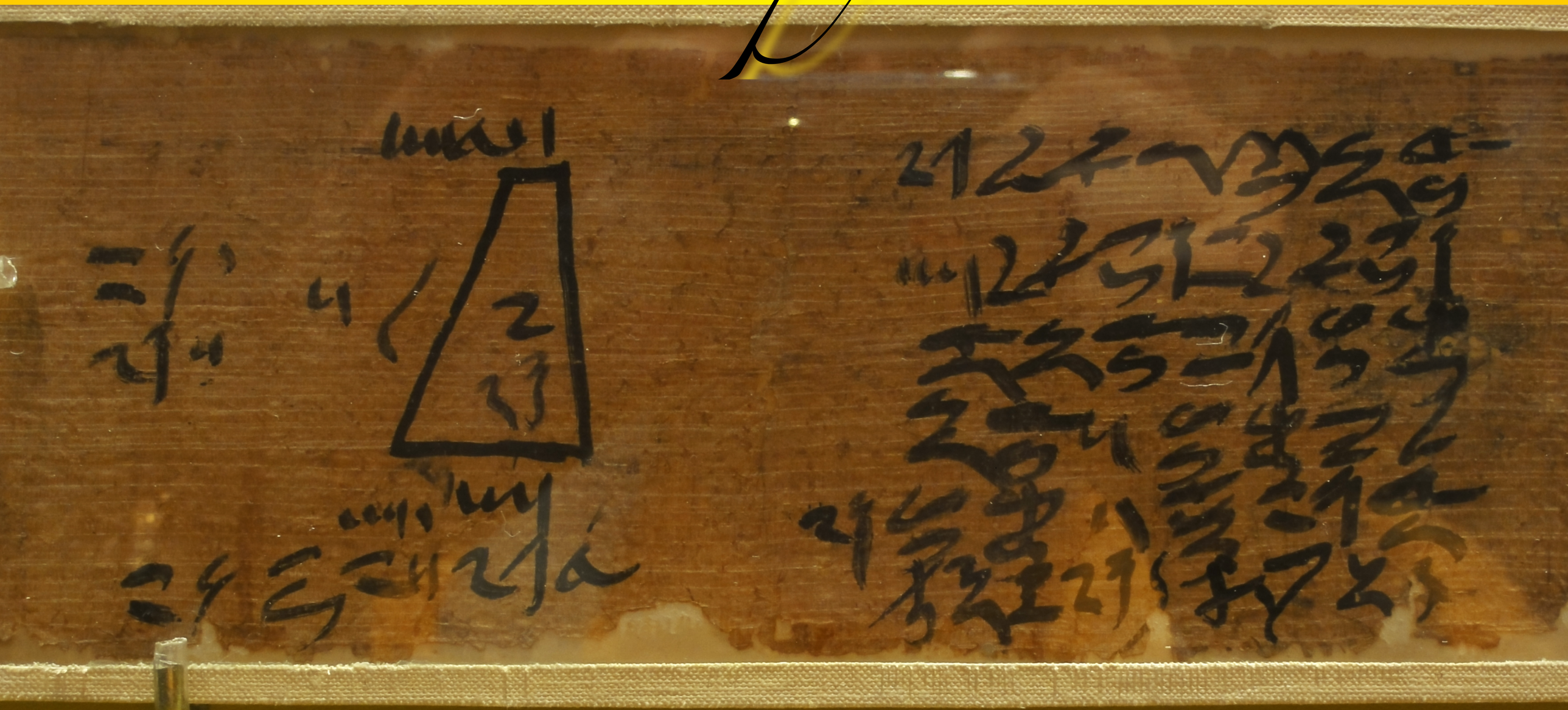
$$r(x) = \sqrt{9 - x^2}$$



Space X, 20 times faster

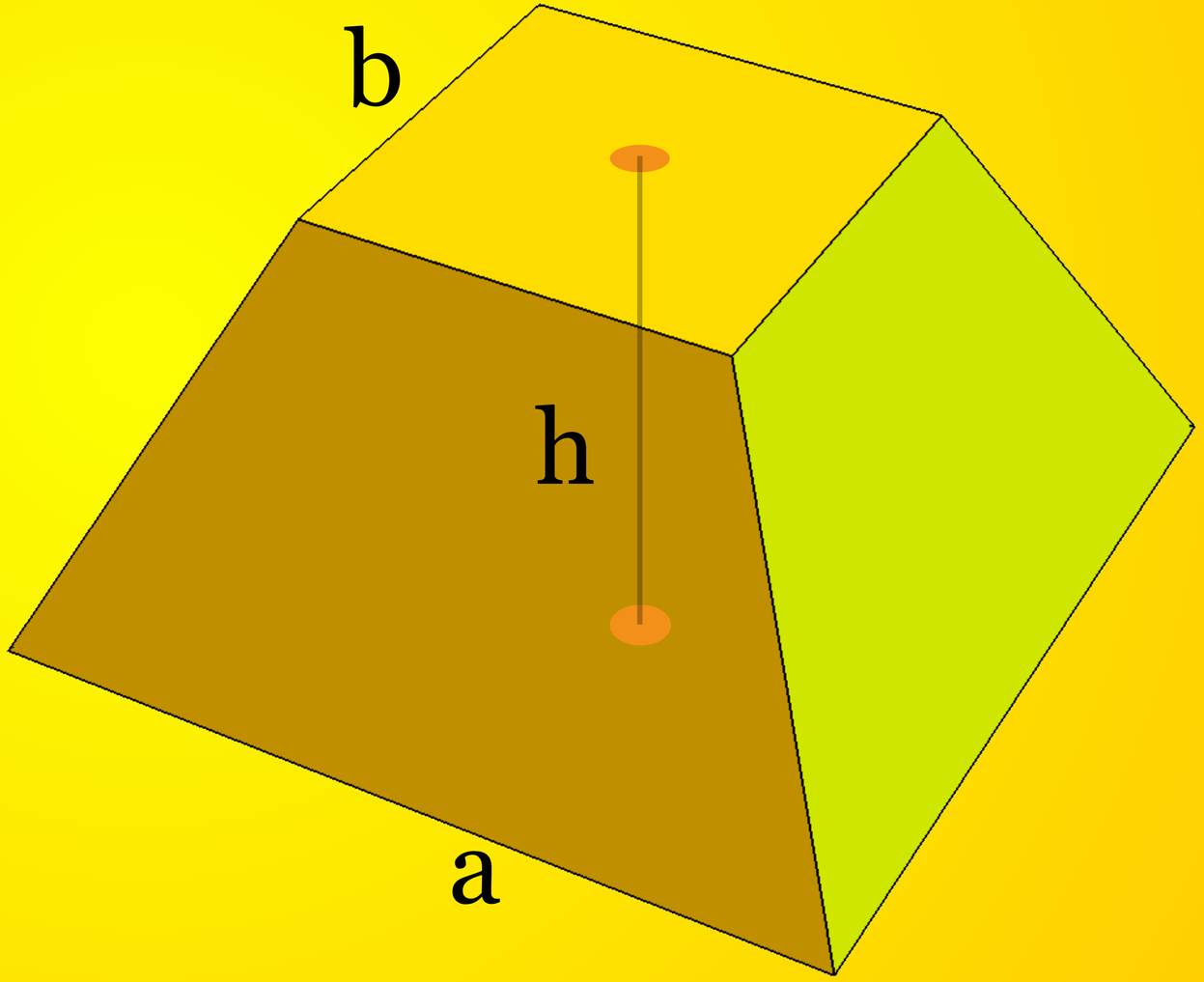
Moscow Papyrus

1850 BC



Volume Frustrum

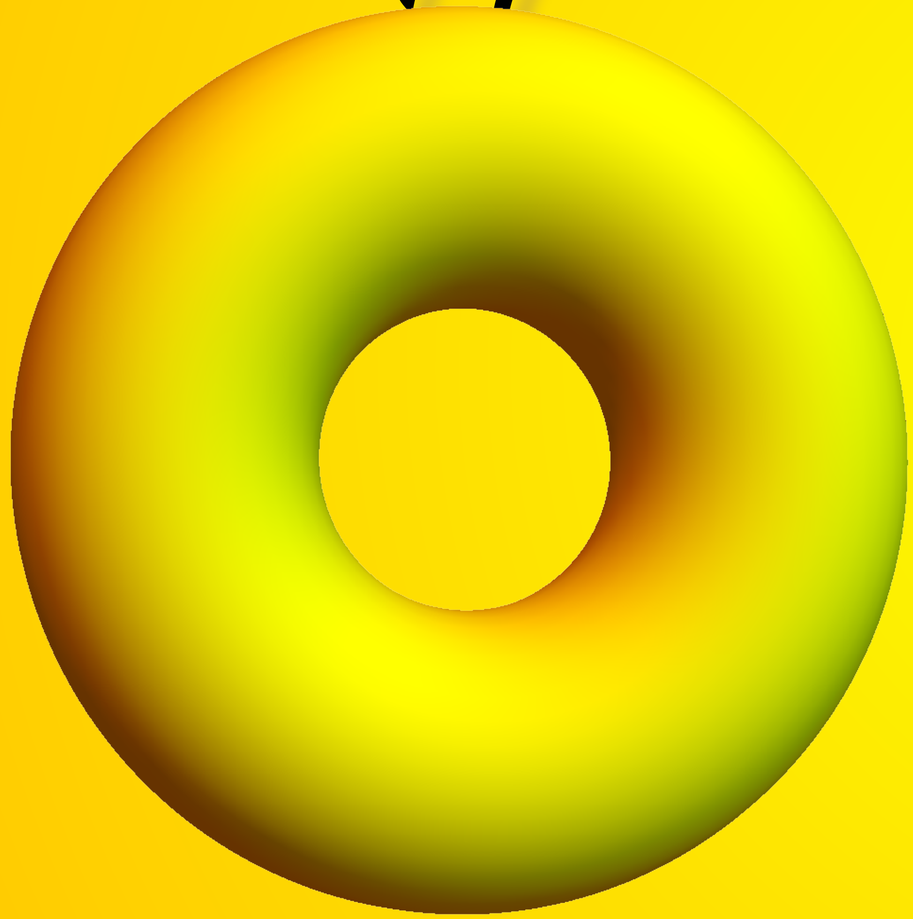
$$V = \frac{h}{3}(a^2 + ab + b^2)$$



Pyramid

height 4,
base length 4

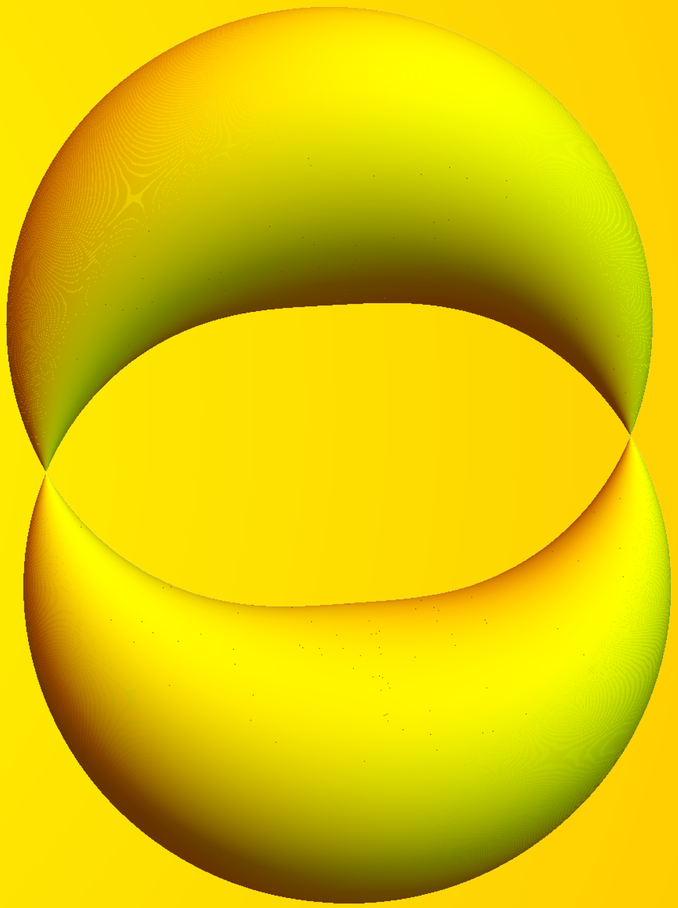
Pappus Centroid result



The formula

$$V = \int_0^{2\pi} A(x)dx$$

also holds if the center moves along a curve



$A(x) = \pi/4$

$A(x) = \pi \sin^2(x)/4$

String Beans

The area at position x is

$$A(x) = \pi \sin^2(12x)$$

The string is parametrized by

$$0 \leq x \leq 2\pi$$

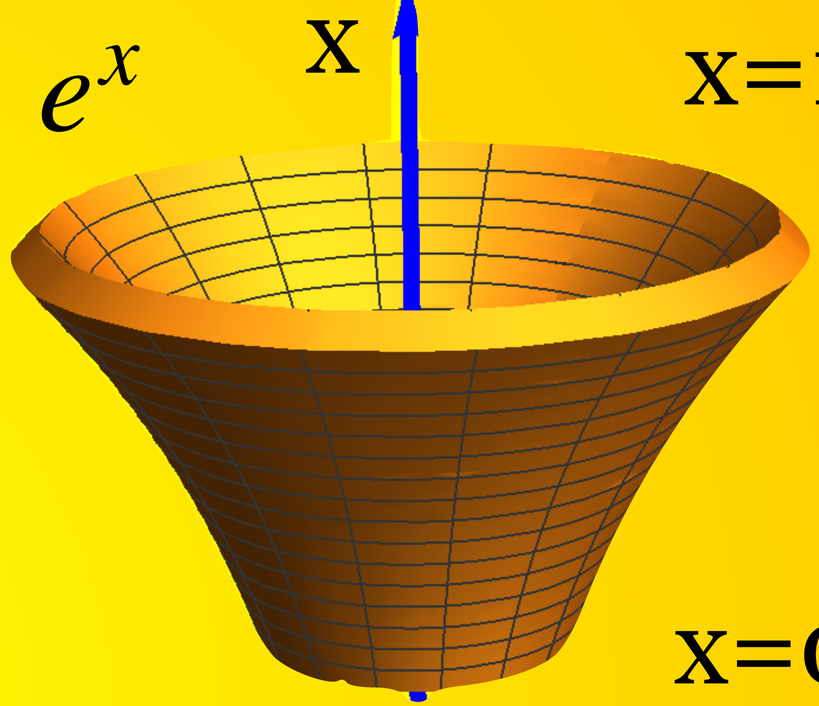
Find its volume

$$V = \int_0^{2\pi} A(x)dx$$

Jam

A

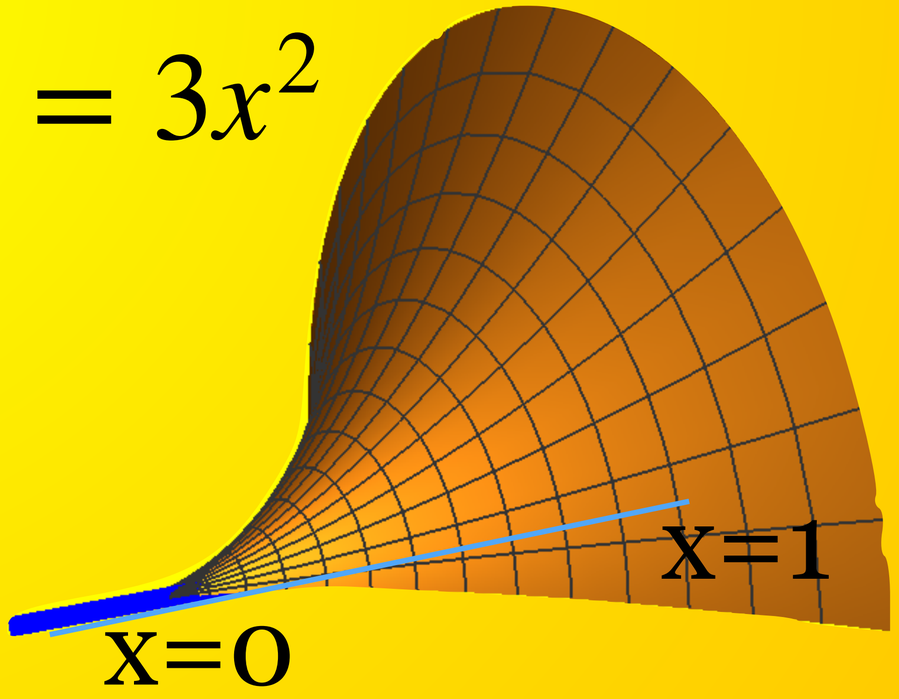
$r(x) = e^x$



Find the volumes of the solids for which the radius of the cross section is given. In the second case the cross section is a half circle.

B

$r(x) = 3x^2$



The End