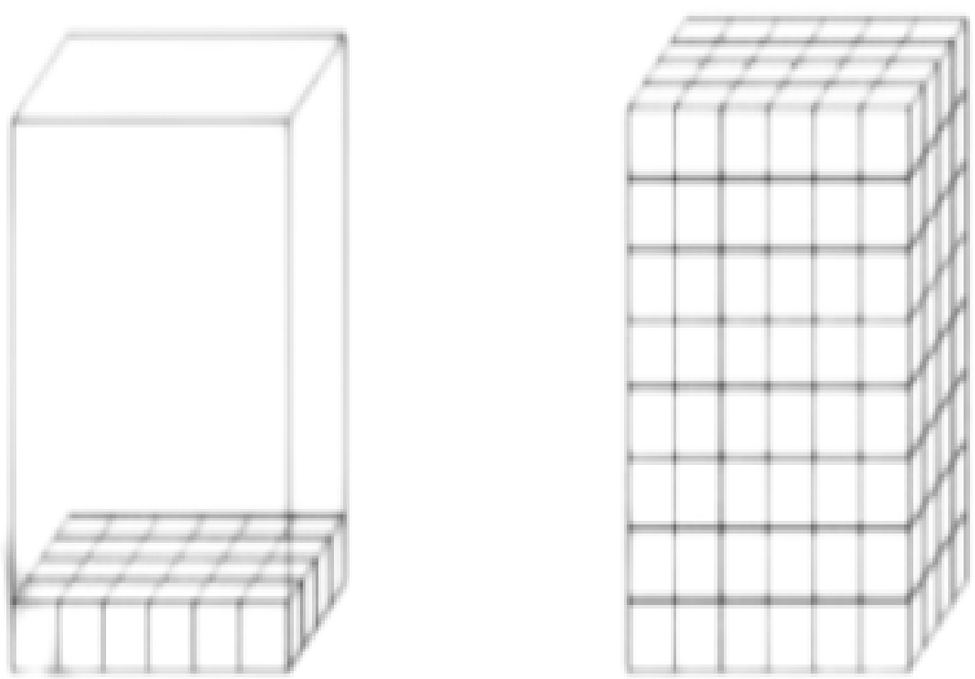
UNDERSTANDING THE VOLUME OF PRISMS, PYRAMIDS, AND OTHER 3D SHAPES AND SOLVING WORD PROBLEMS RELATED TO IT

$$\sqrt[b]{x^a} = x^{\frac{a}{b}}$$

In this lesson, you will learn the relationship between the volumes of a prism and a pyramid. To begin, take a look at the figures below.



How many cubic units are there in one layer?
How many layers fill the figure?

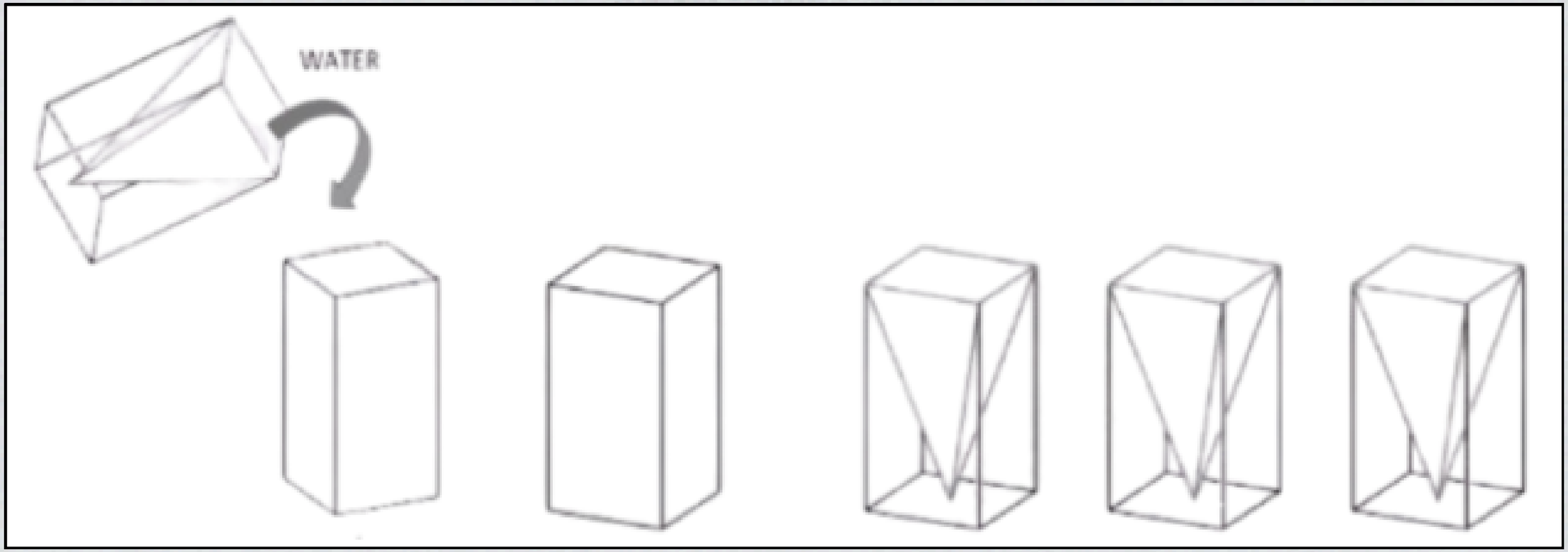
In the figures above, it has **24 cubic units in one layer,** and it has **8 layers**. If you are going to count the total number of cubic units in the figure, it has **192 cubic units**, which represent the **volume** of this figure.

If you can still remember that the **volume** of a **rectangular prism** is the **product of its length, width, and height.**

rectangular prism, cube, cylinder, cone, pyramid, rectangular prism, sphere.

According to the book 21st Century Mathletes 2016, the volume of a prism is the amount of **space inside it**, and it is measured in cubic units, which means it tells you how many **cubes** of a given size it takes to fill the prism.

What if we are to get the **volume of a pyramid** where the dimensions of the base and its height are the same as the given rectangular prism?

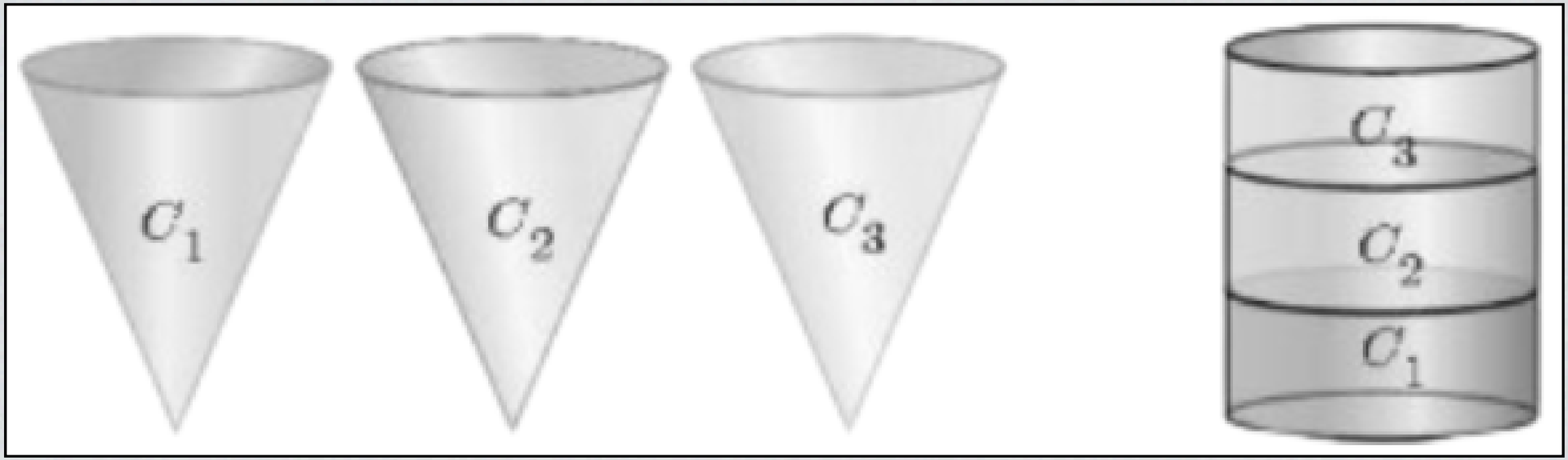


Let us take a look at this figure. Let us fill the rectangular prism with water using the pyramid. The prism and pyramid have the same base and height.

Therefore, if the volume of the given **prism is 192 cubic units**, then the volume of the **pyramid is 192 ÷ 3 = 64 cubic units.**

Vice versa, if the volume of the given **pyramid is 64 cubic units,** the volume of the **rectangular prism is 64 x 3 = 192.**

What if we have to pour **water** in a cylinder using a cone of the same base and height?



It takes **three cones** to fill in the cylinder. The cone and the **cylinder** have the same base and height.

Example 1: Find the volume of the cone inside the cylinder. The cone and cylinder have the same base and height.

Volume of cylinder is **300 cubic units.**

To find the Volume of cone is **V = 300 ÷ 3 = 100 cubic units.**

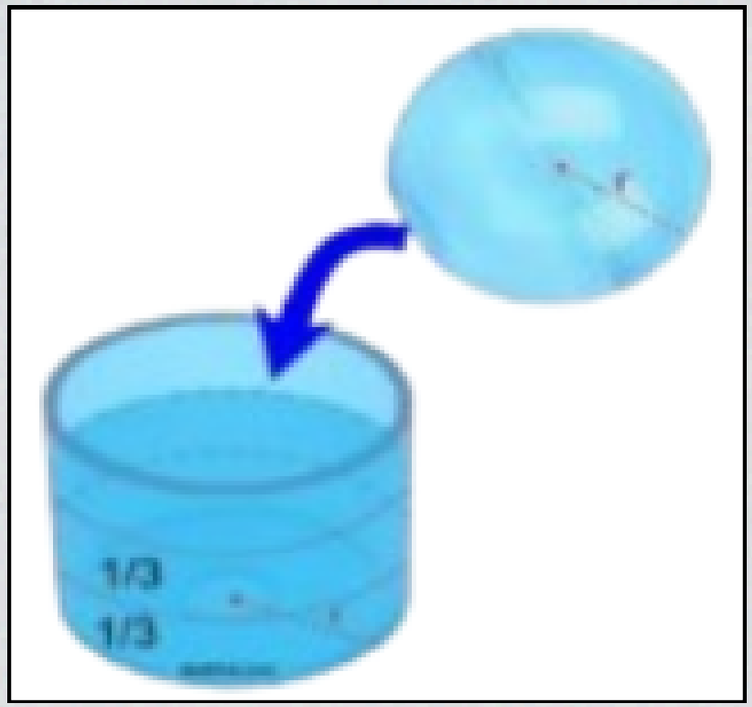
Example 2: Find the volume of the **cylinder.** The cone and cylinder have the same base and height.

Volume of cone is **50 cubic units.**

The volume of cylinder is 3 times the volume of cone, therefore to get the volume of the cylinder in the example;

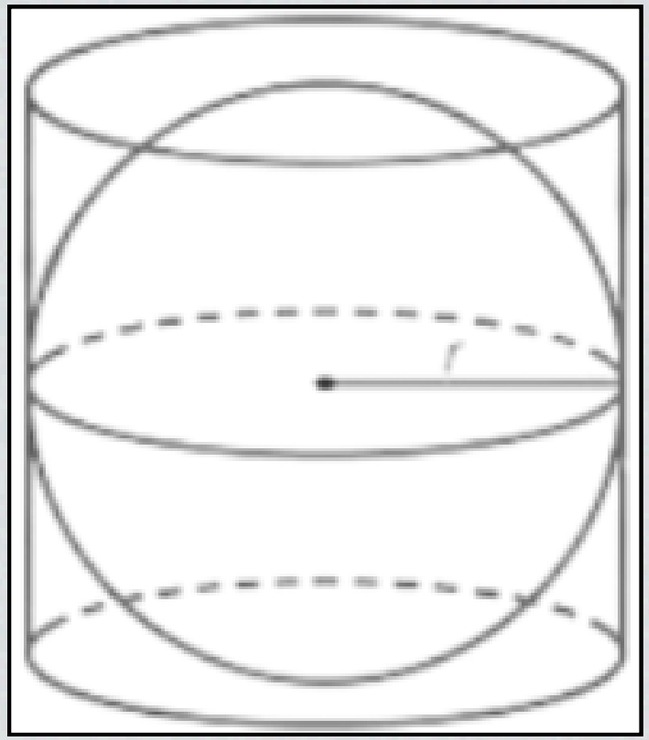
V = 50 x 3 = 150 cubic units.

What if we have to pour **water** into a **cylinder using a sphere** of the same base and height?



It still needs **three spheres** to fill in the **cylinder.** The cylinder and sphere have the same base and height.

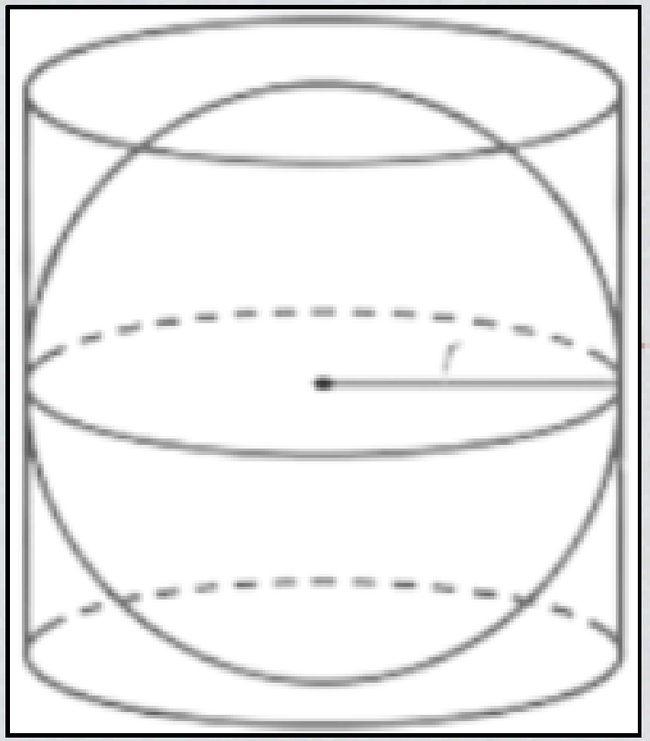
Guide 1: Find the volume of the sphere inside the cylinder. The sphere and the cylinder have the same base and height.



Volume of cylinder is **69 cubic units.**

To find the Volume of sphere is **V = 69 ÷ 3 = 23 cubic units.**

Guide 2: Find the volume of the cylinder. The sphere and cylinder have the same base and height.



Volume of sphere is **42 cubic units.**

The volume of cylinder is 3 times the volume of sphere, therefore to get the volume of the cylinder in the example;

V = 42 x 3 = 126 cubic units.

Therefore, from the given examples, we say that if the prism and pyramid have the same base and height, It takes **three pyramids** to fill in the **volume of the prism**, or we could say that the volume of the pyramid is $\frac{1}{3}$ the volume of the prism with the **same base and height.**