Advances in Theoretical and Applied Mathematics
ISSN 0973-4554 Volume 12, Number 2 (2017), pp. 135-137

http://www.ripublication.com

New Method for Finding Volume of the Sphere

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Abstract

In this article, it is introduced a new way for finding the volume of the Sphere using the volume of the solids like cylinder.

Key words: Volume, Hemisphere, Sphere, Cylinder.

INTRODUCTION

There are number of ways to find the volume of the Cylinder, Cone and Sphere. In this article it is introduced a new way (approach) for finding the volume of the Sphere using the volume of the Cylinder. We first consider the hemisphere with the radius of the base r and divided it into n (assume that n is so large) equal parts (with respect to height from base to top) as cylinders and the height of the each cylinder is considered as $\frac{r}{n}$. It is observed that the total number of cylinders formed with respect to height is $n+1$. Also observed that the radius of the first cylinder (base cylinder) is r, radius of the second cylinder is $r-\frac{r}{n}$, radius of the third cylinder is $r-\frac{2r}{n}$,……., the radius of the $n+1$ cylinder is $r-\frac{nr}{n}$ (i.e., zero) and hence the number of cylinder is n. Again divide these n cylinders into n equal parts with respect to height with decrement in the radius is $\frac{r}{2n}$. It is clear that the total number of cylinders formed is $2n+1$ with radii r , $r-\frac{r}{2n}$, $r-\frac{2r}{2n}$, $r-\frac{3r}{2n}$, ... , $r-\frac{2nr}{2n}$.

Main Result:

It is clear that the Volume of the hemisphere is equal to the sum of the volumes of $n+1$ cylinders with the height of the each cylinder is $\frac{r}{n}$.

Therefore,

Volume of the hemisphere

$$=\pi r^2\left(\frac{r}{n}\right)+\pi\left(r-\frac{r}{2n}\right)^2\left(\frac{r}{n}\right)+\pi\left(r-\frac{2r}{2n}\right)^2\left(\frac{r}{n}\right)+\ldots+\pi\left(r-\frac{2nr}{2n}\right)^2\left(\frac{r}{n}\right)$$

$$=\pi r^2\left(\frac{r}{n}\right)\left(1+\left(1-\frac{1}{2n}\right)^2+\left(1-\frac{2}{2n}\right)^2+\ldots+\left(1-\frac{2n}{2n}\right)^2\right)$$

$$=\pi r^2\left(\frac{r}{n}\right)\left((2n+1)+\left(\frac{1}{2n}\right)^2\left(1^2+2^2+\ldots+(2n)^2\right)-\frac{2}{2n}(1+2+\ldots+2n)\right)$$

$$=\pi r^2\left(\frac{r}{n}\right)\left((2n+1)+\left(\frac{1}{2n}\right)^2\frac{2n(2n+1)(4n+1)}{6}-\frac{2}{2n}\frac{2n(2n+1)}{2}\right)$$

$$=\frac{\pi r^3}{3}\left(1+\frac{1}{2n}\right)\left(2+\frac{1}{2n}\right)$$

$$=\frac{2}{3}\pi r^3 \qquad \text{(since } n \text{ is so large, we can neglect } \frac{1}{2n}\text{)}$$

Hence the volume of the Sphere $=\frac{2}{3}\pi r^3+\frac{2}{3}\pi r^3=\frac{4}{3}\pi r^3$.

CONCLUSION

It can be applied the same idea for finding the volumes of the cone and cylinder.

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