Guide to:
Volume of a frustum

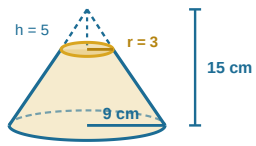
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Explanation:

A **frustum** is the solid remaining when a smaller cone (or pyramid) is sliced off the top of a larger cone parallel to its base. Because the removed top cone and the original full cone are **mathematically similar**, the ratio of their heights equals the ratio of their radii: $\frac{h}{H} = \frac{r}{R}$.

Use similar triangles first if the height of the removed top cone is not given, then calculate: **Volume of frustum = Volume of large cone − Volume of small cone = $\frac{1}{3}\pi R^2 H - \frac{1}{3}\pi r^2 h$.**

Example 1: A cone of radius 9 cm and height 15 cm has a smaller cone of radius 3 cm and height 5 cm removed from its top. Find the exact volume of the frustum.

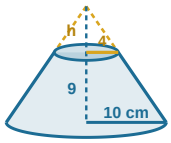


Solution:

$V_{large} = \frac{1}{3}\pi(9)^2(15) = \mathbf{405\pi}$; $V_{small} = \frac{1}{3}\pi(3)^2(5) = \mathbf{15\pi}$

$V_{frustum} = 405\pi - 15\pi = \mathbf{390\pi\ cm^3}$

Example 2: A frustum has top radius 4 cm, base radius 10 cm, and vertical height 9 cm. Find the volume of the frustum (3 s.f.).



Solution:

$\frac{h}{h+9} = \frac{4}{10} \Rightarrow 10h = 4h + 36 \Rightarrow \mathbf{h = 6\ cm}$ (H = 15 cm)

$V = \frac{1}{3}\pi(10^2 \times 15 - 4^2 \times 6) = 468\pi = \mathbf{1470\ cm^3\ (3\ s.f.)}$

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