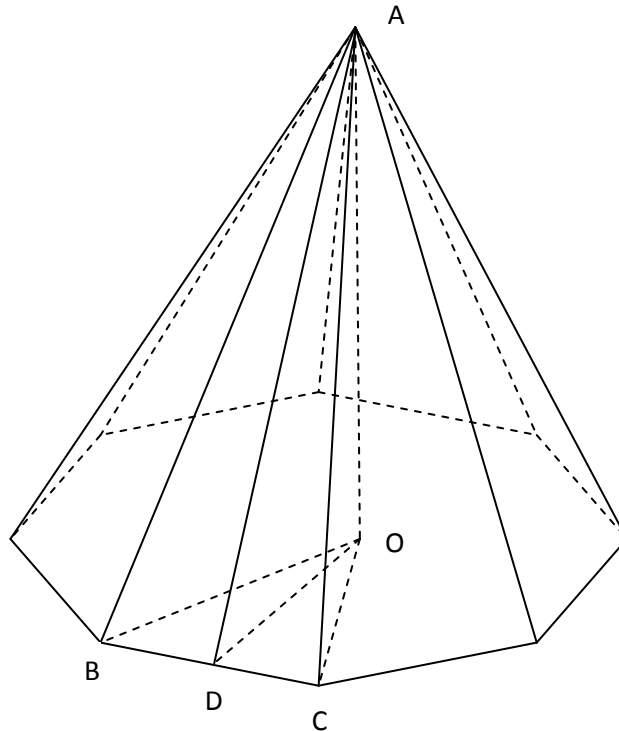


Find the surface area of a right octagonal pyramid with height 2.5 yards, and its base has apothem length 1.5 yards

Solution:



We have

$$AO = 2.5 \text{ (yards)}, OD = 1.5 \text{ (yards)}, OD \perp BC.$$

Denote  $S$  as the surface area of the right octagonal pyramid. Then

$$S = 8S_{ABC}$$

where  $S_{ABC}$  is the area of  $\triangle ABC$  and

$$S_{ABC} = \frac{1}{2} AD \cdot BC.$$

We have

$$AD^2 = AO^2 + OD^2,$$

$$AD = \sqrt{AO^2 + OD^2} = \sqrt{(2.5)^2 + (1.5)^2} = \sqrt{6.25 + 2.25} = \sqrt{8.5} \text{ (yards)}.$$

Because the pyramid is the right octagonal one then

$$\angle BOD = \frac{1}{2} \cdot \frac{2\pi}{8} = \frac{\pi}{8} (\text{rad}).$$

Then

$$BC = 2 \cdot BD = 2 \cdot OD \cdot \tan \angle BOD = 2 \cdot 1.5 \cdot \tan \frac{\pi}{8} = 3 \tan \frac{\pi}{8} (\text{yards}).$$

Thus we have

$$S = 8S_{ABC} = 8 \cdot \frac{1}{2} AD \cdot BC = 4 \cdot \sqrt{8.5} \cdot 3 \tan \frac{\pi}{8} = 12\sqrt{8.5} \tan \frac{\pi}{8} \approx 14.4916 (\text{yards}^2).$$

Answer:

$$S = 12\sqrt{8.5} \tan \frac{\pi}{8} \approx 14.4916 (\text{yards}^2)$$