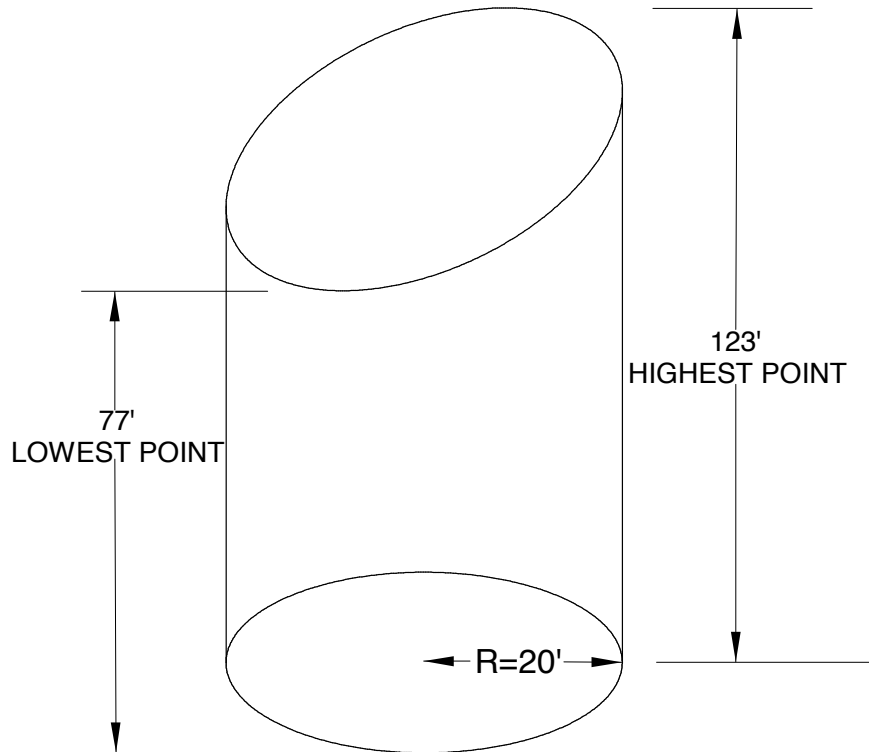


Solution
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This problem can be solved by integral calculus, but it is easier to imagine a similar cylindrical segment turned upside down and placed atop this one such that the long side of the upper one lines up with the short side of the lower one, and vice versa.

The volume of such an arrangement would be twice that required and the surface area of the sides would be doubled also.

The required volume is: $\frac{1}{2} \pi (20)^2(77+123) = 251,327.4$ divided by 2 = 125,663.7 cubic feet.

The required side surface area is: $\frac{1}{2}(2\pi)(20)(77 + 123) = 12,566.4$ square feet.

The top surface is an ellipse with a long axis $\sqrt{40^2 + 46^2} = 60.959'$ and a short axis of $40'$.

The area of the ellipse is $\pi(20)(30.4795) = 1915.1$ square feet.

The total surface area is 14481.5 square feet.