Answer on Question #79252 – Math – Analytic Geometry

Question

A cooling tower for a nuclear reactor is to be constructed in the shape of a hyperboloid of one sheet. The diameter at the base is $260\,m$ and the minimum diameter, $500\,m$ above the base, is $200\,m$. Find an equation for the tower. (Assume the position of the hyperboloid is such that the center is at the origin with its axis along the $z-axis$, and the minimum diameter at the center.)

Solution

$$\frac{x^2}{a^2}+\frac{y^2}{b^2}-\frac{z^2}{c^2}=1$$

We have points:

$$(200,200,0),(260,260,500)$$

Then:

$$a=b=200\sqrt{2}$$

and:

$$\frac{67600}{80000}+\frac{67600}{80000}-\frac{250000}{c^2}=1$$

$$\frac{676}{800}+\frac{676}{800}-\frac{250000}{c^2}=1$$

$$\frac{169}{100}-1=\frac{250000}{c^2}$$

$$c=\sqrt{\frac{250000}{0.69}}$$

$$\frac{x^2}{80000}+\frac{y^2}{80000}-\frac{z^2}{362319}=1.$$

Answer: $\frac{x^2}{80000} + \frac{y^2}{80000} - \frac{z^2}{362319} = 1.$