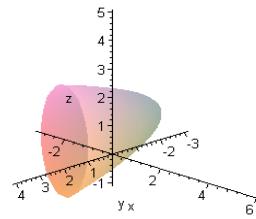


Q.1: Use completing square to identify the surface $4y^2 + z^2 - x - 16y - 4z + 20 = 0$.

Sol: $4y^2 + z^2 - x - 16y - 4z + 20 = 0$

$$4(y^2 - 4y + 4) + (z^2 - 4z + 4) = x$$

$$4(y-2)^2 + (z-2)^2 = x$$



$$\frac{(y-2)^2}{1} + \frac{(z-2)^2}{4} = \frac{x}{4}$$

Elliptic Paraboloid.

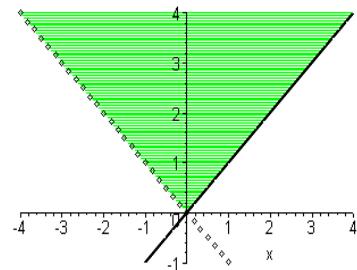
Q.2: Identify the surface $\rho^2 (\sin^2 \varphi - 4 \cos^2 \varphi) = 1$.

Sol: $\rho^2 \sin^2 \varphi - 4\rho^2 \cos^2 \varphi = 1 \Rightarrow r^2 - 4z^2 = 1 \Rightarrow x^2 + y^2 - 4z^2 = 1$

This is a hyperboloid of one sheet

Q.3: Find and sketch the domain of the surface $f(x, y) = \sqrt{y-x} \ln(x+y)$.

Sol: $y - x \geq 0 \Rightarrow y \geq x$ and $x + y > 0 \Rightarrow x > -y$



The domain is $\{(x, y) | -y < x \leq y\}$. Graph of the domain is