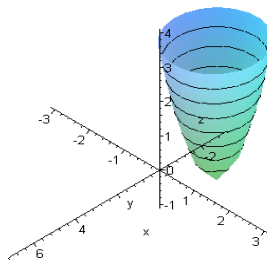


Q.1: Use completing square to identify the surface $3y^2 + x^2 + 2x - 6y - z + 4 = 0$.

Sol: $3y^2 + x^2 + 2x - 6y + 4 = z$

$$3(y^2 - 2y + 1) + (x^2 + 2x + 1) = z$$

$$3(y - 1)^2 + (x + 1)^2 = z$$



$$\frac{(y - 1)^2}{1} + \frac{(x + 1)^2}{3} = \frac{z}{3}$$

Elliptic Paraboloid.

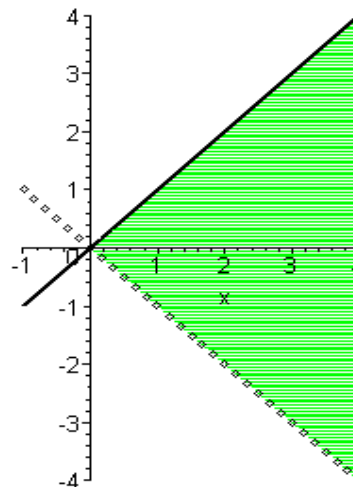
Q.2: Identify the surface $\rho^2 (\sin^2 \varphi - 2 \cos^2 \varphi) = 3$.

Sol: $\rho^2 \sin^2 \varphi - 2\rho^2 \cos^2 \varphi = 3 \Rightarrow r^2 - 2z^2 = 3 \Rightarrow x^2 + y^2 - 2z^2 = 3$

This is a hyperboloid of one sheet

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

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



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