Warmup

Sketch the graphs of the surfaces described by the following equations:

1. $6x - 3y + 4z = 6$
2. $x^2 + y^2 = 1$ (in $\mathbb{R}^3$)
3. $x^2 + y^2 + z^2 = 1$
4. $z = x^2 + 2y^2$
5. $z = x^2 - 2y^2$
6. $z^2 = 2x^2 + y^2$

Planes

Which of the following four planes are parallel? Are any of them identical?

$P_1 : 3x + 6y - 3z = 6$, $P_2 : 4x - 12y + 8z = 5$, $P_3 : 9y = 1 + 3x + 6z$, $P_4 : z = x + 2y - 2$

Find an equation for the plane that passes through the points $(2,1,2), (3,-8,6), \text{ and } (-2,-3,1)$.

Find an equation for the plane that passes through the point $(3,1,4)$ and contains the line of intersection of the planes $x + 2y + 3z = 1$ and $2x - y + z = -3$. 
Conic sections
Consider the cone described by \( z^2 = x^2 + y^2 \). Sketch its intersection with the following planes. Use substitution to eliminate one of the three variables, and describe the intersection.

1. \( z = 5 \)
2. \( x = 2 \)
3. \( z = y + 1 \)
4. \( z = (x/2) + 1 \)

Find an equation for the surface consisting of all points equidistant from the points \((-1, 0, 0)\) and the plane \( x = 1 \). Identify the surface.