Facts to Know:

1. Level sets of 2-variable functions $f(x, y)$ are:
   - Defined by ____________,
   - _________ on the $xy$-plane,
   - On the graph of ____________ in $\mathbb{R}^3$.

2. Level sets of 3-variable functions $g(x, y, z)$ are:
   - Defined by ____________,
   - _________ in $\mathbb{R}^3$.

Examples:

1. Sketch the level sets $\frac{3}{x^2 + y^2 + 1} = C$ for $C = 3, 2, 1, \frac{1}{2}$ on $xy$-plane, then use the level sets to sketch the graph of $z = \frac{3}{x^2 + y^2 + 1}$ in $\mathbb{R}^3$.
2. Sketch the following level sets in $\mathbb{R}^3$:

- The Plane $x + y + 2z = 2$

Graph:

- The Cylinder $y^2 + z^2 = 4$

Graph:

- The Cone $x^2 + y^2 - z^2 = 0$

Graph:

- The Sphere $x^2 + y^2 + z^2 = 1$

Graph: