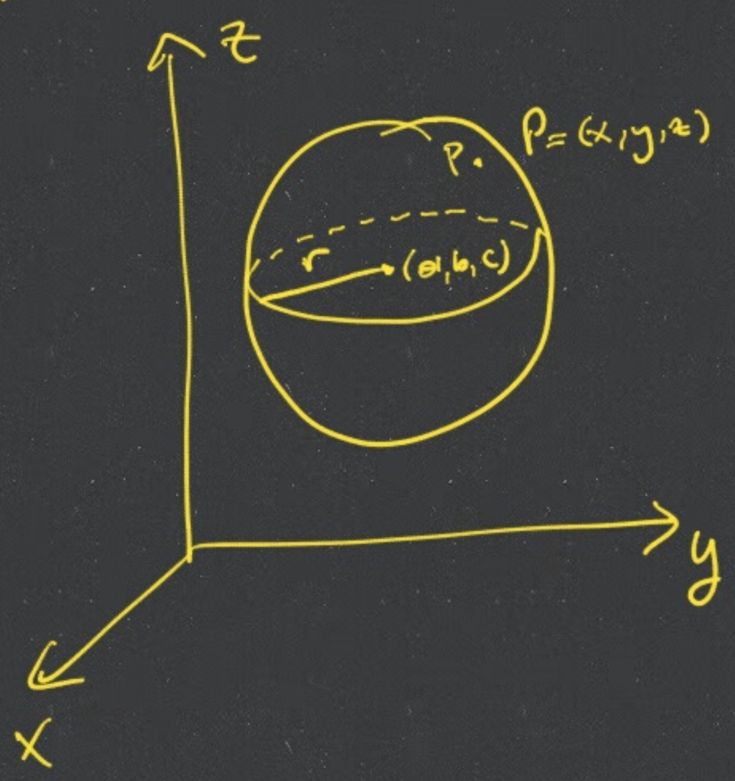
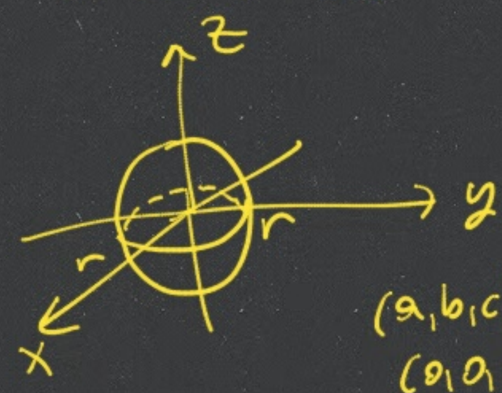
10.1. Part 2.

We have obtained the equation of a sphere centered at (a,b,c) with radius r as $r^2 = (x-a)^2 + (y-b)^2 + (z-c)^2$



$r^2 = x^2 + y^2 + z^2$



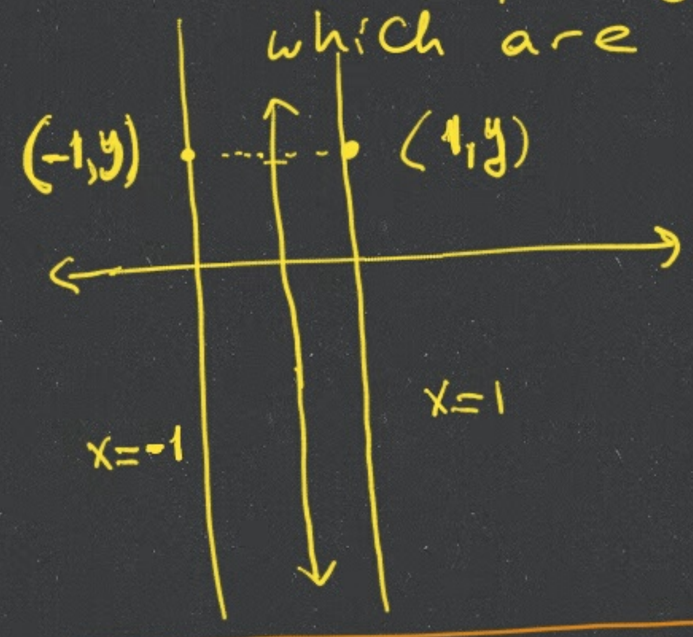
$(a,b,c) = (0,0,0)$

Graph / Solution set of an equation in $\mathbb{R}^n$, $n = 1, 2, 3$

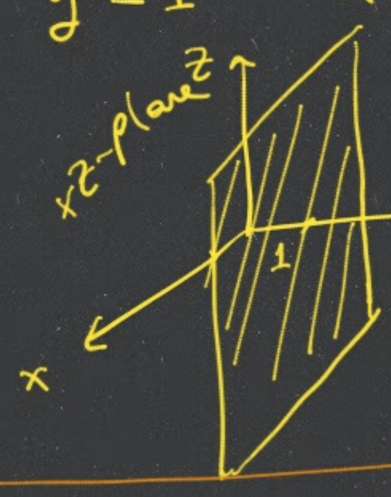
1) $x^2 = -1$ has no solution in $\mathbb{R}$ or $\mathbb{R}^2$, or $\mathbb{R}^3$.

2) $|x| = 1$ has two solutions in $\mathbb{R}$, which are $x = 1$, $x = -1$

3) $|x| = 1$ has infinitely many solutions in $\mathbb{R}^2$, which are $(1, y)$ and $(-1, y)$ for any $y \in \mathbb{R}$

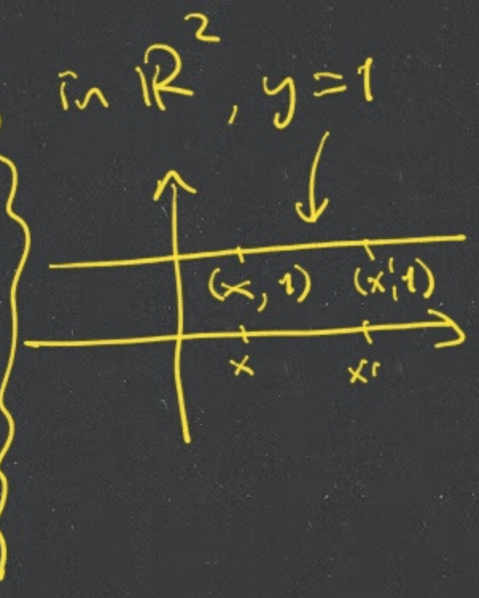


4) $y = 1$ has infinitely many solutions in $\mathbb{R}^3$

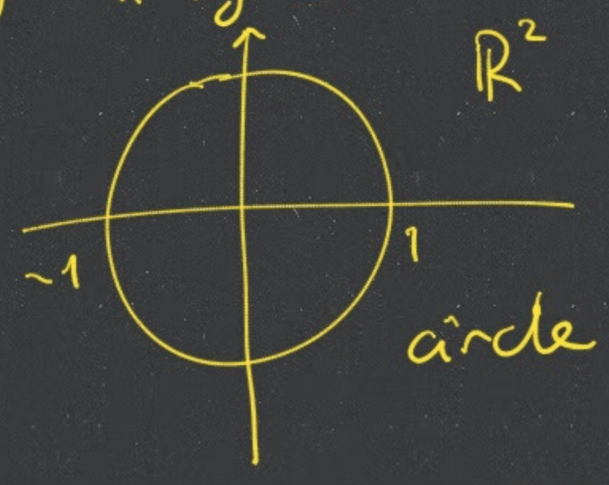


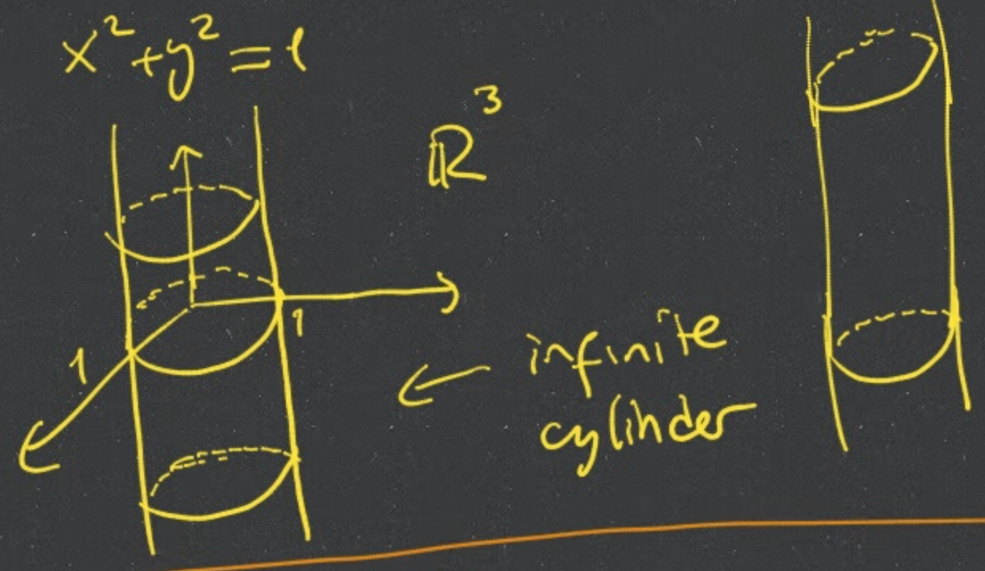
yz-plane $(x, 1, z)$ $x, z \in \mathbb{R}$

All such points in $\mathbb{R}^3$ form a plane which is parallel to the xz-plane

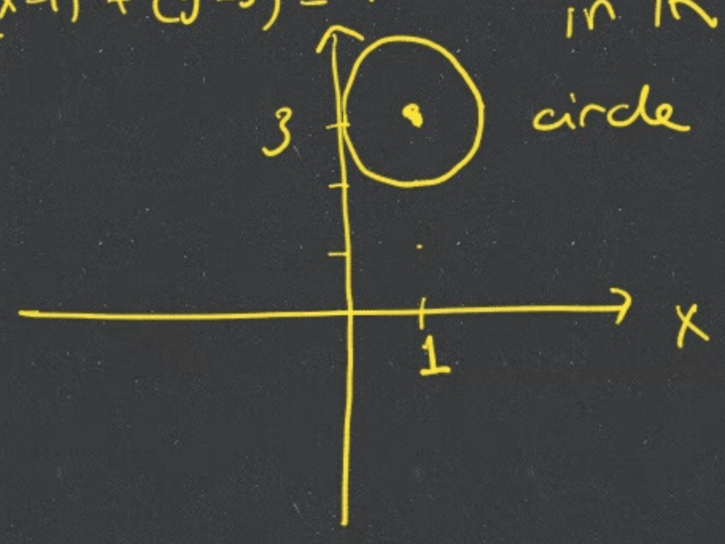


5) $x^2 + y^2 = 1$

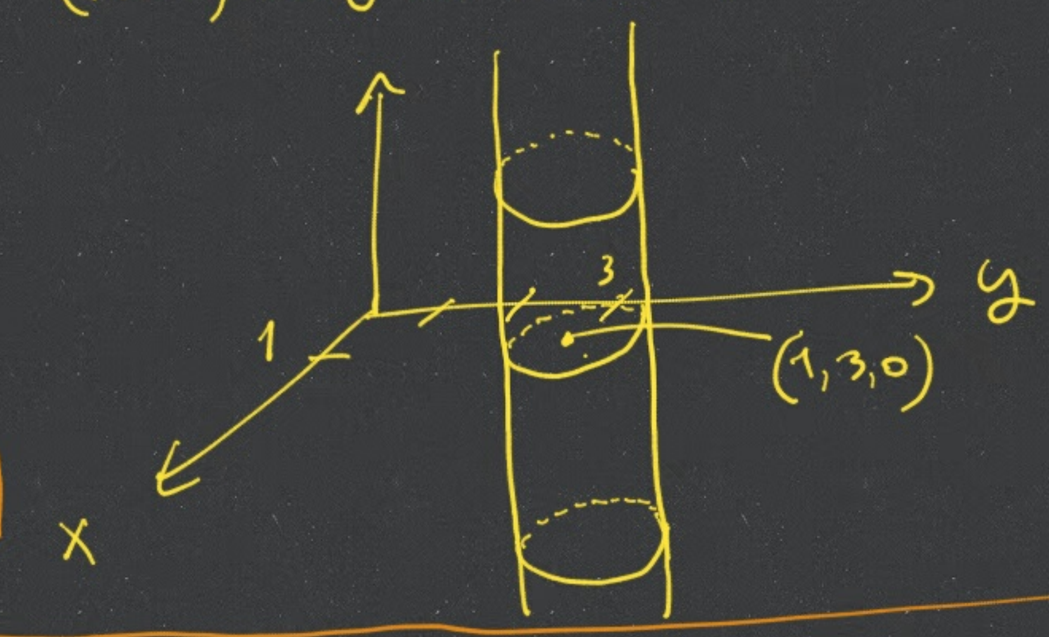




6) $(x-1)^2 + (y-3)^2 = 1$ in $\mathbb{R}^2$

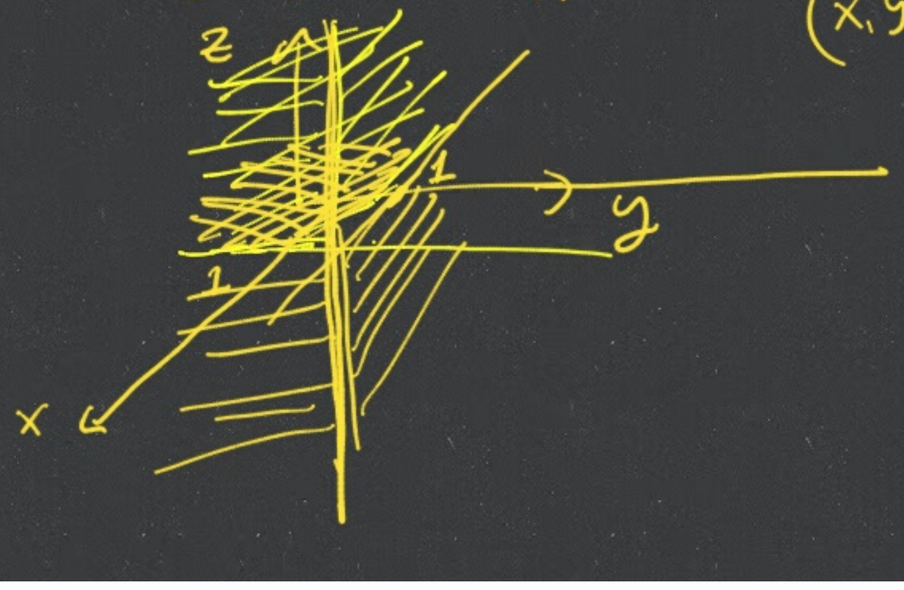


$(x-1)^2 + (y-3)^2 = 1$ in $\mathbb{R}^3$



7) $\{ x \le 1, \ y \le 1 \}$ in $\mathbb{R}^2$

$x \le 1$, $y \le 1$ in $\mathbb{R}^3$ (x, y, z)



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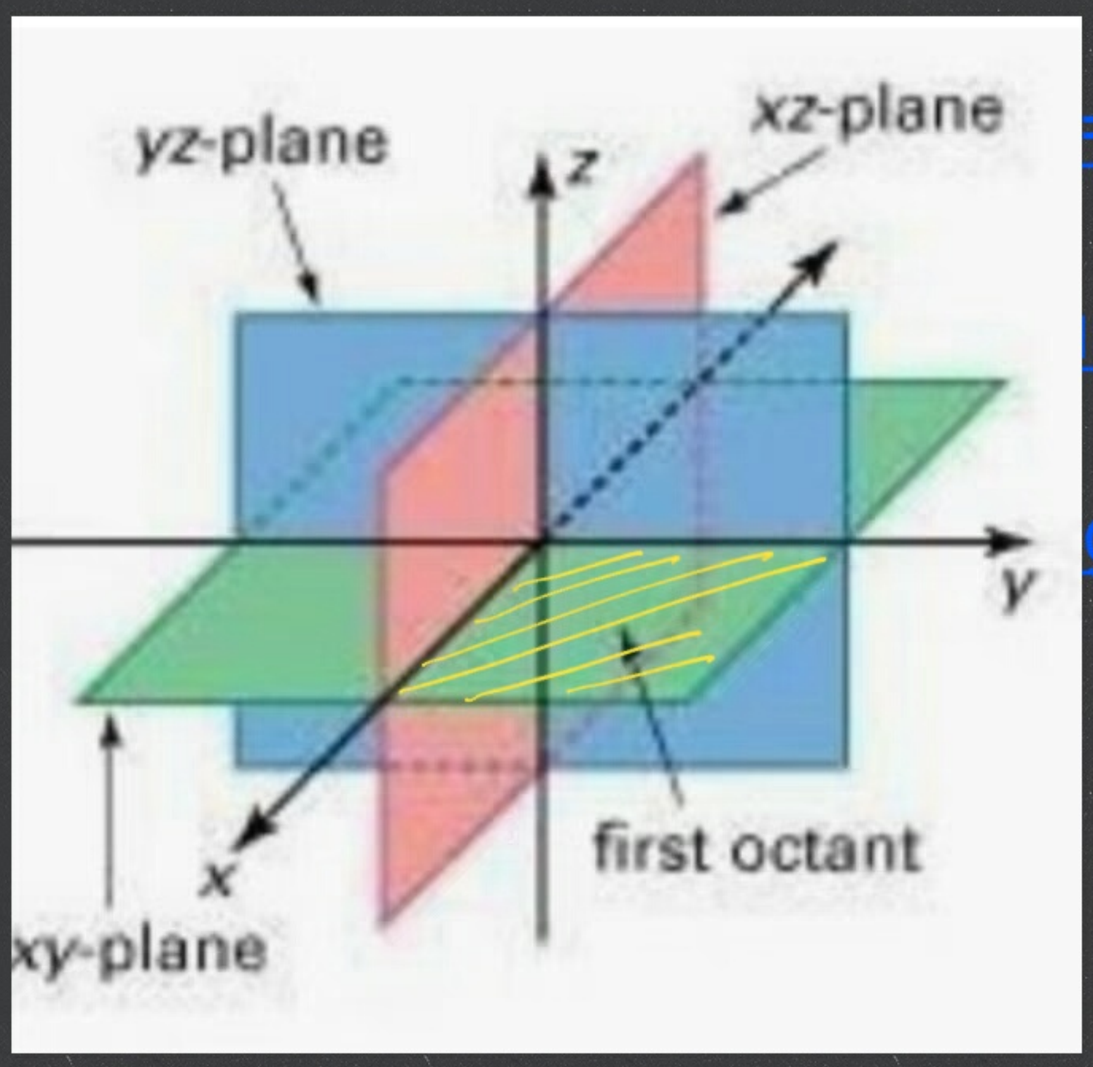

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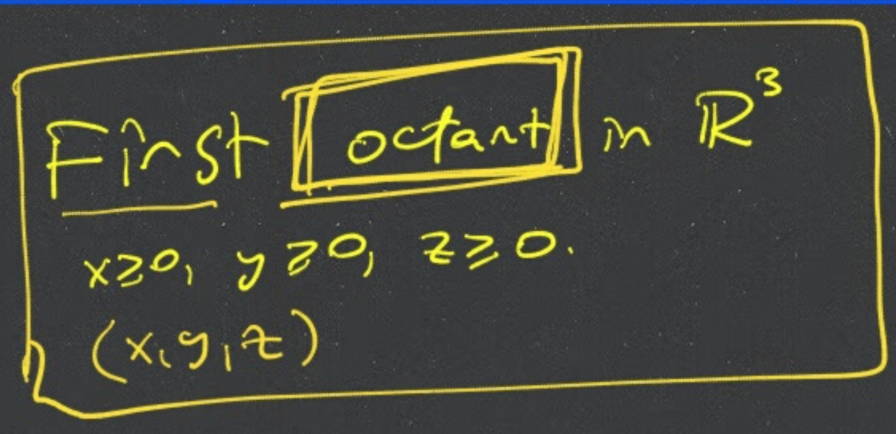

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