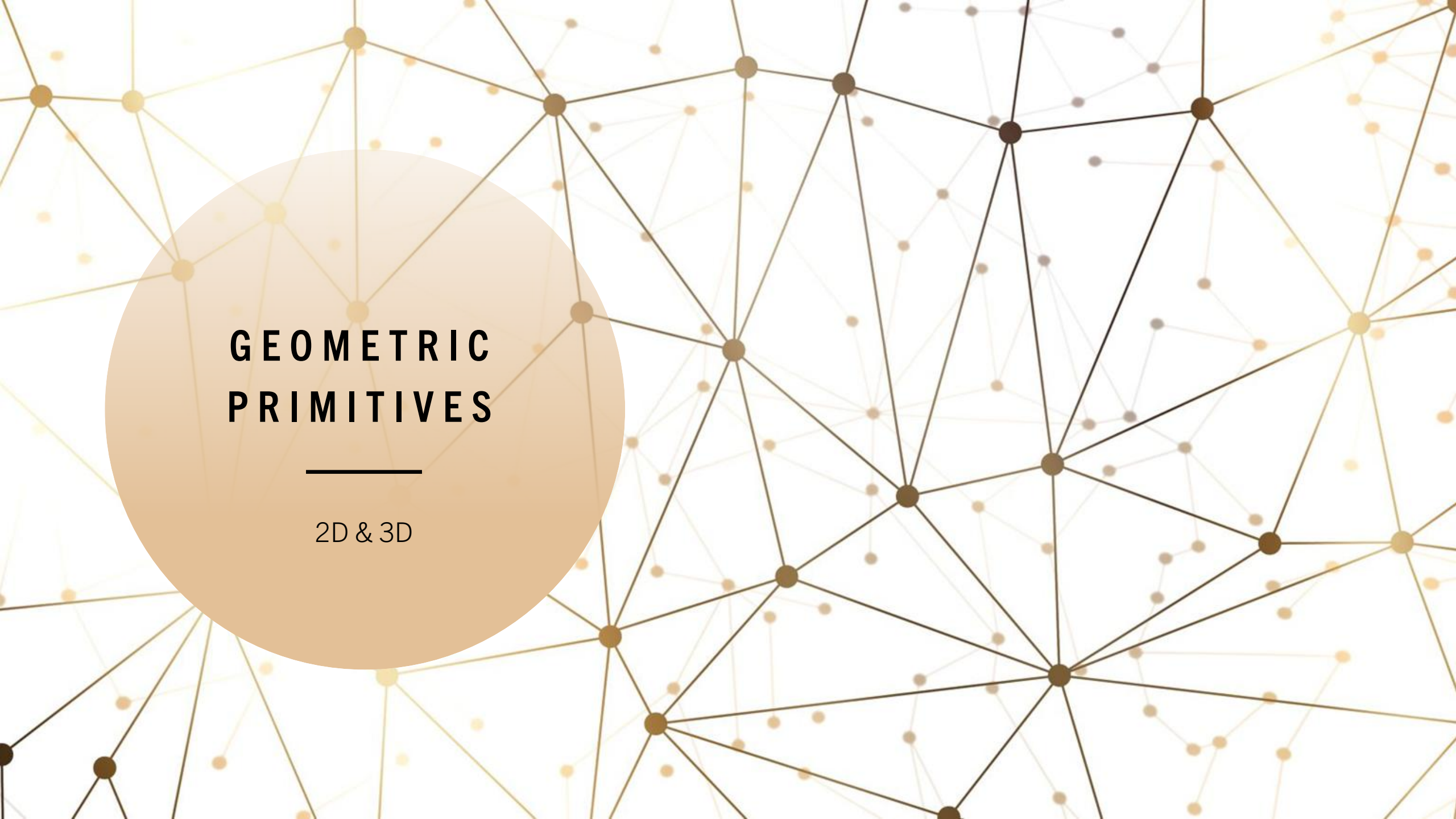

GEOMETRIC
PRIMITIVES
2D & 3D

2D Point $\rightsquigarrow x = (x, y) \in R^2$

$P^2 = R^3 - (0,0,0)$

h.c.s. $\rightarrow (wx, wy, w) \in P^2$

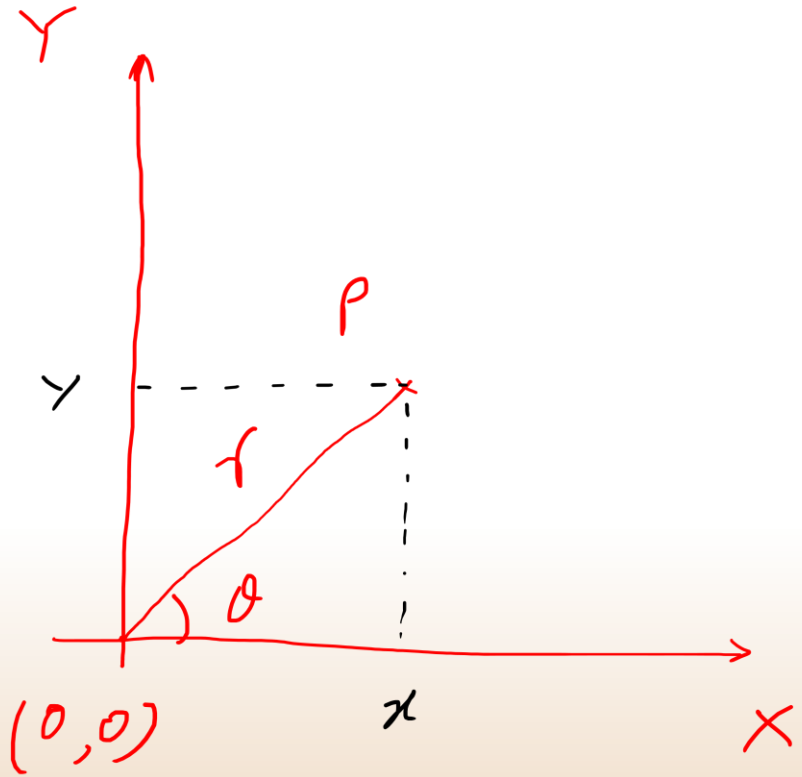
$\left(\frac{wx}{w}, \frac{wy}{w}, 1\right)$

Augmented vector

2, 4, 1

2, 4, 2 2, 3, 1

Polar



$$x = r \cos \theta$$

$$y = r \sin \theta$$

2D line

$$Y = mx + C$$

$$\tilde{l} = (a, b, c)$$

$$\bar{x}\,\tilde{l} = \underline{a}x + \underline{b}y + \underline{c} = 0$$

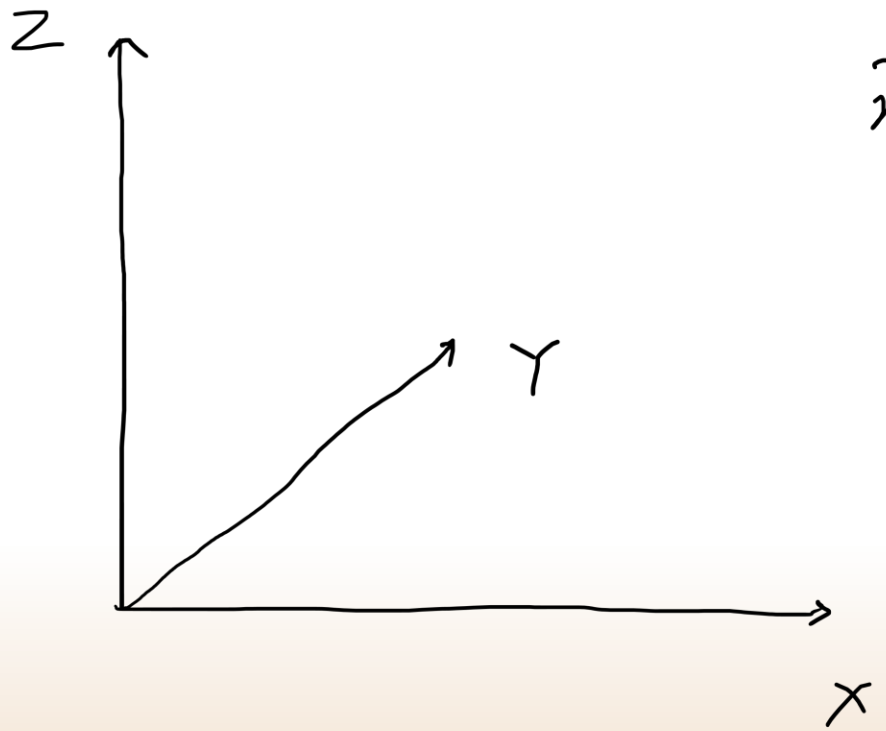
$$\tilde{x} =$$

$$\bar{x}$$

3D

$$x = (x, y, z) \in R^3$$

$$\tilde{x} = (\tilde{x}, \tilde{y}, \tilde{z}, \tilde{w}) \in P^3$$

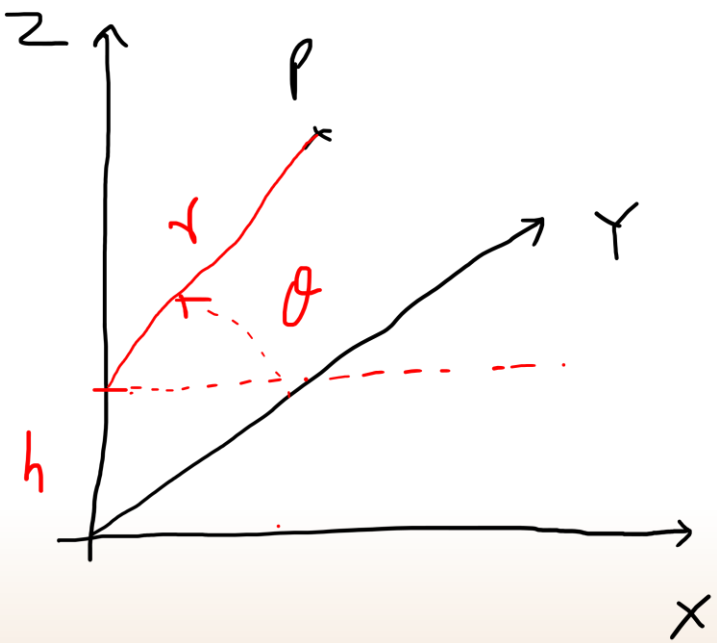


$$P^3 = R^4 - (0, 0, 0, 0)$$

$$\bar{x} = (x, y, z, 1)$$

$$\tilde{\bar{x}} = \tilde{\bar{w}}\,\bar{x}$$

Cylindrical



$$x = r\cos\theta$$

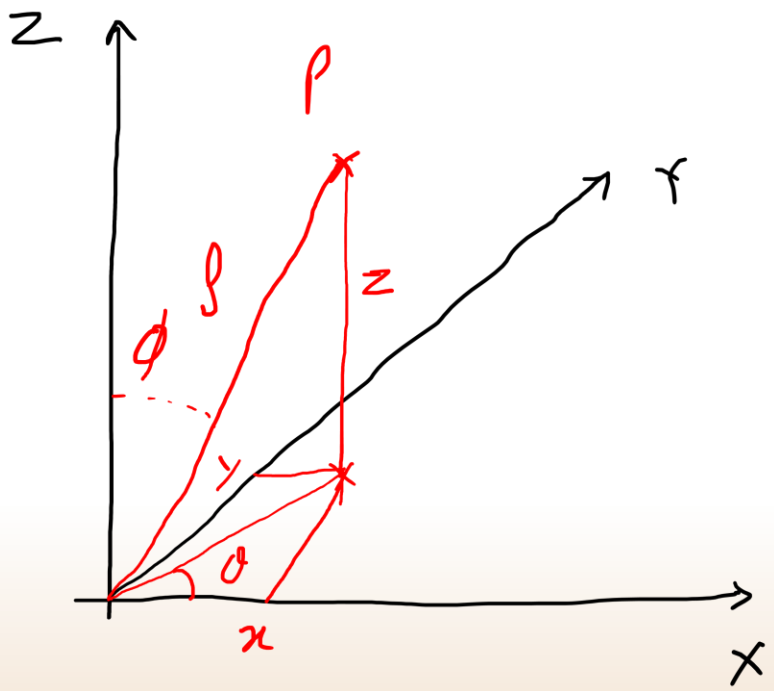
$$y = r\sin\theta$$

$$z = h$$

$$(r, \theta, h)$$

Spherical

(ρ, ϕ, θ)



$$x = \rho \sin\phi \cos\theta$$

$$y = \rho \sin\phi \sin\theta$$

$$z = \rho \cos\phi$$

3D Planes

$$\tilde{m} = (a, b, c, d)$$

$$\bar{x} \cdot \tilde{m} = ax + by + cz + d = 0$$