

Example: plane equation

Linear Algebra Essentials

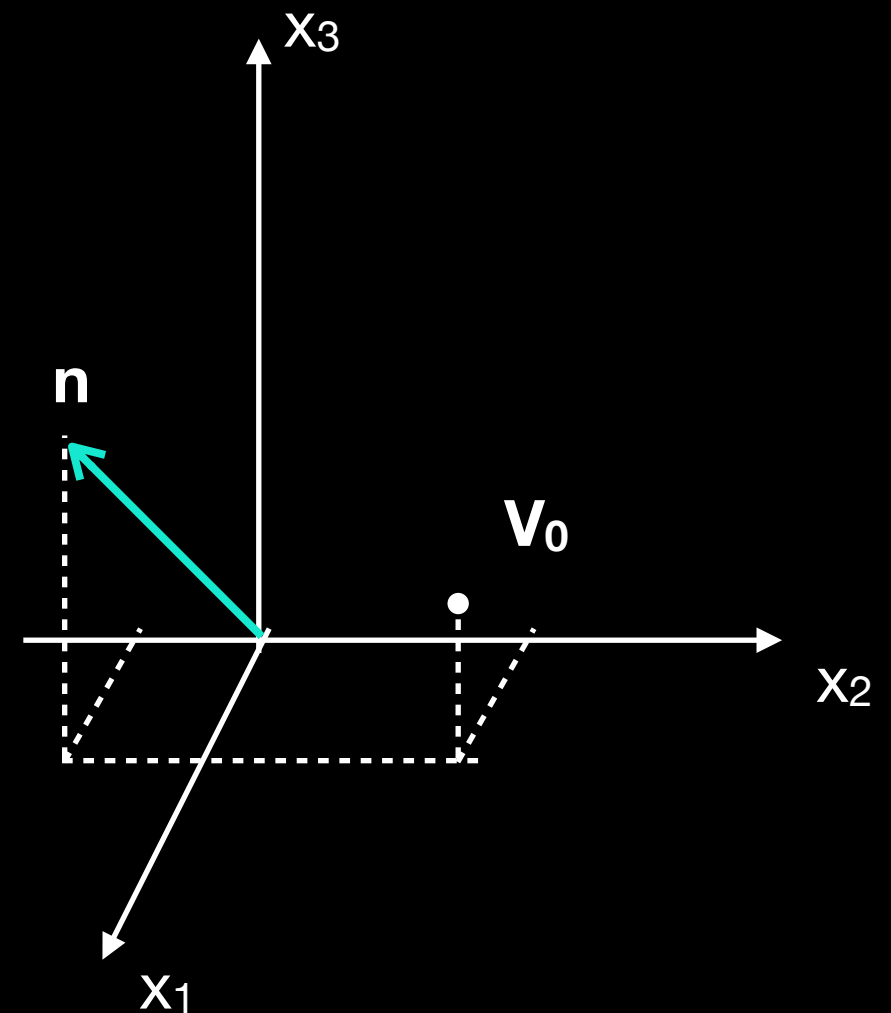


Plane in 3D

$$\mathbf{v}_0 = (1, 2, 1) \in \mathbf{P}$$

$\mathbf{n} = (1, -1, 2)$ - normal vector

- **Plane equation**
- **Distance to the origin**
- **Intersections with the axis**



Plane equation

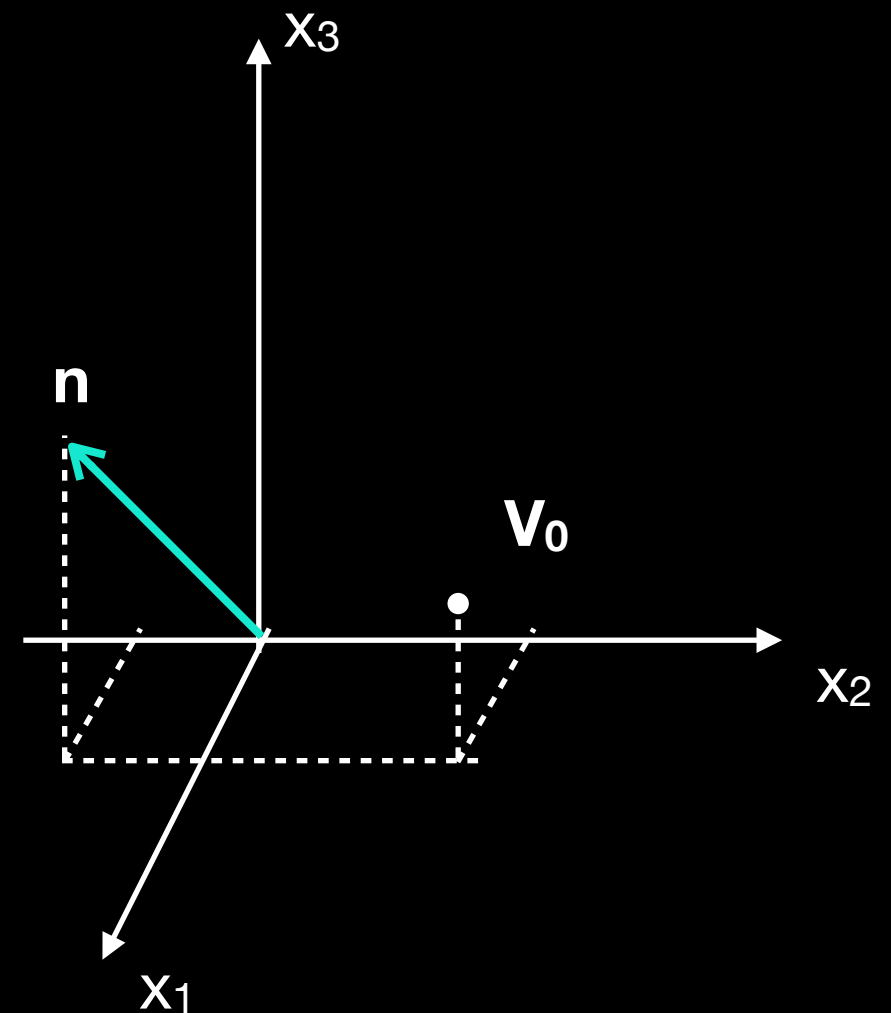
$$\mathbf{v}_0 = (1, 2, 1) \in \mathbf{P}$$

$$\mathbf{n} = (1, -1, 2) - \text{normal vector}$$

$$\begin{aligned} (\mathbf{x}, \mathbf{n}) &= \lambda = (\mathbf{v}_0, \mathbf{n}) = 1 \\ &= 1 \times 1 + 2 \times (-1) + 1 \times 2 \end{aligned}$$

$$(\mathbf{x}, \mathbf{n}) = 1$$

$$x_1 - x_2 + 2x_3 = 1$$



Distance to the origin

$$(v, n) = \|v\| \cdot \|n\| \cdot \cos(\alpha)$$

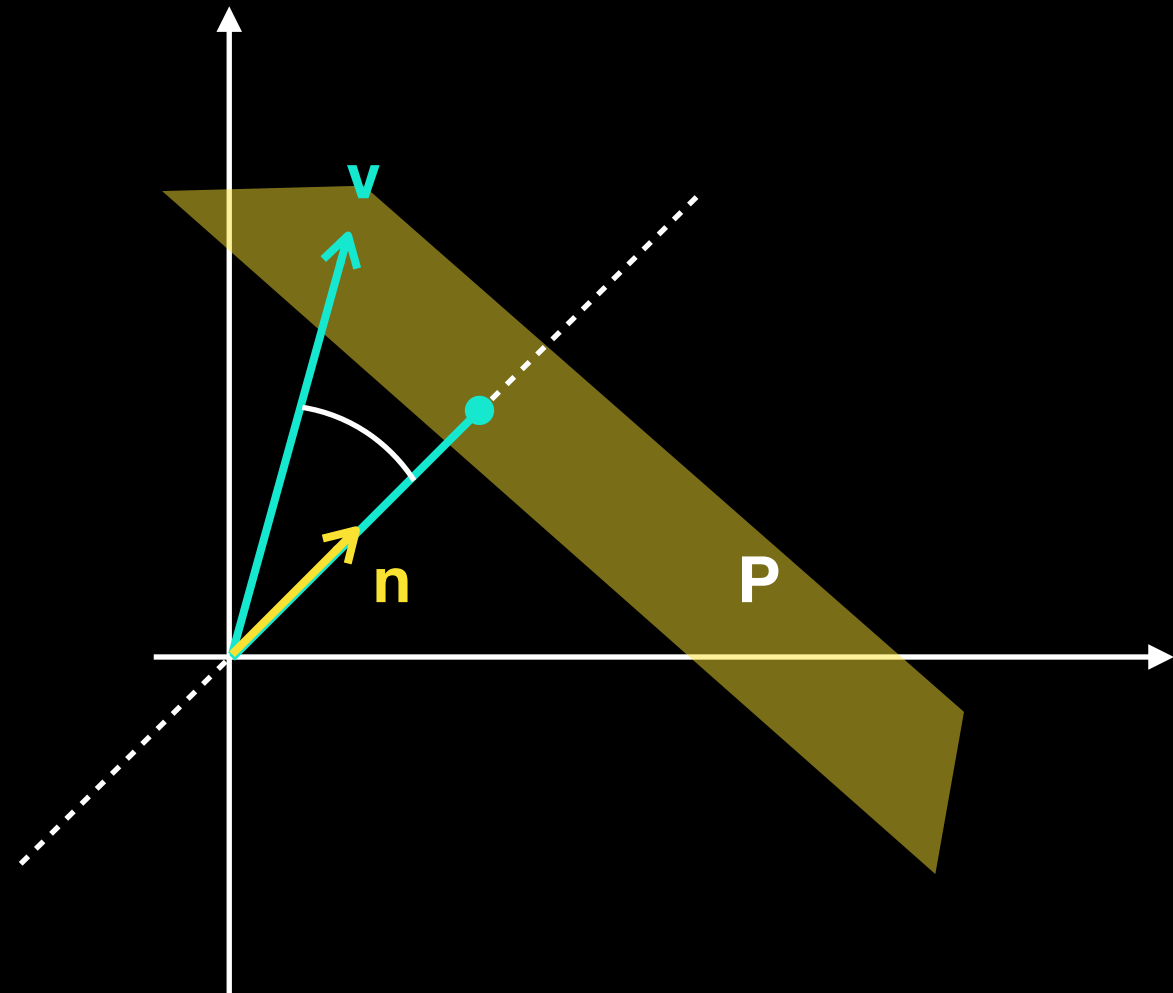
$$(v, n) = \|v\| \cdot \cos(\alpha) \cdot \|n\|$$

= distance

$$(v, n) = 1$$

$$n = (1, -1, 2)$$

$$\|n\| = \sqrt{1 + 1 + 4} = \sqrt{6}$$



$$D = \frac{(v, n)}{\|n\|} = \frac{1}{\sqrt{6}}$$

Intersections with axis

$$x_1 - x_2 + 2x_3 = 1$$

$$x_1 : (1, 0, 0)$$

$$x_2 : (0, -1, 0)$$

$$x_3 : (0, 0, 1/2)$$

