Distance from Point to Plane

Wednesday, May 17, 2023 9:31 AM

distance from point S to plane π: ← minimum!!

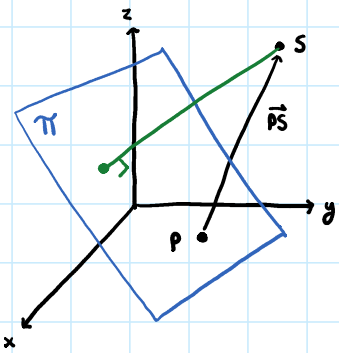
- if P in plane π & $\vec{n}$ = normal to π, then...

$$\text{distance}(S, \pi) = \left| \vec{PS} \cdot \frac{\vec{n}}{|\vec{n}|} \right|$$

($|\vec{n}|$: length; $|\ |$: absolute value)

* never give - distance *

* need point P to define plane *



ex) find distance (S, π) with $S = (3, 4, 0)$ & $\pi = \{x + y + z = 0\}$ ← check if in plane

* if S in plane, no work needed *

solution: need point P in π & normal direction $\vec{n}$

- $P = (0,0,0)$ or $(-2, 1, 1)$ or $(0, 3, -3)$
- $\vec{n} = \langle 1, 1, 1 \rangle$ ← a, b, c

- since $|\vec{n}| = \sqrt{3}$ ($\sqrt{1^2+1^2+1^2} = \sqrt{3}$), $\frac{\vec{n}}{|\vec{n}|} = \left\langle \frac{1}{\sqrt{3}}, \frac{1}{\sqrt{3}}, \frac{1}{\sqrt{3}} \right\rangle$ & $\vec{PS} = \langle 3, 4, 0 \rangle$ if $P = (0,0,0)$, then...

$$\underbrace{\langle 3, 4, 0 \rangle}_{\vec{PS}} \cdot \underbrace{\left\langle \frac{1}{\sqrt{3}}, \frac{1}{\sqrt{3}}, \frac{1}{\sqrt{3}} \right\rangle}_{\frac{\vec{n}}{|\vec{n}|}} = \boxed{\frac{7}{\sqrt{3}}}$$ → distance from point to plane