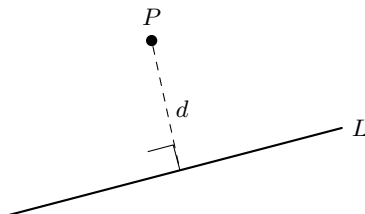


Question 3

Find the distance from $P = (3, 1, -2)$ to the line $L : \vec{r} = \langle 1, -1, 2 \rangle + t \langle 2, 1, -2 \rangle$ and find the closest point on L .

Question 3 – Solution

Strategy At the closest point Q , the connector $P - Q$ is perpendicular to the line's direction.



Perpendicular condition Write $Q = (1 + 2t, -1 + t, 2 - 2t)$. Then

$$(P - Q) \cdot \langle 2, 1, -2 \rangle = 0.$$

Since $P - Q = \langle 2 - 2t, 2 - t, -4 + 2t \rangle$, the equation is $14 - 9t = 0$, so $t = 14/9$.

Closest point and distance Thus $Q = \boxed{(37/9, 5/9, -10/9)}$. Also $P - Q = \frac{1}{9} \langle -10, 4, -8 \rangle$, so

$$\boxed{d(P, L) = \frac{\sqrt{180}}{9} = \frac{2\sqrt{5}}{3}}.$$

Verification The dot product of $\langle -10, 4, -8 \rangle$ with $\langle 2, 1, -2 \rangle$ is zero.