Question 1 (Distance point to line)

Find the distance from a point \( P_0 \) to a line \( L \).

(a) Describe \( L \) using a direction vector \( v \) and a specific point \( P_1 \) on \( L \).

(b) Let \( P_2 \) be the point on \( L \) closest to \( P_0 \).

(c) Let \( r_0 \) be the vector from the origin to \( P_0 \).

(d) Let \( r_1 \) be the vector from the origin to \( P_1 \).

(e) Label the picture.

(f) Use trigonometric identities to describe relationships between as many lengths as you can.

(g) Solve for the distance from \( P_0 \) to \( L \).

Question 2 (Distance point to line)

Find the distance from the point \( P_0 = (1, 1, -1) \) to the line \( L \) of intersection between the planes

\[ x + y + z = 1, \quad 2x - y - 5z = 1. \]

(a) Explain why the direction vector of \( L \) is \( v = n_1 \times n_2 \), where \( n_1 = i + j + k \), and \( n_2 = 2i - j - 5k \).

(b) Find \( v \).

(c) Pick \( P_1 = (1, \frac{1}{7}, \frac{1}{7}) \) on the line. How far is \( P_1 \) from the closest point to \( P_0 \) on \( L \)?

(d) What is the distance from \( P_0 \) to each of the two planes?
(e) Find the distance from the point \( P_0 = (1, 1, -1) \) to the line \( L \) of intersection.