

HW #3

To receive full credit, you must provide a detailed explanation of how you arrived at your answers.

Question 1. Determine whether the following pairs of lines (in 3D) are parallel, intersecting or skew. If they intersect, find the point of intersection.

- (1) $L_1 : x = 2 + 3t, \quad y = -4 + t, \quad z = 2t$
 $L_2 : x = -3 - 4s, \quad y = -1 + s, \quad z = -8 - 5s$
- (2) $L_1 : x = -3t, \quad y = 3t + 2, \quad z = t + 1$
 $L_2 : x = 3 - s, \quad y = 3 - s, \quad z = s - 3$

Question 2. Find an equation of the line of intersection of the two planes

$$P_1 : x + y + z = 4, \quad P_2 : 2x + 3y + 4z = 3.$$

Question 3. Determine whether the following line and plane are parallel or intersecting. If they intersect, find the point of intersection.

$$L_1 : x = -t + 1, \quad y = t + 4, \quad z = t - 3, \quad P_1 : 3x - 2y + 5z = -2.$$

Question 4.

- (1) Find the angle between the two planes

$$P_1 : 6x + 2y - 3z = 2, \quad P_2 : 9x - 4y - z = 5$$

- (2) Find the angle between the line and the plane

$$L_1 : x = t + \sqrt{2}, \quad y = \sqrt{2}t - 1, \quad z = 2, \quad P_1 : \sqrt{3}y + z = \sqrt{3}$$

Question 5. Determine whether the following statement in 3D is true or false. If it is false, provide a counterexample.

- (1) Two lines orthogonal to each other must intersect.
- (2) Given a plane P and two parallel lines L_1 and L_2 , the angle between P and L_1 is equal to the angle between P and L_2 .
- (3) Given a line L_3 , any two lines L_4 and L_5 orthogonal to L_3 must be parallel to each other.