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Geometry 1 (Analytic Geometry)

Exercise Sheet 11

Exercise 1. Find the angle determined by d_1 and d_2 , when:

(a) $d_1 : x = 4 - t, y = 3 + 2t, z = -2t, t \in \mathbb{R}$

$$d_2 : x = 5 + 2s, y = 1 + 3s, z = 5 - 6s, s \in \mathbb{R}$$

(b) $d_1 : \frac{x-1}{2} = \frac{y+5}{7} = \frac{z-1}{-1}$

$$d_2 : \frac{x+3}{-2} = \frac{y-9}{1} = \frac{z}{4}$$

Exercise 2. Find the angle determined by the planes $\pi_1 : x - \sqrt{2}y + z - 1 = 0$ and $\pi_2 : x + \sqrt{2}y - z + 3 = 0$.

Exercise 3. Find the equations of the projection of the line $d : \begin{cases} 2x - y + z - 1 = 0 \\ x + y - z + 1 = 0 \end{cases}$ on the plane $\pi : x + 2y - z = 0$.

Exercise 4. Find the coordinates of the orthogonal projection of the point $P(2, 1, 1)$ on the plane $\pi : x + y + 3z + 5 = 0$.

Exercise 5. Find the angle determined by the lines

$$d_1 : \begin{cases} x + 2y + z - 1 = 0 \\ x - 2y + z + 1 = 0 \end{cases} \quad \text{and} \quad d_2 : \begin{cases} x - y - z - 1 = 0 \\ x - y + 2z + 1 = 0 \end{cases}$$

Exercise 6. Find the angle determined by the planes $\pi_1 : x + 3y + 2z + 1 = 0$ and $\pi_2 : 3x + 2y - z - 6 = 0$.

Exercise 7. Find the angle determined by the plane xOy and the line M_1M_2 , where $M_1(1, 2, 3)$ and $M_2(-2, 1, 4)$.

Exercise 8. Find the distance from the point $P(1, 2, -1)$ to the line $d : x = y = z$.

Exercise 9. Find the distance from $P(3, 1, -1)$ to the plane $\pi : 22x + 4y - 20z - 45 = 0$

Exercise 10. Find the equation of the line passing through $P(4, 3, 10)$ and orthogonal on the line $d : \frac{x-1}{2} = \frac{y-2}{4} = \frac{z-3}{5}$, the distance from P to d and the coordinates of the symmetrical P' of P with respect to the line d .

Exercise 11. Find the distance between the lines $d_1 : \frac{x-1}{2} = \frac{y+1}{3} = \frac{z}{1}$ and $d_2 : \frac{x+1}{3} = \frac{y}{4} = \frac{z-1}{3}$

Exercise 12. Find the distance from the point $P(0, 1, 4)$ to the plane $\pi : 3x + 6y - 2z - 5 = 0$

Exercise 13. Find the distance between the planes $\pi_1 : 2x - 3y + 4z - 7 = 0$ and $\pi_2 : 4x - 6y + 8z - 3 = 0$.

Exercise 14. Show that the line $d : \frac{x+1}{1} = \frac{y-3}{2} = \frac{z}{-1}$ and the plane $\pi : 2x - 2y - 2z + 3 = 0$ are parallel and find the distance between them.

Exercise 15. Find the geometric locus of the lines passing through a given point and having a constant distance to a given line.