Planes in the Euclidean space $\mathbb{E}^3$.

1. Determine parametric equations for the plane π in the following cases:

1. π contains the point $M(1,0,2)$ and is parallel to the vectors $\mathbf{a}_1(3,-1,1)$ and $\mathbf{a}_2(0,3,1)$,
2. π contains the point $A(1,2,1)$ and is parallel to $\mathbf{i}$ and $\mathbf{j}$,
3. π contains the point $M(1,7,1)$ and is parallel coordinate plane Oyz,
4. π contains the points $M_1(5,3,4)$ and $M_2(1,0,1)$, and is parallel to the vector $\mathbf{a}(1,3,-3)$,
5. π contains the point $A(1,5,7)$ and the coordinate axis Ox.

2. Determine Cartesian equations for the plane π in the following cases:

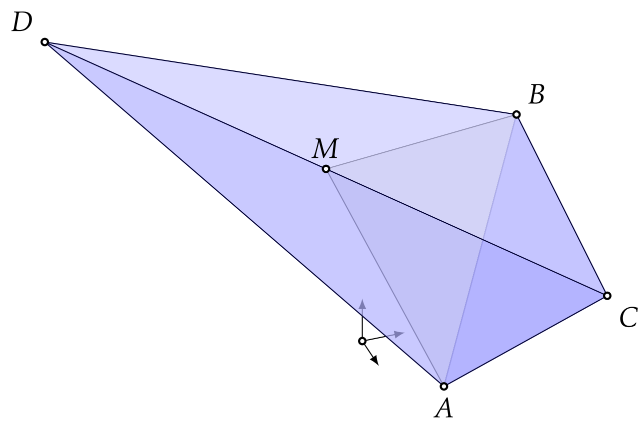
1. $\pi : x = 2+3u-4v,\ y = 4-v,\ z = 2+3u$;
2. $\pi : x = u+v,\ y = u-v,\ z = 5+6u-4v$.

3. Determine parametric equations for the plane π in the following cases:

1. $3x-6y+z=0$;
2. $2x-y-z-3=0$;

4. Determine an equation for each plane passing through $P(3,5,-7)$ and intersecting the coordinate axes in congruent segments.

5. Let $A(2,1,0)$, $B(1,3,5)$, $C(6,3,4)$, $D(0,-7,8)$ be vertices of a tetrahedron. Determine a Cartesian equation of the plane containing $[AB]$ and the midpoint of $[CD]$.



6. Show that a parallelepiped with faces in the planes $2x+y-2z+6=0$, $2x-2y+z-8=0$ and $x+2y+2z+1=0$ is rectangular.

7. Determine a Cartesian equation of the plane π if $A(1,-1,3)$ is the orthogonal projection of the origin on π.

8. Determine the distance between the planes $x-2y-2z+7=0$ and $2x-4y-4z+17=0$.

Lines in the Euclidean space $\mathbb{E}^3$.

9. Determine parametric equations for the line ℓ in the following cases:

1. ℓ contains the point $M_0(2,0,3)$ and is parallel to the vector $\mathbf{a}(3,-2,-2)$,
2. ℓ contains the point $A(1,2,3)$ and is parallel to the Oz-axis,
3. ℓ contains the points $M_1(1,2,3)$ and $M_2(4,4,4)$.

10. Give Cartesian equations for the lines ℓ in the previous exercise.

11. Determine parametric equations for the line contained in the planes $x+y+2z-3=0$ and $x-y+z-1=0$.

12. Determine the relative positions of the lines $x=-3t, y=2+3t, z=1$ and $x=1+5s, y=1+13s, z=1+10s$.

13. Let $A(1,2,-7)$, $B(2,2,-7)$ and $C(3,4,-5)$ be vertices of a triangle. Determine the equation of the internal angle bisector of $\measuredangle A$.

14. Determine the parameter m for which the line $x=-1+3t, y=2+mt, z=-3-2t$ doesn't intersect the plane $x+3y+3z-2=0$.

15. Determine the values a and d for which the line $\frac{x-2}{3}=\frac{y+1}{2}=\frac{z-3}{-2}$ is contained in the plane $ax+y-2z+d=0$.

16. Determine the values a and c for which the line $3x-2y+z+3=0\cap 4x-3y+4z+1=0$ is perpendicular to the plane $ax+8y+cz+2=0$.

17. Determine the orthogonal projection of the point $A(2,11,-5)$ on the plane $x+4y-3z+7=0$.

18. Determine the orthogonal reflection of the point $P(6,-5,5)$ in the plane $2x-3y+z-4=0$.

19. Determine the orthogonal projection of the point $A(1,3,5)$ on the line $2x+y+z-1=0\cap 3x+y+2z-3=0$.