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

a) π contains the point $M(1,0,2)$ and is parallel to the vectors $\mathbf{a}_1(3,-1,1)$ and $\mathbf{a}_2(0,3,1)$,

b) π contains the points $A(-2,1,1)$, $B(0,2,3)$ and $C(1,0,-1)$,

c) π contains the point $A(1,2,1)$ and is parallel to $\mathbf{i}$ and $\mathbf{j}$,

d) π contains the point $M(1,7,1)$ and is parallel coordinate plane Oyz,

e) π contains the points $M_1(5,3,4)$ and $M_2(1,0,1)$, and is parallel to the vector $\mathbf{a}(1,3,-3)$,

f) 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:

a) $\pi : x = 2+3u-4v,\ y = 4-v,\ z = 2+3u$;

b) $\pi : x = u+v,\ y = u-v,\ z = 5+6u-4v$.

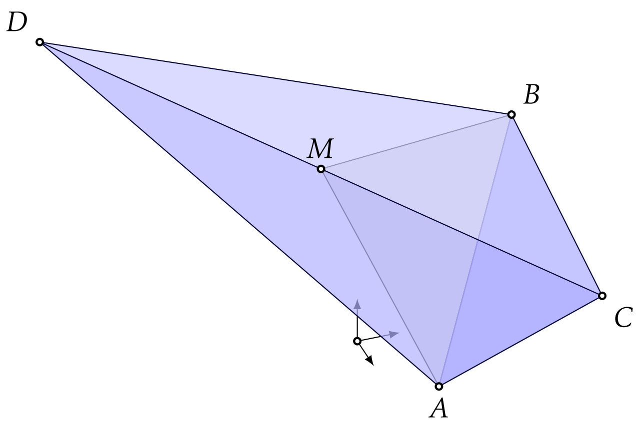
3. Determine parametric equations for the plane π in the following cases:

a) $3x-6y+z=0$;

b) $2x-y-z-3=0$;

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. Show that the points $A(1,0,-1)$, $B(0,2,3)$, $C(-2,1,1)$ and $D(4,2,3)$ are coplanar.

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

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

10. Determine the relative positions of the planes in the following cases

a) $\pi_1 : x+2y+3z-1=0$, $\pi_2 : x+2y-3z-1=0$.

b) $\pi_1 : x+2y+3z-1=0$, $\pi_2 : 2x+y+3z-2=0$, $\pi_3 : x+2y+3z+2=0$.

11. Show that the planes

$$\pi_1 : 3x+y+z-1=0, \quad \pi_2 : 2x+y+3z+2=0, \quad \pi_3 : -x+2y+z+4=0$$

have a point in common.

12. Show that the pairwise intersection of the planes

$$\pi_1 : 3x+y+z-5=0, \quad \pi_2 : 2x+y+3z+2=0, \quad \pi_3 : 5x+2y+4z+1=0$$

are parallel lines.

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

a) ℓ contains the point $M_0(2,0,3)$ and is parallel to the vector $\mathbf{a}(3,-2,-2)$,

b) ℓ contains the point $A(1,2,3)$ and is parallel to the Oz-axis,

c) ℓ contains the points $M_1(1,2,3)$ and $M_2(4,4,4)$.

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

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

16. Consider the lines $\ell_1 : x=1+t, y=1+2t, z=3+t, t\in\mathbb{R}$ and $\ell_2 : x=3+s, y=2s, z=-2+s, s\in\mathbb{R}$. Show that ℓ_1 and ℓ_2 are parallel and find the equation of the plane determined by the two lines.