11.1. Determine the tangent planes to the ellipsoid

$$\mathcal{E}_{2,3,2\sqrt{2}} : \frac{x^2}{4} + \frac{y^2}{9} + \frac{z^2}{8} = 1$$

which are parallel to the plane $\pi : 3x - 2y + 5z + 1 = 0$.

11.2. Show that the line

$$\begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 2 \\ -3 \\ 6 \end{bmatrix} + t \begin{bmatrix} 0 \\ -1 \\ 2 \end{bmatrix} \quad \text{is tangent to the quadric} \quad \frac{x^2}{4} + \frac{y^2}{9} + \frac{z^2}{16} - 1 = 0$$

and determine the tangency point.

11.3. Determine the points P of the ellipsoid

$$\mathcal{E} : \frac{x^2}{a^2} + \frac{y^2}{b^2} + \frac{z^2}{c^2} = 1$$

for which the tangent space $\mathcal{T}_P\mathcal{E}$ intersects the coordinate axis in congruent segments.

11.4. For the cone

$$\mathcal{C}_{2,3,1} : \frac{x^2}{4} + \frac{y^2}{9} - \frac{z^2}{1} = 1$$

find the intersection points with the line

$$\ell : \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 0 \\ 3 \\ 1 \end{bmatrix} + t \begin{bmatrix} -2 \\ 3 \\ 0 \end{bmatrix}$$

and give equations for the tangent planes in the intersection points. Moreover, determine the generators of the cone that are contained in these tangent planes.

11.5. Prove that the intersection of an ellipsoid with a plane is either the empty set or a point or an ellipse.