
(1) Find both the parametric and symmetric equations for the line passing through the point \((1, 2, 3)\) and perpendicular to the plane with the equation \(7x + 11y + 13z = 17\).

**Solution:** since we want the line to be perpendicular to the plane, we can use a normal vector of the plane, which is \(\langle 7, 11, 13 \rangle\) as the direction vector of the line. We get: parametric equation

\[ x = 1 + 7t, \quad y = 2 + 11t, \quad z = 3 + 13t. \]

Symmetric equation:

\[ \frac{x - 1}{7} = \frac{y - 2}{11} = \frac{z - 3}{13}. \]

(2) Find an equation for the plane containing the points \(P(0, 1, 2)\) and \(Q(0, 1, 3)\), and parallel to the line with the vector parametric equation

\[ \mathbf{r}(t) = \langle 11 + 5t, 17 + t, 3 \rangle. \]

**Solution:** Our plane has to be parallel to both the vector \(\overrightarrow{PQ} = \langle 0, 0, 1 \rangle\) and the direction vector of the line, which is \(\langle 5, 1, 0 \rangle\). Then the normal vector of the plane is perpendicular to both these vectors, so we can find it using cross product:

\[ \mathbf{n} = \langle 0, 0, 1 \rangle \times \langle 5, 1, 0 \rangle = \langle -1, 5, 0 \rangle. \]

**Answer:** \(x - 5(y - 1) = 0.\)

(3) Describe the intersection of the surface \(x^2 + 4y^2 + 9z^2 = 14\) with the plane \(y = 1\).

**Solution:** The surface is an ellipsoid. Plug in \(y = 1\): we get \(x^2 + 9z^2 = 10\) – this is an equation of an ellipse. The answer is: an ellipse lying in the vertical plane \(y = 1\).