Q.1. Find the equation of the line which passes through the point \((1, 2, 3)\) and is parallel to the vector \(3\mathbf{i} + 2\mathbf{j} - 2\mathbf{k}\).

Q.2. Find the value of \(p\) so that the lines, \(\frac{1-x}{3} = \frac{7y-14}{2p} = \frac{z-3}{2}\) and \(\frac{7-7x}{3p} = \frac{y-5}{1} = \frac{6-z}{5}\) are at right angles.

Q.3. Find the shortest distance between the lines whose vector equations are:

\[\mathbf{r} = (1-t)\mathbf{i} + (t-2)\mathbf{j} + (3-2t)\mathbf{k}\] and

\[\mathbf{r} = (s+1)\mathbf{i} + (2s-1)\mathbf{j} - (2s+1)\mathbf{k}\]

Q.4. Find the coordinates of the foot of the perpendicular drawn from the origin to the plane \(2x - 3y + 4z - 6 = 0\).

Q.5. Find the vector equation of the plane passing through the intersection of planes \(\mathbf{r} \cdot (i + j + k) = 6\) and \(\mathbf{r} \cdot (2i + 3j + 4k) = -5\) and the point \((1,1,1)\).

Q.6. Find the angle between the line \(\frac{x+1}{2} = \frac{y}{3} = \frac{z-3}{6}\) and the plane \(10x + 2y - 11z = 3\).

Q.7. Prove that if a plane has the intercepts \(a, b, c\) and is at a distance of \(p\) units from the origin, then \(\frac{1}{a^2} + \frac{1}{b^2} + \frac{1}{c^2} = \frac{1}{p^2}\).

Q.8. Show that the angles between the diagonals of a cube is \(\cos^{-1}\left(\frac{1}{3}\right)\).

Q.9. Find the equation of the line passing through the point \((-1, 3, -2)\) and perpendicular to the lines \(\frac{x+1}{2} = \frac{y}{3} = \frac{z-3}{6}\) and \(\frac{x+2}{-3} = \frac{y-1}{2} = \frac{z+1}{5}\).

Q.10. Find the foot of the perpendicular drawn from the point \((0, 2, 3)\) on the line \(\frac{x+3}{5} = \frac{y-1}{2} = \frac{z+4}{3}\). Also, find the length of the perpendicular.

Q.11. Find the shortest distance between the following pairs of lines whose cartesian equations are:

\[\frac{x-1}{2} = \frac{y+1}{3} = z\] and \[\frac{x+1}{3} = \frac{y-2}{1}, z=2\]

Q.12. A plane meets the coordinate axis in A, B, C such that the centroid of triangle ABC is the point \((p,q,r)\). Show that the equation of the plane is \(\frac{x}{p} + \frac{y}{q} + \frac{z}{r} = 3\).

Q.13. Find the equation of the plane passing through the point \((1, 1, -1)\) and perpendicular to the planes \(x + 2y + 3z - 7 = 0\) and \(2x - 3y + 4z = 0\).

Q.14. Find the distance between parallel planes, \(\mathbf{r} \cdot (2\mathbf{i} - 3\mathbf{j} + 6\mathbf{k}) = 5\) and \(\mathbf{r} \cdot (6\mathbf{i} - 9\mathbf{j} + 18\mathbf{k}) + 20 = 0\).

Q.15. Show that the lines:

\[\mathbf{r} = (\mathbf{i} + \mathbf{j} - \mathbf{k}) + \lambda(3\mathbf{i} - \mathbf{j})\] and \(\mathbf{r} = (4\mathbf{i} - \mathbf{j}) + \mu(2\mathbf{i} + 3\mathbf{k})\) are coplanar.

Also, find the plane containing these two lines.