Answer on Question #67644- Physics / Quantum Mechanics

A particle of mass 'm' is located at the vector position r and has a linear momentum p. The vector r and p are nonzero.if the particle moves only in y-z plane.Prove that Ly=Lz=0 and Lx is not equal to zero.

Solution:

In the case when particle moves only in y-z plane

$$\mathbf{r} = (0, y, z),$$

$$\mathbf{p} = (0, p_y, p_z).$$

By definition the angular momentum is given by

$$\mathbf{L} = [\mathbf{r} \times \mathbf{p}]$$

The components of angular momentum

$$L_x = yp_z - zp_y \neq 0,$$

$$L_y = zp_x - xp_y = z \cdot 0 - 0 \cdot p_y = 0,$$

$$L_z = xp_y - yp_x = 0 \cdot p_y - y \cdot 0 = 0.$$