Answer on Question 48461, Physics, Mechanics | Kinematics | Dynamics

Question:

A particle projected from origin to move in X-Y plane, with a velocity $v = 3i + 6xj$, where i, j are the unit vector along X and Y axis. Find the equation of path following by the particle is…

Solution:

The path following by the particle will be :

$$s = \sqrt{x^2 + y^2},$$

where x and y are projections of the particle displacement on axes x and y respectively. To find the displacement of particle along axis x and y we use the second equation of motion:

$$s = v \cdot t + \frac{1}{2} \cdot a \cdot t^2,$$

where s is the displacement, v is the initial velocity, t is time, a is acceleration. So, the displacement along axis x would be:

$$x = 3 \cdot t.$$

The component of velocity along the y axis would be: $v = 6j \cdot (3t) = 18 \cdot t$

Assuming that at $t = 0$ initial velocity $v = 0$ we obtain for displacement along axis y:

$$y = \frac{1}{2} \cdot a \cdot t^2 = \frac{1}{2} 18 \cdot t^2 = 9 \cdot t^2.$$

Therefore, the equation of path following by the particle would be: $s = \sqrt{x^2 + y^2} = \sqrt{(3 \cdot t)^2 + (9 \cdot t^2)^2} = \sqrt{9 \cdot t^2 \cdot (1 + 9 \cdot t^2)} = 3 \cdot t \cdot \sqrt{(1 + 9 \cdot t^2)}$

Answer:

$$s = 3 \cdot t \cdot \sqrt{(1 + 9 \cdot t^2)}$$