

Answer on Question # 62711 – Physics – Mechanics | Relativity

1. Suppose we are told that the acceleration a of a particle moving with uniform speed v in a circle of radius r is proportional to some power of r , say r^n , and some power of v , say v^m i.e where k is a proportionality constant. Determine the values of n and m and write the equation for the acceleration. [5].

Solution:

Let acceleration be as follows:

$$a = kr^n v^m.$$

Since we know the dimensions of acceleration, radius and velocity, we can write a dimensional equation:

$$L/T^2 = L^n (L/T)^m = L^{n+m} / T^m.$$

The dimensional equation is balanced under conditions: $n + m = 1$ and $m = 2$. Therefore, $n = -1$. The equation for acceleration is as follows:

$$a = kr^{-1} v^2 = k \frac{v^2}{r}.$$

Answer: $a = k \frac{v^2}{r}$, $n = -1$, $m = 2$.

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