Q 2. **Give examples of a one-dimensional motion where**

(a) the particle moving along positive x-direction comes to rest periodically and moves forward.

(b) the particle moving along positive x-direction comes to rest periodically and moves backward**.**

Sol: The equation which contains sine and cosine functions is periodic in nature.

(a) The particle will be moving along positive x-direction only if t > sin t We have displacement as a function

of time, x(t) = t – sin t By differentiating this equation w.r.t. time we get velocity of the particle as a function of time.

$$\text{velocity } v(t) = \frac{dx(t)}{dt} = 1 - \cos t$$

If we again differentiate this equation w.r.t. time we will get acceleration of the particle as a function of time.

$$\text{acceleration } a(t) = \frac{dv}{dt} = \sin t$$

when $t = 0; x(t) = 0$

when $t = \pi; x(t) = \pi > 0$

when $t = 0; x(t) = 2\pi > 0$

(b) Equation can be represented by

$$x(t) = \sin t$$

$$v = \frac{d}{dt}x(t) = \cos t \text{ and } a = \frac{dv}{dt} = -\sin t$$

At $t = 0; x = 0, v = 1$ (positive) and $a = 0$

At $t = \frac{\pi}{2}; x = 1$ (positive), $v = 0$ and $a = -1$ (negative)

At $t = \pi, x = 0, v = -1$ (negative) and $a = 0$

At $t = \frac{3\pi}{2}; x = -1$ (negative), $v = 0$ and $a = +1$ (positive)

At t = 2π, x = 0, v = 1 (positive) and a = 0

Hence the particle moving along positive x-direction comes to rest periodically and moves backward.

As displacement and velocity is involving sin t and cos t, hence these equations represent periodic nature.