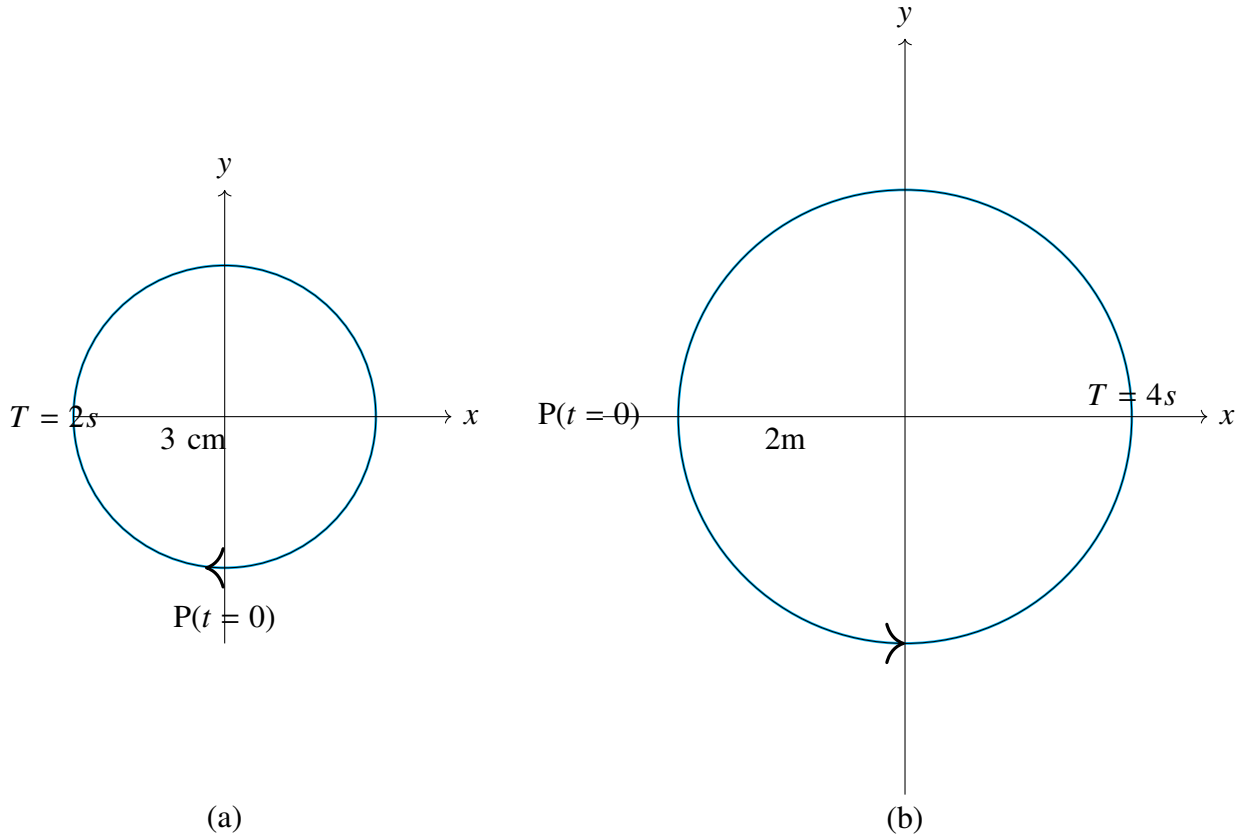


Q: Figures correspond to two circular motions. The radius of the circle, the period of revolution, the initial position and the sense of revolution(i.e. clockwise or anti-clockwise) are indicated on each figure. Obtain the corresponding simple harmonic motions of the x-projections of the radius vector of revolving particle P in each case.



Solution:

Parameter	(a)	(b)
Radius(r)	3cm	2m
Time Period(T)	2s	4s
Sense	clockwise	anti-clockwise
Initial Phase(ϕ)	$\frac{\pi}{2}$	π

TABLE I

INPUT PARAMETERS TABLE

Given \mathbf{r} as radius vector making angle θ with positive x-axis, its x-projection = $\mathbf{r} \cos \theta$

a. At $t = 0$, the radius vector makes an angle $\frac{\pi}{2}$ with the positive x-axis, $\phi = \frac{\pi}{2}$,

From Table I, equation of x-projection of radius:

$$x(t) = r \cos \left(\frac{2\pi}{T} t + \phi \right) \quad (1)$$

$$= 3 \cos \left(\frac{2\pi}{2} t + \frac{\pi}{2} \right) \quad (2)$$

$$= -3 \sin (\pi t) \text{ cm} \quad (3)$$

b. Similarly,

At $t = 0$, radius vector makes an angle π with x-axis in anti-clockwise direction, $\phi = \pi$,

$$x(t) = r \cos\left(\frac{2\pi}{T}t + \phi\right) \quad (4)$$

$$= 2 \cos\left(\frac{2\pi}{4}t + \pi\right) \quad (5)$$

$$= -2 \cos\left(\frac{\pi}{2}t\right) \text{m} \quad (6)$$