

Consider “Simple Harmonic Motion” (SHM) along the x -axis about the origin.

$$x = A \cos(\omega t + \phi)$$

and

$$v = -A\omega \sin(\omega t + \phi).$$

At $t = 0$, $x = x_0$, and $v = v_0$, select the correct expression for the amplitude A .

A) $A = x_0$.

B) $A = \frac{\omega}{v_0}$.

C) $A = \sqrt{x_0^2 + \left(\frac{v_0}{\omega}\right)^2}$.

D) $A = \sqrt{x_0^2 + \left(\frac{\omega}{v_0}\right)^2}$.

This is the situation of two equations and two unknown.

Using $\cos^2 \phi + \sin^2 \phi = 1$, one may eliminate ϕ .

In particular,

$$(A \cos \phi)^2 + (A \sin \phi)^2 = x_0^2 + \left(\frac{v_0}{\omega}\right)^2 = A^2,$$

$$A = \sqrt{x_0^2 + \left(\frac{v_0}{\omega}\right)^2}.$$

Answer **C**.