

Answer on Question #41349 – Physics – Mechanics

Which of the following correctly represents the equation of a simple harmonic oscillator?

$$d^2x/dt^2 + \omega x = 0$$

$$d^2x/dt^2 + \omega^2 x^2 = 0$$

$$dx/dt^2 + \omega^2 x = 0$$

$$d^2x/dt^2 + \omega^2 x = 0$$

Solution:

For one-dimensional simple harmonic motion, the equation of motion, which is a second-order linear ordinary differential equation with constant coefficients, could be obtained by means of Newton's second law and Hooke's law.

$$F_{\text{net}} = m \frac{d^2x}{dt^2} = -kx$$

where m is the inertial mass of the oscillating body, x is its displacement from the equilibrium (or mean) position, and k is the spring constant.

Therefore,

$$\frac{d^2x}{dt^2} = -\left(\frac{k}{m}\right)x$$

Substitution $\omega^2 = \frac{k}{m}$:

$$\frac{d^2x}{dt^2} + \omega x = 0$$

Hence, the correct answer is first: $d^2x/dt^2 + \omega x = 0$

Answer: $d^2x/dt^2 + \omega x = 0$