

Solving Differential Equations representing Simple Harmonic Motion

Amritpal Singh

July 28, 2015

Consider m be the mass of object, k be spring constant, x be a displacement from equilibrium state of a spring and t is time.

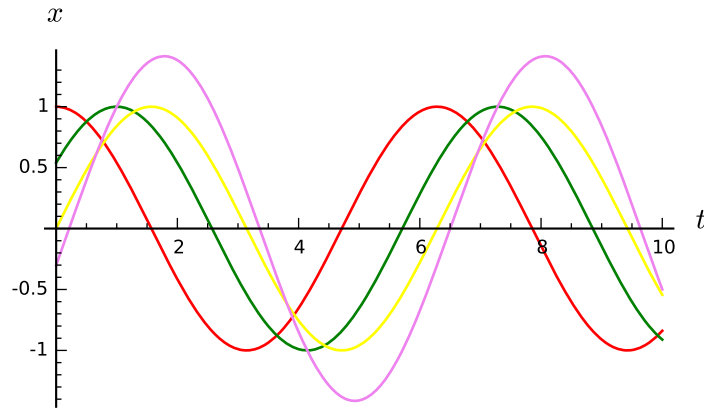
Therefore, the given differential equation of Simple Harmonic Motion is

$$\frac{d^2x}{dt^2} + \frac{kx(t)}{m} = 0.$$

Solving the above differential equation, we get,

$$x = K_2 \cos\left(\frac{\sqrt{k}t}{\sqrt{m}}\right) + K_1 \sin\left(\frac{\sqrt{k}t}{\sqrt{m}}\right)$$

When $m = 1$, $k = 1$, then the graph is



where red, green, yellow and violet curves are drawn when the initial or boundary conditions are $[0,1,0]$, $[1,1,0]$, $[0,0,1]$ and $[1,1,1]$ respectively.

The initial or boundary conditions means for a second-order equation, specify the initial x , y , and $\frac{dx}{dt}$, i.e. write $[t, x(t), \frac{dx}{dt}]$