There are two linearly indept. solns to the homog. equation:

$$y_1 = \cos \omega t, \qquad y_2 = \sin \omega t,$$

and the general soln is

$$y = c_1 \cos \omega t + c_2 \sin \omega t, \qquad (c_1, c_2 \text{ any constants}).$$

This can be written in form

$$y = A \sin(\omega t + \phi)$$
$$= A(\sin \omega t \cos \phi + \cos \omega t \sin \phi),$$

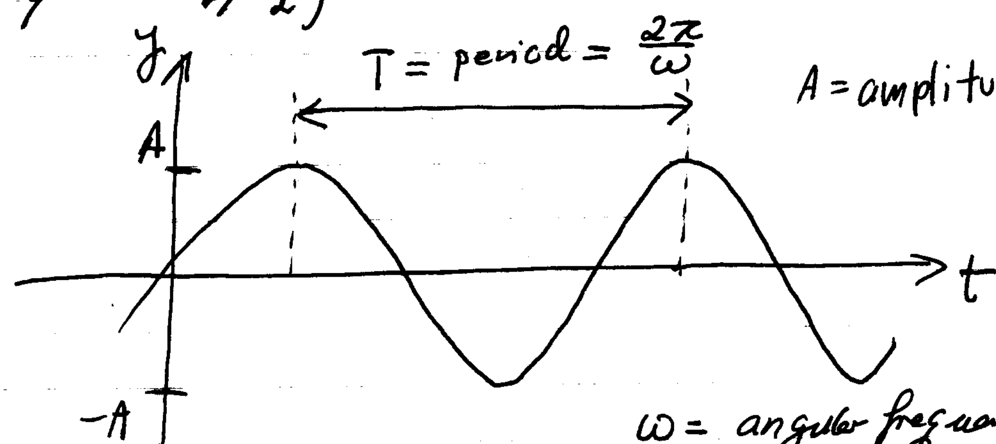
where

$$A \sin \phi = c_1$$
$$A \cos \phi = c_2$$

(i.e.: A, ϕ are the polar coords of the point (c_2, c_1))

$$c_1^2 + c_2^2 = A^2, \qquad A = \sqrt{c_1^2 + c_2^2},$$
$$\tan \phi = c_1/c_2)$$

SIMPLE HARMONIC MOTION



Natural frequency $= \frac{\omega}{2\pi}$ (cycles per sec) $\qquad \omega$ = angular frequency $= \sqrt{\frac{k}{m}}$

Example: (#2) a 2kg mass is attached to spring with stiffness $= k = 50$ N/m. The mass is displaced 1/4 m to the left of equilibrium and given an initial velocity of 1m/s to the left. Neglecting damping find the eqn. of motion along with amplitude, period & frequency. How long after release does the mass pass thro the equilibrium point?