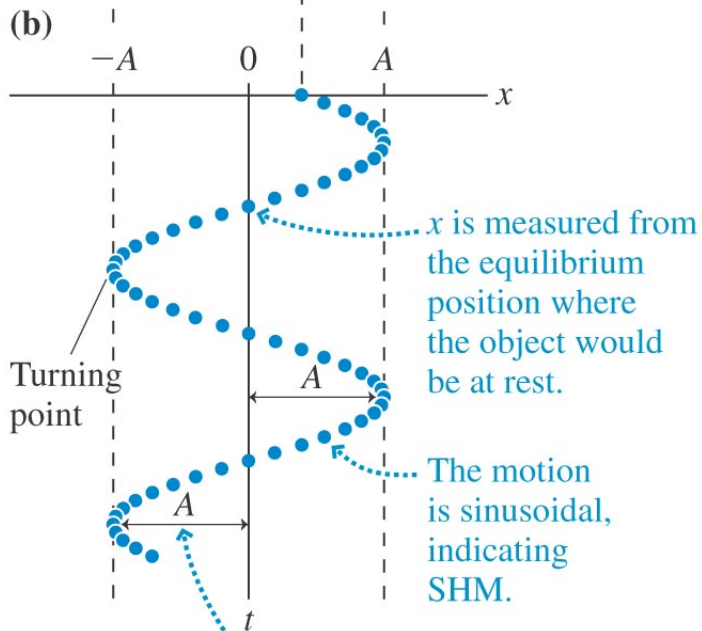
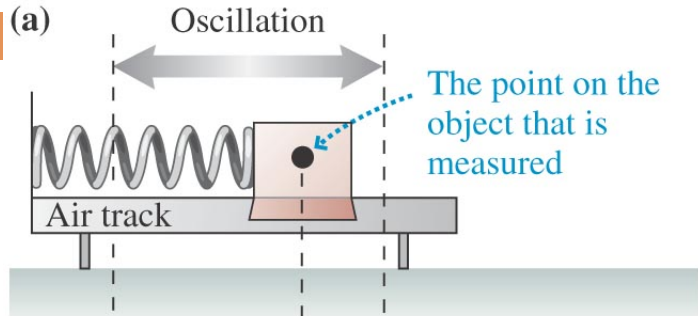


SIMPLE HARMONIC MOTION



Simple Harmonic Motion



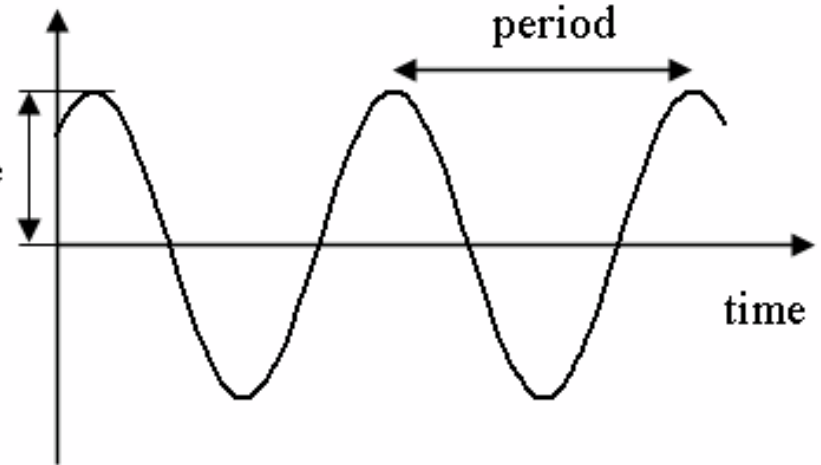
The motion is symmetrical about the equilibrium position. Maximum distance to the left and to the right is A .

Amplitude (A): An objects maximum displacement from its equilibrium position.

include picture below

displacement

amplitude



Simple Harmonic Motion

If the object is released from from rest at time $t=0$, we can model the motion with the cosine function

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

Cosine is a sinusoidal function.

ω is greek letter omega.

ω is called the angular frequency

****Calculator must be in degrees****

$$\omega = 2\pi f$$

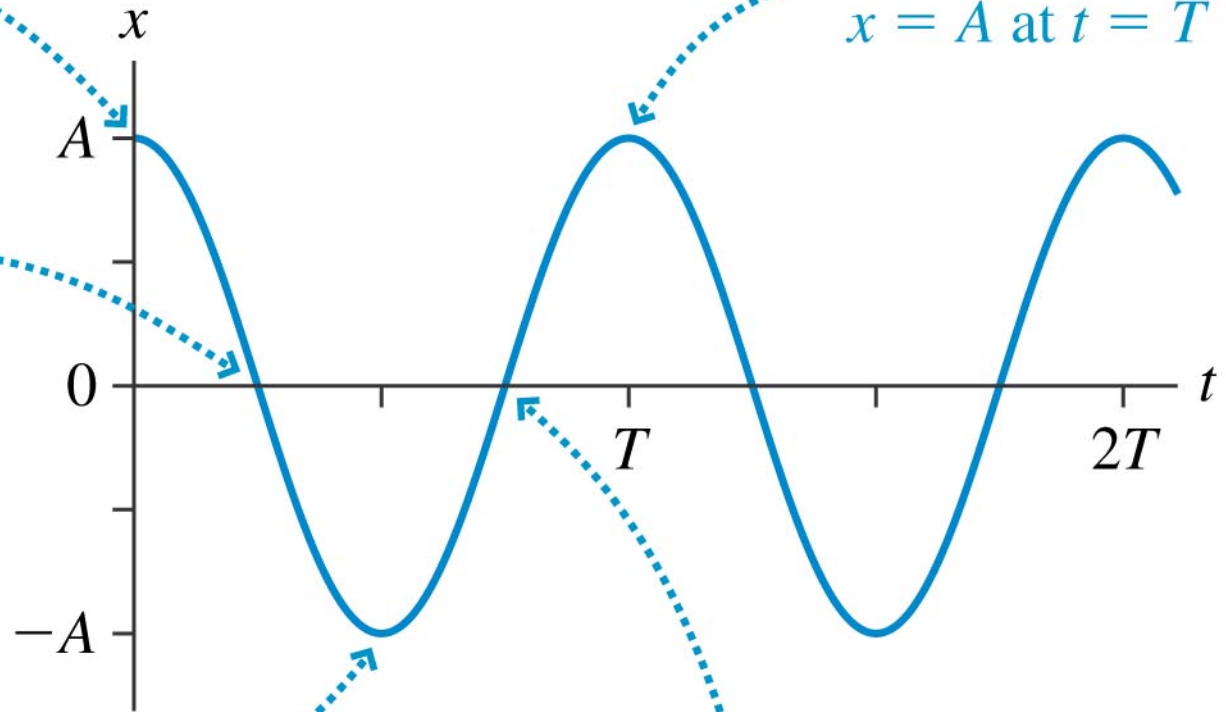
1. Starts at $x = A$

2. Passes through
 $x = 0$ at $t = \frac{1}{4}T$

3. Reaches $x = -A$ at $t = \frac{1}{2}T$

4. Passes through $x = 0$ at $t = \frac{3}{4}T$

5. Returns to
 $x = A$ at $t = T$

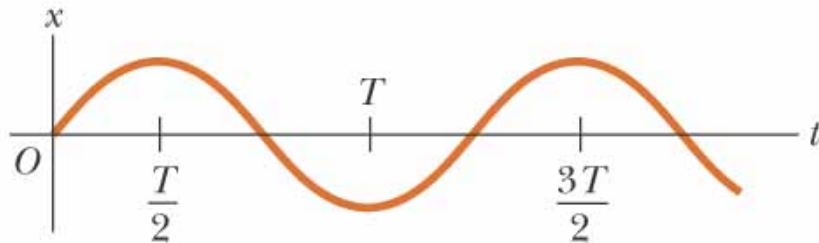


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$$x(t) = A \cos\left(\frac{2\pi}{T}t\right)$$

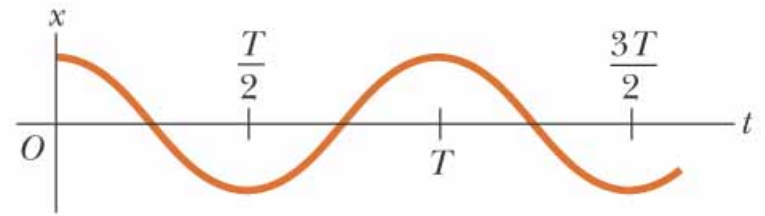
$$\text{since } f = \frac{1}{T} \text{ then } \omega = \frac{2\pi}{T}$$

Sine vs. Cosine Function



Sine function

$$x(t) = A \sin\left(\frac{2\pi}{T}t\right)$$



Cosine function

$$x(t) = A \cos\left(\frac{2\pi}{T}t\right)$$

$$x_{\max} = A$$

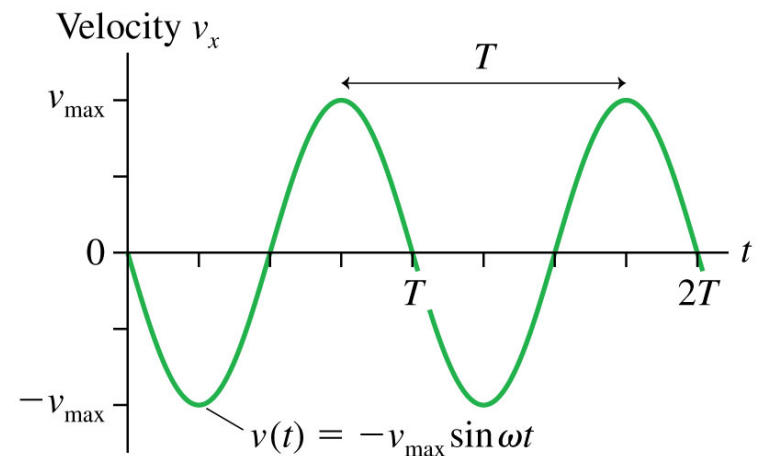
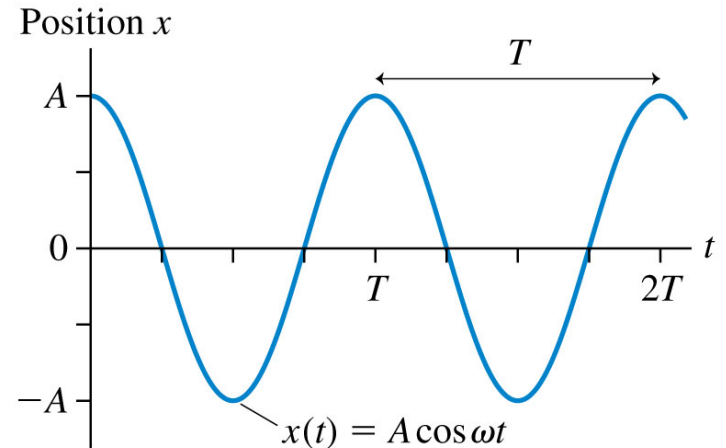
$$x = A \cos(\omega t)$$

$$v_x = -A\omega \sin(\omega t)$$

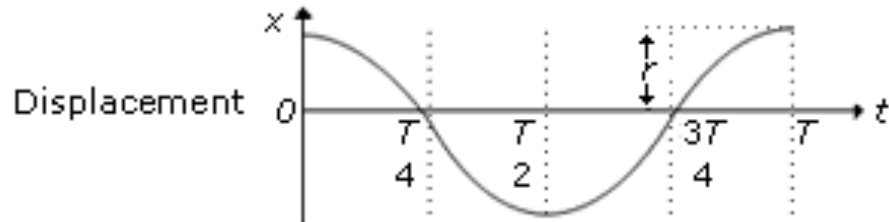
The maximum speed is

$$v_{\max} = A\omega$$

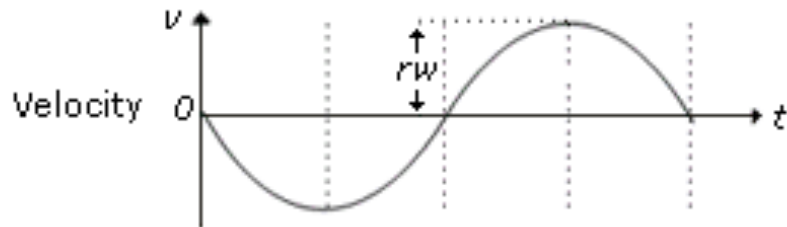
$$v_x(t) = -v_{\max} \sin(\omega t)$$



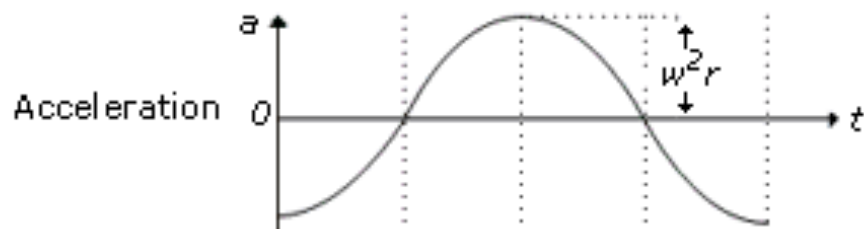
Acceleration



$$x(t) = A \cos\left(\frac{2\pi}{T}t\right)$$



$$v(t) = -\omega A \cos(\omega t)$$



$$a(t) = -\omega^2 A \cos(\omega t)$$

$$a_{\max} = \omega^2 A$$

$$a(t) = -a_{\max} \cos(\omega t)$$