Chap. 13

Periodic Motion : A motion that repeats itself over and over
e.g) Heart beat and the ticking of a clock

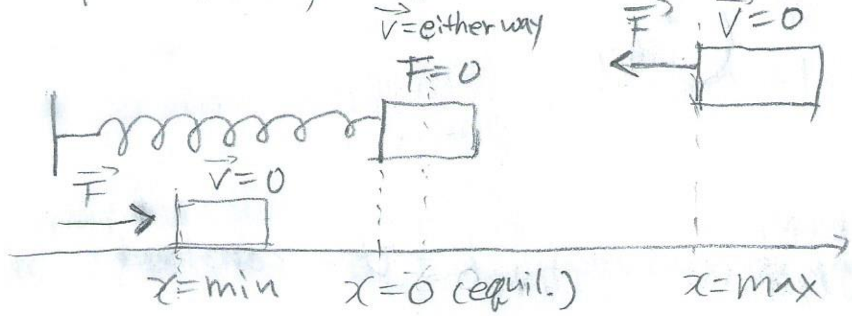
Period $T = \text{seconds}/\text{cycle} = s$

Frequency $f = 1/T = \text{cycle}/\text{second} = s^{-1} = Hz$

- f is a measure of periodic motion. (Hertz = Hz)
- The higher f, the more rapid the oscillations.

Simple Harmonic Motion

$F = -kx$, $a_x = -\omega^2 x$



Angular frequency, ω
$\omega = 2\pi f = \frac{2\pi}{T} (s^{-1})$

Also, $F = ma = -kx$ and $a_x = -\omega^2 x$
$-m\omega^2 x = -kx$

$$\omega = \sqrt{\frac{k}{m}}$$

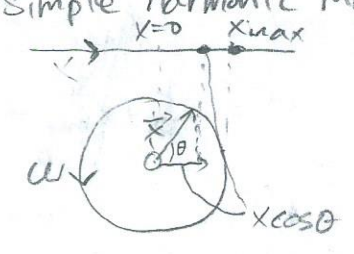
→ Period of a mass on a spring,
$T = 2\pi\sqrt{\frac{m}{k}}$

Position of shadow as function of time
- It is identical to Position vs. Time in simple harmonic Motion.

From book

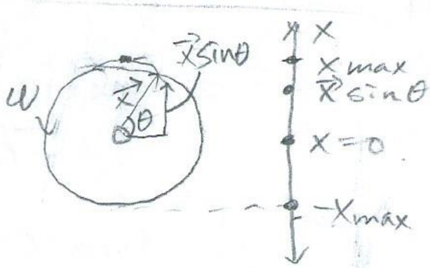
$x(t) = x_{max}\cos\left(\frac{2\pi}{T}t\right)$ since $\omega = \frac{2\pi}{T}$

$x(t) = x_{max}\cos(\underbrace{\omega t}_{\theta})$



From lecture

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



Connection between Circular motion and SHM
- Increasing the force constant (k) causes the mass to oscillate with a greater f
- Increasing the mass lowers the frequency of oscillation
- An increase in amplitude (x) has no effect on the oscillation frequency, but it will increase the maximum speed and the maximum acceleration of the mass