**Harmonic Motion**

The simplest example of harmonic motion is a rotating disc, like a record. We will use this to develop equations to describe position, velocity and acceleration of an object undergoing simple harmonic motion.

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| --- | --- |
|  | A marker at the edge of the record and trace its horizontal motion. Max distance = Amplitude Will be from R to – RHorizontal position =  |

**ϴ = ωt so x = A cos θ = A cos ω t or A cos (2πf)**

**Velocity**

The velocity of the marker will be along the tangent line, so the x component of velocity will be the x component of that v­tan.

|  |  |
| --- | --- |
|  | Here, that x component is the sin of the vtan sin ϴ and it is in the negative direction. vx =  |

**vx = – vtan sin ϴ = – ω A sin (ω t) = – ω A sin (2π f)**

**Acceleration**

|  |  |
| --- | --- |
|  | Acceleration is along radiusac = (vtan)2/R  |

**ax = – ω2 A cos (ω t) = – ω2 A cos (2π f)**

**ax = – ω2 A cos θ = – ω2 x (A cosϴ = x)**

**Motion Graphs**

Think about a mass on a spring oscillating up and down or horizontally.



 **Θ = ω t = 2πnf (t) ω = 2πn n is revolutions**

**x = A cos ω t vx = – ω A sin ω t a­x = – ω2 A cos ω t**

**x = A cos θ vx = – ω A sin θ ax = – ω2 A cos θ**

xmax = A vmax = – ω A amax = – ω2 A

xmax when θ is vmax when θ is amax when θ is

0, π or n π (n -1/2)π (odd ½’s) 0, π, or n π

The spring has a restorative force and by Hooke’s Law

Newton’s 2nd law

**ma = - kx = m (– ω2x) = – kx ω2 = m/k**