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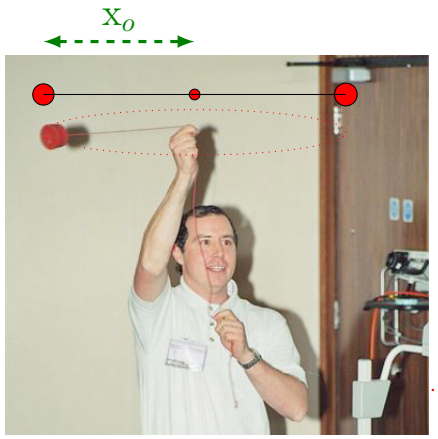
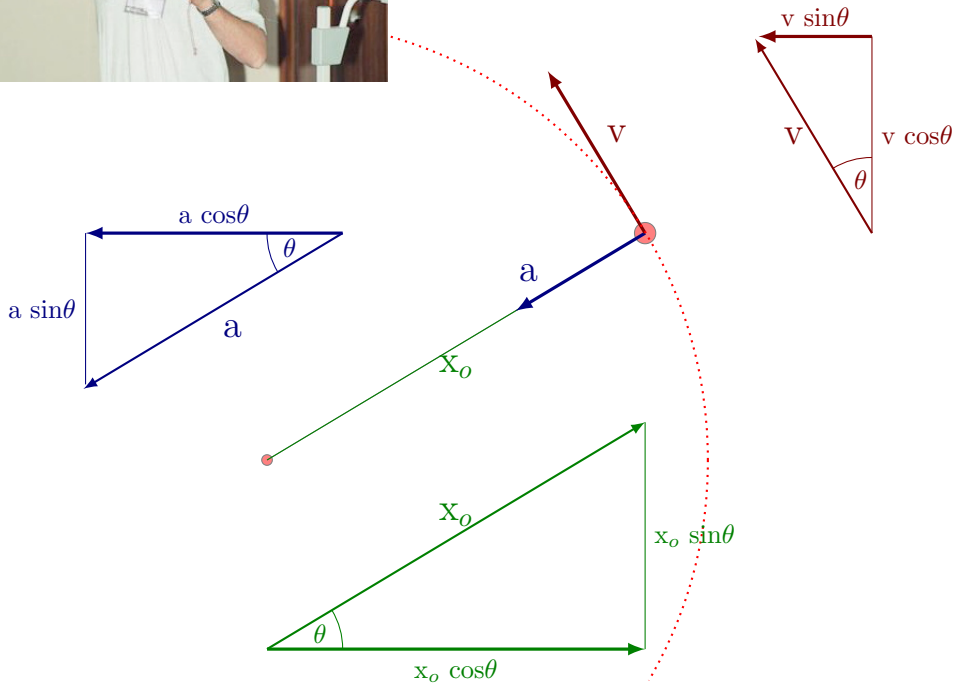
SHM Kinematics 2 (4.1.3)



- When viewed from above, the red ball would supposedly be moving in a circle
- When viewed from straight ahead, if you disregard depth perception, the red ball would supposedly be moving horizontally back and forth, in SHM. We are going to be focusing on the **horizontal SHM motion**.
- If a body oscillating with SHM has an angular frequency of $\omega = 2\pi f$ and amplitude x_o then it's displacement(x), velocity (v) and acceleration (a) at any given time can be derived from these formulas:



Velocity

1) Velocity $= \frac{\text{distance}}{\text{time}} = \frac{2\pi r}{t} = \omega r$
2) If $v = \omega r$, here we have $v = \omega x_o$
3) The horizontal velocity at displacement x is $v = -vsin\theta$
4) Add 2 and 3 we get horizontal velocity $= -\omega x_o sin\theta$

Acceleration

1) Centripetal acceleration $= \frac{v^2}{r} = \frac{\omega^2 r^2}{r} = \omega^2 r$
2) For circular motion, $a = \omega^2 r$, so here we have $a = \omega^2 x_o$
3) The horizontal acceleration at x is $a = -acos\theta$
4) Add 2 and 3 we get $a = -\omega^2 x_o cos\theta$

Defining Equation

1) The horizontal displacement at x is $x = x_o cos\theta$
2) Add 1 and acceleration and we get $a = -\omega^2 x$