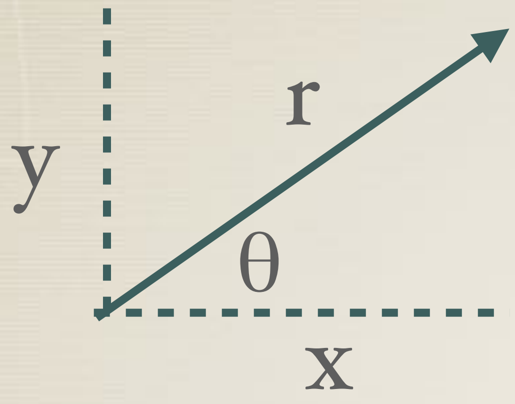
PHYS 1441

Review 2

Vectors



$$x = r\cos(\theta)$$

$$y = r\sin(\theta)$$

$$r = \sqrt{x^2 + y^2}$$

$$\theta = \arctan\frac{y}{x}$$

components are independent
and can be treated like scalars

Kinematics

$$\vec{v} = \frac{d\vec{r}}{dt} \qquad \vec{a} = \frac{d\vec{v}}{dt}$$

if a is constant:

$$x = x_0 + v_{x0}t + \frac{1}{2}a_x t^2$$

$$v_x = v_{x0} + a_x t$$

$$v_x^2 = v_{x0}^2 + 2a_x(x - x_0)$$

Angular Kinematics

$$L = R\theta$$

$$\omega = \frac{d\theta}{dt} \qquad \alpha = \frac{d\omega}{dt}$$

$$v = R\omega$$

$$a_{tan} = R\alpha$$

$$a_R = -\frac{v^2}{R}$$

if α is constant:

$$\theta = \theta_0 + \omega_0 t + \frac{1}{2}\alpha t^2$$

$$\omega = \omega_0 + \alpha t$$

$$\omega^2 = \omega_0^2 + \alpha(\theta - \theta_0)$$

Forces and Torques

$$\tau = RF\sin\theta$$

$$\tau = I\alpha$$

$$\vec{F} = m\vec{a}$$

$$\vec{F}_{ab} = -\vec{F}_{ba}$$

$$\vec{F}_g = mg$$

$$F_{fr} = \mu F_N$$

$\vec{F}_N =$ what it needs to be to keep the object from going through the surface

$$F_G = G\frac{M_1 M_2}{R^2}$$

$$F_s = -kx$$

Energy

Is conserved if only conservative forces

$$W = \int \vec{F} \cdot d\vec{x}$$ if F is constant $$W = \vec{F} \cdot \vec{x}$$

$$KE = \frac{1}{2}mv^2 \qquad KE = \frac{1}{2}I\omega^2$$

$$U(x) = \int F(x)dx$$

$$U_g(h) = mgh \qquad U_s(x) = \frac{1}{2}kx^2 \qquad U_G(r) = -G\frac{M_1M_2}{R}$$

Power $P = \frac{dE}{dt} = \vec{F} \cdot \vec{v}$ if F is constant

Momentum

Is conserved if no outside force (torque)

$$\vec{p} = m\vec{v}$$

$$L = I\omega = mvR\sin\theta$$

$$\vec{F} = \frac{d\vec{p}}{dt}$$

$$\tau = \frac{dL}{dt}$$

example: collision that stick together

$$m_A v_A + m_B v_B = (m_A + m_B)v'$$

Statics

$$\sum F = 0 \qquad \sum \tau = 0$$