PHY 303L

Homepage: www.ph.utexas.edu/~itiq/303Lf13/chiu

(UT Physics department)

Resources used in this course:

- Syllabus
- Lesson plan
- Lecture slides

Overview of this course:

- Preview the lesson: learning modules (in Quest)
- Use of Clickers during the lecture
- Use of Quest homework system
- TA sessions
- **4 midterms and 1 final**

Basic Principles of Mechanics

impulse

Momentum principle: $\Delta p = F\Delta t$

Nonrelativistic: $\Delta mv = m\Delta v = F\Delta t$

$$\therefore m\frac{\Delta v}{\Delta t} = F \rightarrow F = ma$$

Energy Principle:

For 1 massive particle: $K = \frac{1}{2}mv^2$ $\Delta K = W = F \cdot \Delta l$

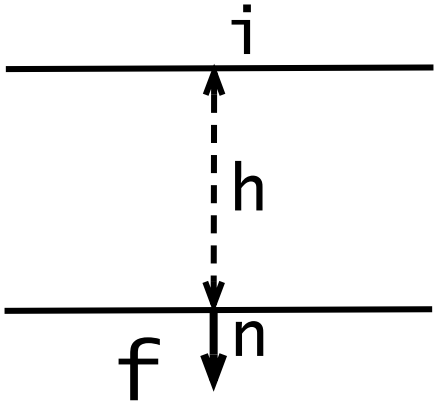
Gravity

Path *m* by height *h*

Let go at the initial point *i*

Particle is accelerated with acceleration *g*

$$\Delta K = K_f - K_i = mgh$$

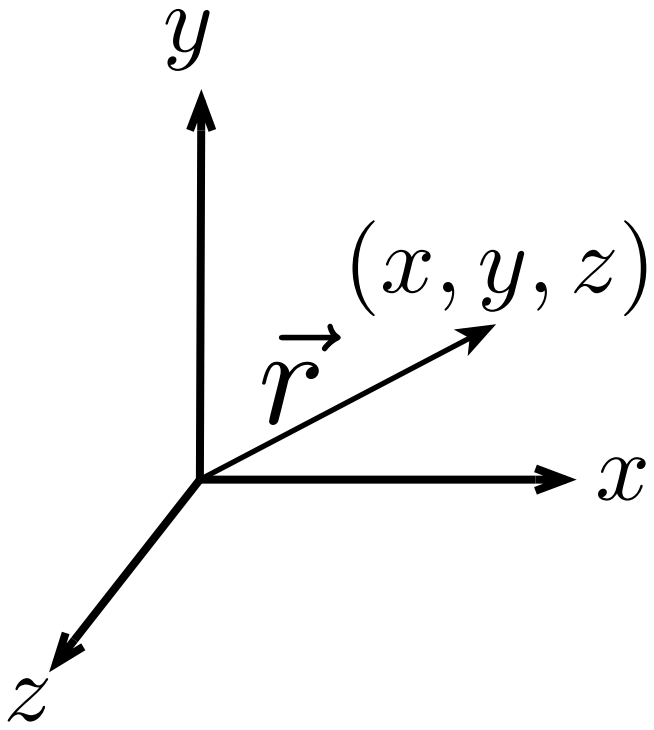


You are ready to study M&I Vol. II: E&M so long as you have the basic knowledge of:

$$\begin{cases} \Delta p = F \cdot \Delta t \\ \Delta E = \vec{F} \cdot \Delta \vec{l} \end{cases}$$

(and their applications)

Review Vectors



Vector in 3D: $\vec{r} =< x, y, z >$

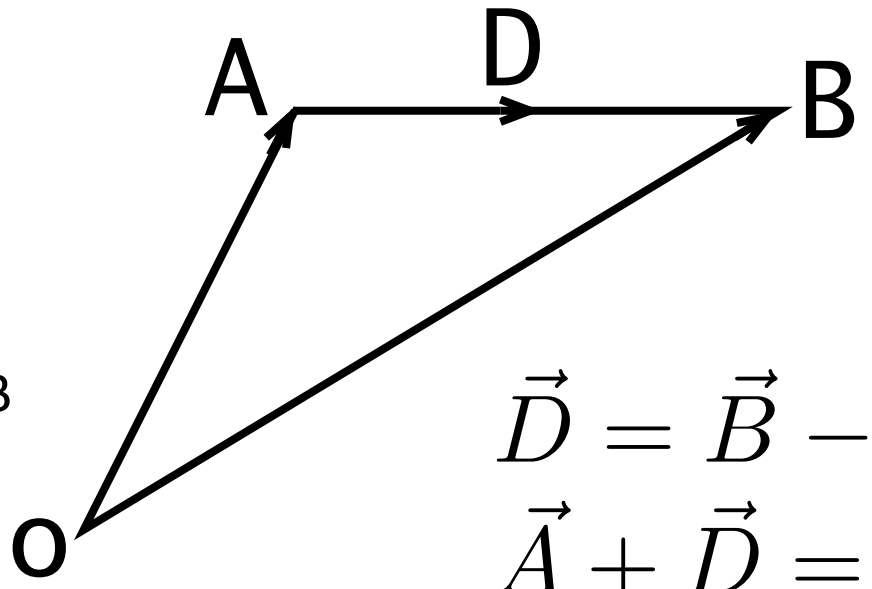
Vector in 2D: $\vec{r} =< x, y, z = z_1 >$

$=< x, y >$

Displacement Vectors

Intuitive Description:

Starting at A, add D, it ends at B



$$\vec{D} = \vec{B} - \vec{A}$$

$$\vec{A} + \vec{D} = \vec{B}$$

Magnitude

$$|D| : \left|\vec{D}\right|^2 = D_x^2 + D_y^2 + D_z^2 \qquad \text{(3D)}$$

$$D = \sqrt{D_x^2 + D_y^2} \qquad \text{(2D)}$$

Unit Vector: $\hat{D} = \dfrac{\vec{D}}{|D|}$

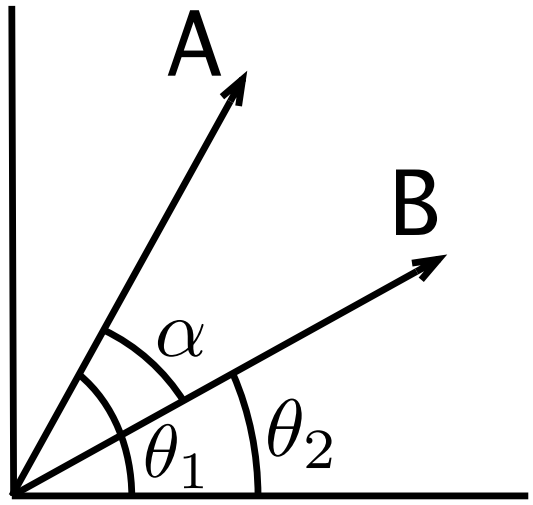
Product of 2 Vectors:

Scalar Product = Dot Product

Vector Product = Cross Product

Scalar Product = Dot Product

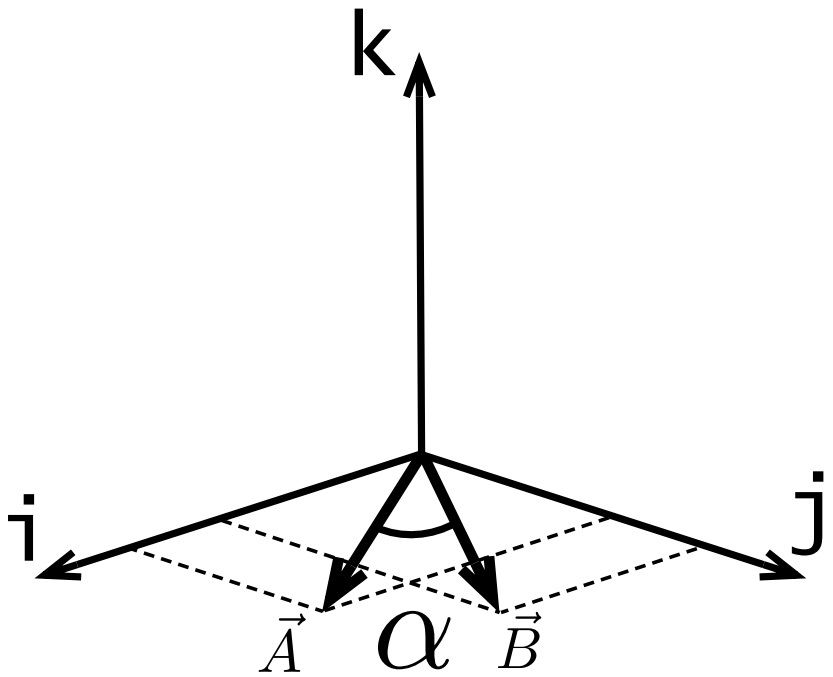
$$\vec{A} \cdot \vec{B} = A_x B_x + A_y B_y = AB \cos \alpha$$



$$\begin{aligned} RHS &= A_x B_x + A_y B_y \\ &= A \cos \theta_1 B \cos \theta_2 + A \sin \theta_1 B \sin \theta_2 \\ &= AB \cos (\theta_1 - \theta_2) \\ &= AB \cos \alpha \\ &= A_\perp B = A B_\perp \end{aligned}$$

Vector Product = Cross Product

$$\vec{A} \times \vec{B} = AB \sin\alpha \, \hat{n}$$



$$\begin{vmatrix} i & j & k \\ A_x & A_y & 0 \\ B_x & B_y & 0 \end{vmatrix} = \hat{k}\,(A_x B_x - A_y B_y)$$

$$= \hat{k} AB(\cos\theta_1 \sin\theta_2 - \sin\theta_1 \cos\theta_2)$$

$$= \hat{k} AB \sin(\theta_2 - \theta_1)$$

$$= \hat{k} AB \sin\alpha$$