PHYS 320 ANALYTICAL MECHANICS

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Fall 2108

Apollo launch

TODAY

Syllabus
Lab time
HW
Newton's Laws
Vector review!

Course web page

NEWTON'S LAWS

- I Every body continues in its state of rest, or of uniform motion in a straight line, unless it is compelled to change that state by forces impressed upon it.
- II The change of motion is proportional to the motive force impresses; and is made in the direction of the line in which that force is impressed.
- III To every action there is always imposed an equal reaction; or, the mutual actions of two bodies upon each other are always equal, and directed to contrary parts.

Vectors

- Basis (unit) vector form for writing an arbitrary vector, $\vec{A}$

$$\vec{A} = A_x\hat{i} + A_y\hat{j} + A_z\hat{k} = A_x\hat{e}_1 + A_y\hat{e}_2 + A_z\hat{e}_3$$

Cartesian unit vectors

- So we can write fun things like

$$\vec{A} + \vec{B} = (A_x + B_x)\hat{i} + (A_y + B_y)\hat{j} + (A_z + B_z)\hat{k}$$

$$a\vec{A} = (aA_x)\hat{i} + (aA_y)\hat{j} + (aA_z)\hat{k}$$

scalar multiplication

increase length of vector by a

Vectors

- Perform the operations with the vectors given

$$\vec{A} = 3\hat{i} + 2\hat{j} + 4\hat{k}$$

$$\vec{B} = -2\hat{i} + 5\hat{j} - \hat{k}$$

$$\vec{C} = xz\hat{i} - 3y\hat{j} - xy\hat{k}$$

$i)$ $\vec{A} + \vec{B} = ?$

$ii)$ $\vec{A} - 2\vec{B} = ?$

$iii)$ $-\vec{A} + \vec{B} + 2\vec{C} = ?$

Vectors: scalar (dot) product

$$\vec{A} \cdot \vec{B} = (A_x B_x) + (A_y B_y) + (A_z B_z)$$

or

$$\vec{A} \cdot \vec{B} = \sum_{i,j=1}^{3} A_i B_j \hat{e}_i \cdot \hat{e}_j = \sum_{i=1}^{3} A_i B_i$$

δ_{ij} = Kronecker delta

commutative and associative!

Also $\vec{A} \cdot \vec{B} = \left|\vec{A}\right|\left|\vec{B}\right| \cos\theta$