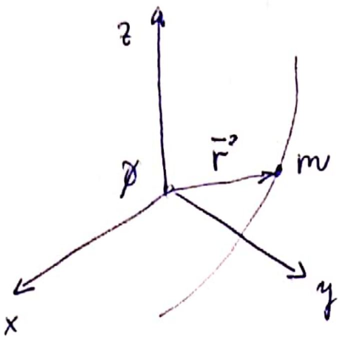
5) Law of change of kinetic energy

2^{nd} Newton's Law - Law of force



$$\vec{F} = \frac{d}{dt}(m \cdot \vec{v}) \quad / \, d\vec{r}$$

$$\vec{F} \cdot d\vec{r} = \underbrace{\frac{d\vec{r}}{dt}}_{\vec{v}} d(m\vec{v}) = \vec{v} \cdot d(m\vec{v}) =$$

$$= m \, \underline{\vec{v} \, d\vec{v}} = *$$

$\vec{r}$ ... displacement vector

$d\vec{r}$ ... element of displacement vector

$$d(\vec{v}\vec{v}) = d\vec{v}\,\vec{v} + \vec{v}\,d\vec{v} = 2v\,d\vec{v}$$

$$\frac{1}{2} d(\vec{v}\cdot\vec{v}) = \underline{\vec{v}\,d\vec{v}}$$

$$\frac{1}{2} d v^2 = \vec{v}\,d\vec{v}$$

scalar multiplication of vectors $\quad \vec{v} \cdot \vec{v} = v^2$

$$* = m \frac{1}{2} dv^2$$

$$dW = \vec{F} d\vec{r} = \frac{1}{2} m \cdot dv^2$$

elementar work of force $\quad dW = \vec{F} d\vec{r}$

$K = \frac{1}{2} m v^2$ ... kinetic energy of particle

$$\underbrace{\int_{\vec{r}_1}^{\vec{r}_2} \vec{F} d\vec{r}}_{W} = \underbrace{\frac{1}{2} m v_2^2}_{K_2} - \underbrace{\frac{1}{2} m v_1^2}_{K_1}$$

W work of force

K_2 kinetic energy at state 2

K_1 k.e. at state 1

Work of force $\vec{F}$ (resulting force) acting on particle $\underline{m}$ on trajectory $\underline{s}$ is equal to difference of kinetic energy at the end of the process and kinetic energy at the beginning of the process.

$$W = K_2 - K_1$$

$$W = \int_{\vec{r_1}}^{\vec{r_1}} \vec{F} d\vec{r} \qquad \begin{array}{|l|} \vec{F}(F_x, F_y, F_z) \\ d\vec{r}(dx, dy, dz) \\ \hline \end{array}, \ \vec{r}(x, y, z)$$

$$\vec{F} d\vec{r} = (F_x, F_y, F_z) \cdot (dx, dy, dz) = F_x dx + F_y dy + F_z dz$$