

PLANE Kinetics of Rigid Bodies

(G1)

WORK and ENERGY

work done by a force \vec{F} is

$$U = \int \vec{F} \cdot d\vec{r} \quad \text{or} \quad U = \int \vec{F} \cos(\phi) ds \quad \text{SCALAR}$$

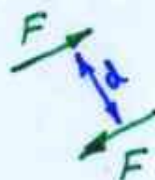
SCALAR-DOT PRODUCT

ϕ is angle between \vec{F} & $d\vec{r}$

WORK DONE BY a COUPLE M is

$$U = \int M d\theta$$

RECALL, A COUPLE is 2 opposite forces
 $M = Fd$



if we TRANSLATE A couple,
WORK DONE BY FORCES
CANCELS OUT (OR IS ZERO)

Kinetic Energy:

TRANSLATION:

$$T = \frac{1}{2} m v^2$$

FIXED Axis Rotation:

CONSIDER PARTICLE m_i

$$v_i = r_i \omega$$

$$\text{K.E. of Particle is } T_i = \frac{1}{2} m_i r_i^2 \omega^2$$

FOR WHOLE BODY

$$T = \sum T_i = \sum \frac{1}{2} m_i r_i^2 \omega^2 = \frac{1}{2} \omega^2 \sum m_i r_i^2$$

$m_i \rightarrow dm \Rightarrow$ integration

$$T = \frac{1}{2} \omega^2 \int m_i r_i^2 \Rightarrow T = \frac{1}{2} I_o \omega^2$$

$$I_o \leftarrow \int r_i^2 dm$$

