## Principle of work & kinetic energy for rigid bodies in plane motion:

$$\boxed{T_1 + U_{1\to 2} = T_2}$$ (***)

$U_{1\to 2}$ = work done on the rigid body, moving from position 1 to position 2, by forces and moments

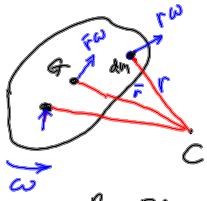
$T_1$ = kinetic energy of the rigid body at position 1

$T_2$ = " " " " " " " " 2

Work of a force on a body is equal to the force on the body times the displacement of the body in the direction of the force. $\boxed{U_F = F\,\delta_{\parallel}}$

Work of a moment on a body is equal to the moment on the body times the angular displacement of the body in the direction of the moment (as defined by the right-hand rule).

$$\boxed{U_M = M(\Delta\theta)_{\parallel}}$$




$dT = \frac{1}{2}(dm)(r\omega)^2 = \frac{1}{2}r^2\omega^2 dm$

$T = \frac{\omega^2}{2}\int r^2 dm = \frac{\omega^2}{2} I_c$ $\boxed{T = \frac{1}{2} I_c \omega^2}$

u.o.… I.

C (velocity center of the body)

By PAT, we have $I_c = \bar{I} + m\bar{r}^2$ $\bar{r}\omega = \bar{v}$

$T = \frac{1}{2}(\bar{I} + m\bar{r}^2)\omega^2 = \frac{1}{2}\bar{I}\omega^2 + \frac{1}{2}m(\bar{r}\omega)^2 = \frac{1}{2}\bar{I}\omega^2 + \frac{1}{2}m\bar{v}^2$

$$\boxed{T = \frac{1}{2}m\bar{v}^2 + \frac{1}{2}\bar{I}\omega^2}$$

For conservative system, $\boxed{T_1 + V_1 = T_2 + V_2}$ (cd)

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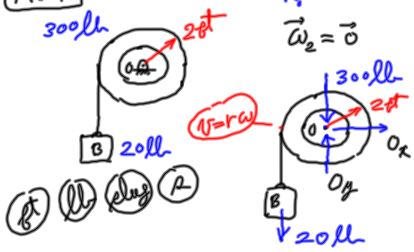
17.4




$\bar{k}_c = 1.5$ ft $\vec{\omega}_1 = 10$ rad/s

$\vec{\omega}_2 = \vec{0}$ $N = ?$ (rev)

(ft) (lb) (slug) (s)

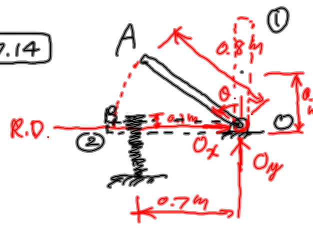
$$\boxed{T_1 + U_{1\to 2} = T_2}$$

$T_1 = \frac{1}{2}\left[\frac{300}{32.2}(1.5)^2\right](10)^2 + \frac{1}{2}\left(\frac{20}{32.2}\right)[2(10)]^2$

$U_{1\to 2} = -20[2(2\pi N)]$, $T_2 = 0$

$\therefore$ $\boxed{N = \square \text{ rev}}$

17.14




$m = 10$ kg $\vec{\omega}_1 = 6$ rad/s

$\theta_1 = 0$ $k = ?$

$$\boxed{T_1 + V_1 = T_2 + V_2}$$

$T_1 = \frac{1}{2}I_o\omega_1^2 = \frac{1}{2}\left[\frac{1}{12}(10)(0.8)^2 + 10(0.4)^2\right](6)^2$

$V_1 = 10(9.81)(0.4)$ $T_2 = 0$

$V_2 = 0 + \frac{1}{2}k(0.1)^2$ $\therefore k = \square$

$$\boxed{k = \square \text{ N/m}}$$

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