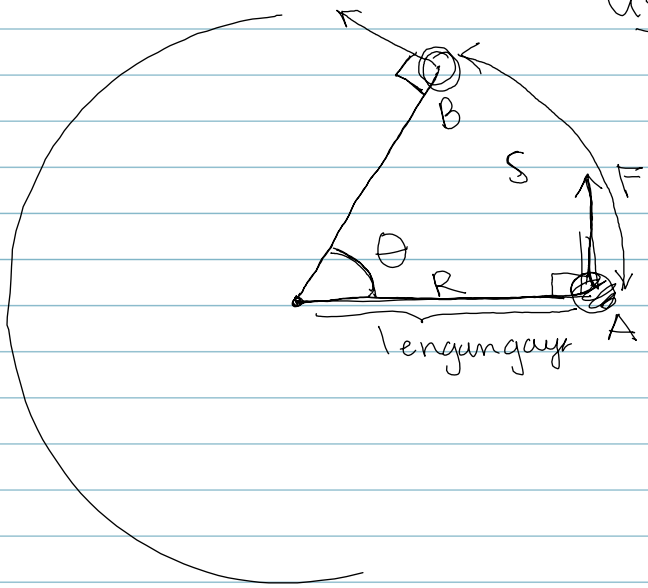
Usaha Rotasi



$$\frac{S}{2\pi R} = \frac{\theta}{2\pi}$$

$$S = R \cdot \theta$$

($\theta \rightarrow$ radian)

$$W = F \cdot S$$

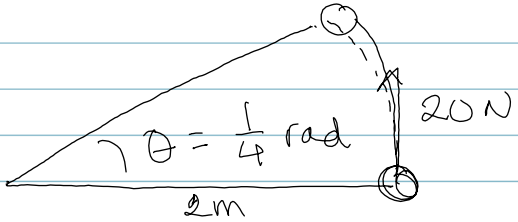
$$= F \cdot R \cdot \theta$$

$$= \tau \cdot \theta$$

$$\boxed{W = \tau \cdot \theta}$$

Usaha dan Energi rotasi

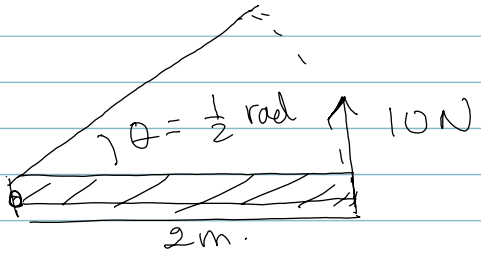
1)



$$W = F \cdot S = F r \cdot \theta$$

$$= 20 \cdot 2 \cdot \frac{1}{4} = 10 \text{ J}$$

2)

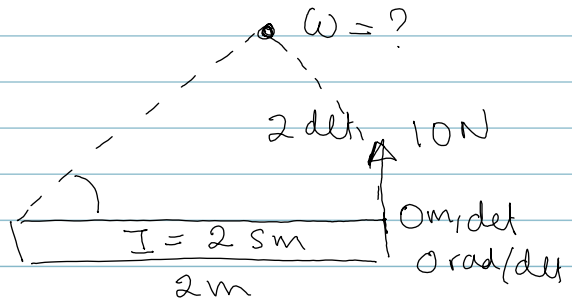


$$W = \tau \cdot \theta$$

$$= 10 \cdot 2 \cdot \frac{1}{2}$$

$$= 10 \text{ J}$$

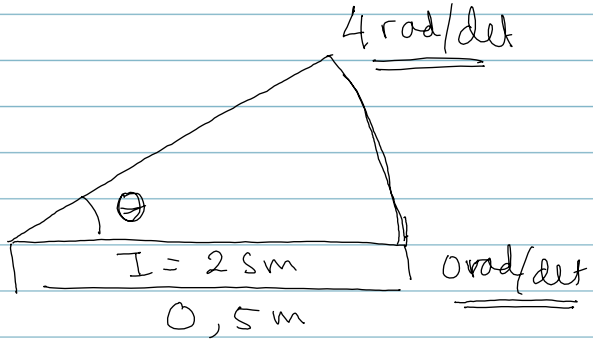
3)



$$\alpha = \frac{10 \cdot 2}{2} = 10 \text{ rad/det}^2$$

$$\omega = 2 \cdot 10 = 20 \text{ rad/det}$$

4)



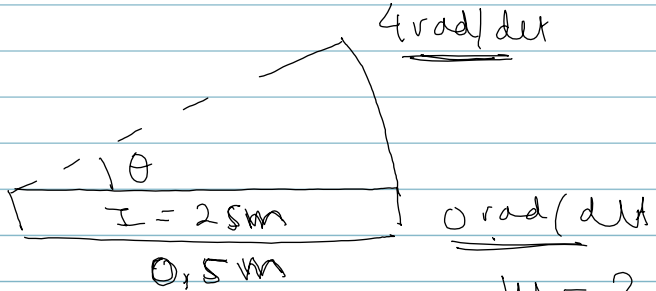
$t = 2 \text{ det}$

$$\alpha = \frac{4 \text{ rad/det}}{2 \text{ det}} = 2 \text{ rad/det}^2$$

$$\tau = I \cdot \alpha = 2 \cdot 2 = 4 \text{ N.m}$$

$$\theta = \frac{0 + 8}{2} = 4 \text{ rad} \Rightarrow W = 4 \cdot 4 = 16 \text{ J}$$

5)



$t = 4\ det$

$$\alpha = \frac{(4-0)\ rad/det}{4\ det} = 1\ rad/det^2$$

$$\tau = I \cdot \alpha = 2 \cdot 1 = 2\ N \cdot m$$

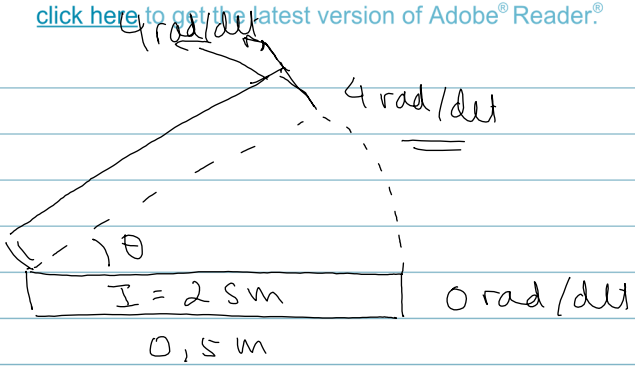
$$\theta = \frac{0+16}{2} = 8\ rad$$

$$W = \tau \cdot \theta = 2 \cdot 8 = 16\ J$$

$t = 2\ det$
$t = 4\ det$
$t = 6\ det$
$t = 1\ det$

$W = 16\ J$

6)



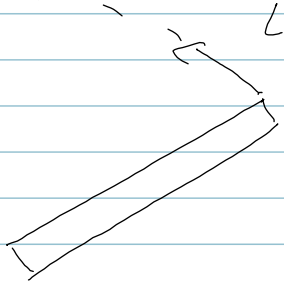
$t = 1\ dt$

$$\alpha = \frac{4\ rad/dt}{1\ dt} = 4\ rad/dt^2$$

$$\tau = I \cdot \alpha = 2 \cdot 4 = 8\ N \cdot m$$

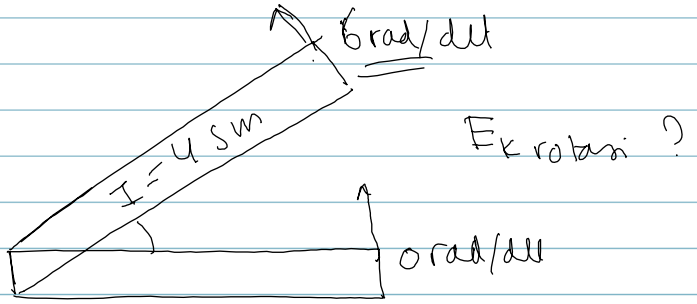
$$\theta = \frac{4 + 0}{2} = 2\ rad$$

$W = 16\ J$



$E_{k\ rotasi} = 16\ J$

7)



$t = 2 det$

$\alpha = \frac{6}{2} = 3 \text{ rad/det}^2$

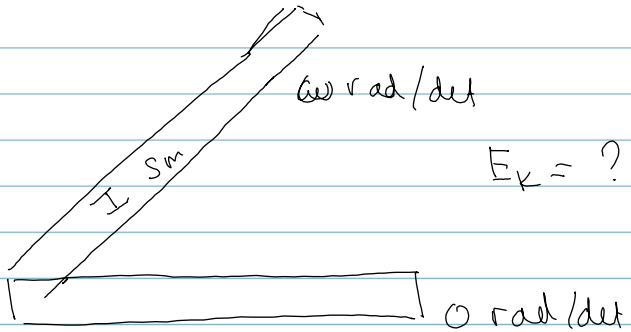
$\tau = I \cdot \alpha = 4 \cdot 3 = 12 \text{ N.m}$

$\theta = \frac{0 + 12}{2} = 6 \text{ rad}$

$W = \tau \cdot \theta = 12 \cdot 6 = 72 \text{ J}$

$E_{k\,rotasi} = 72 \text{ J}$

8)



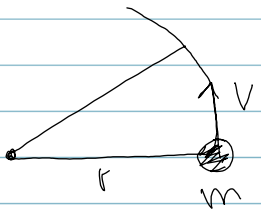
$$\alpha = \frac{\omega - 0}{t} = \frac{\omega}{t} \text{ rad/det}^2$$

$$\tau = I \cdot \alpha = \frac{I \cdot \omega}{t} \text{ N.m}$$

$$\theta = \frac{0 + \omega \cdot t}{2} = \frac{1}{2}\omega t$$

$$W = \tau \cdot \theta = \frac{I\,\omega}{t} \cdot \frac{1}{2}\omega \cdot t = \frac{1}{2} I \omega^2$$

$$\boxed{E_{k\,\text{rotasi}} = \frac{1}{2} I \omega^2} \; !$$



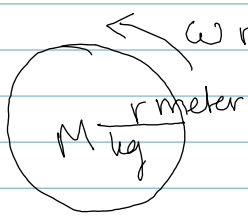
$$E_K = \frac{1}{2} m v^2$$

$$= \frac{1}{2} m (\omega \cdot r)^2$$

$$= \frac{1}{2} m r^2 \omega^2$$

$$\boxed{E_K = \frac{1}{2} I \omega^2} \; !$$

9)



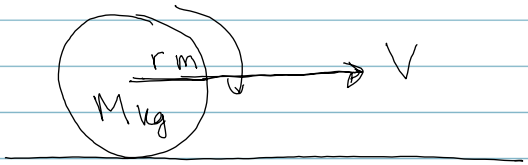
$I = \frac{1}{2} M r^2$

$E_K = \frac{1}{2} I \omega^2$

$= \frac{1}{2} \frac{1}{2} M r^2 \omega^2$

$= \frac{1}{4} M \omega^2 r^2$

10)



$V = \omega r$

$E_K = E_{K\,rotas.} + E_{K\,translas.}$

$= \frac{1}{2} I \omega^2 + \frac{1}{2} M V^2$

$= \frac{1}{2} I \frac{V^2}{r^2} + \frac{1}{2} M V^2$

$= \frac{1}{2} \frac{1}{2} M r^2 \frac{V^2}{r^2} + \frac{1}{2} M V^2$

$= \frac{1}{4} M V^2 + \frac{1}{2} M V^2$

$= \frac{3}{4} M V^2$