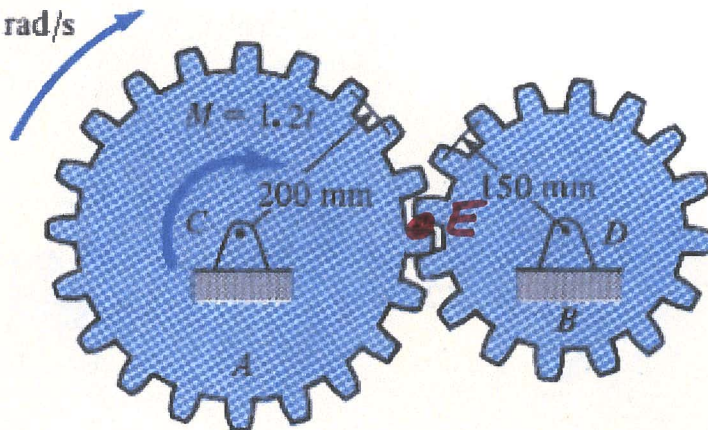


Problem 2: Impulse Momentum II

The flywheel A has a mass of 60 kg and a radius of gyration $k_C = 160$ mm. Gear B has a mass of 25 kg and a radius of gyration $k_D = 125$ mm. If the motor supplies a clockwise torque having a magnitude $M = (1.2t)$ Nm, where t is in seconds, to the flywheel, determine the angular velocity of the gear in 3 seconds. Initially the flywheel is rotating at $\omega_1 = 2$ rad/s.

$$\omega_1 = 2 \text{ rad/s}$$

CLASSIFY MOTIONBOTH RAFAPROPERTIES

$$I_A = 60(.16)^2 = 1.536 \text{ kg}\cdot\text{m}^2$$

$$I_B = 25(.125)^2 = 0.3906 \text{ kg}\cdot\text{m}^2$$

$$V_{E1} = \omega_{A1} r_A = 2(.2) = 0.4 \text{ m/s}$$

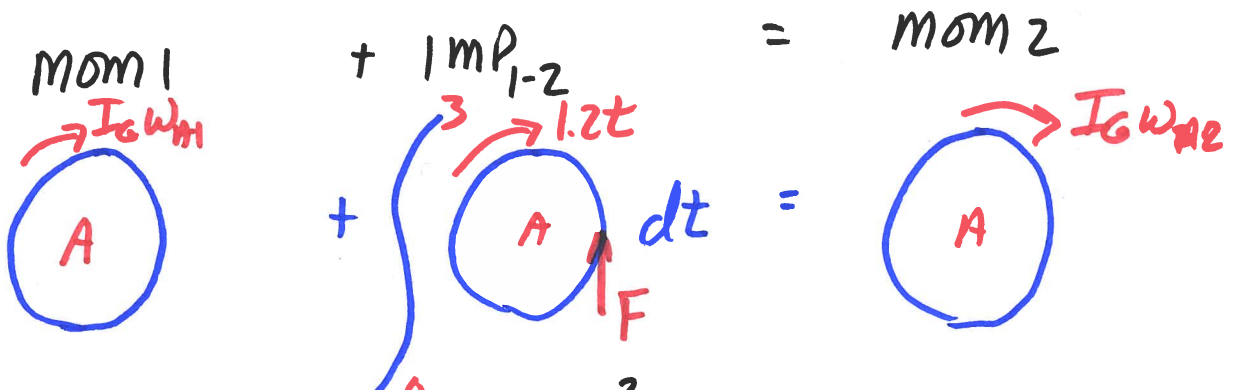
$$V_{E1} = \omega_{B1} r_B$$

$$0.4 = \omega_{B1}(.15) \quad \underline{\omega_{B1} = 2.667 \text{ rad/s}}$$

$$V_{E2} = \omega_{A2} r_A = \omega_{B2} r_B$$

$$\omega_{A2}(.2) = \omega_{B2}(.15)$$

$$\underline{\omega_{A2} = 0.75 \omega_{B2}}$$



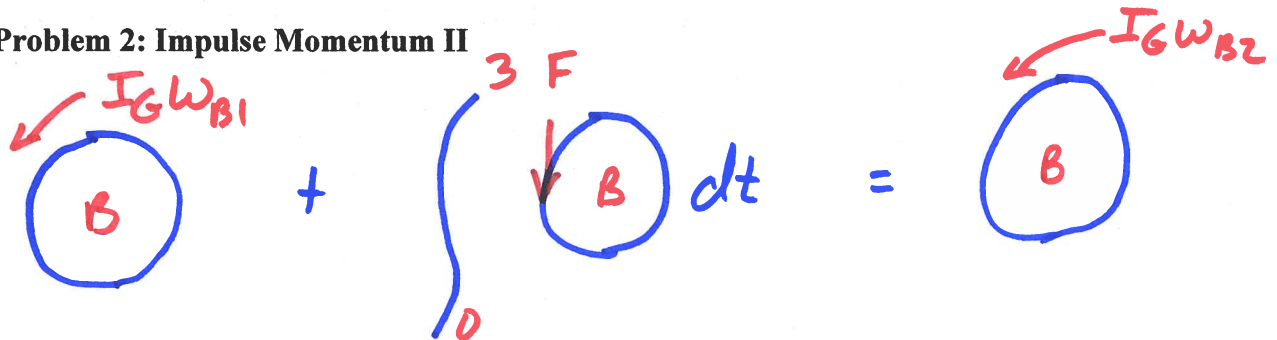
$$\uparrow \sum M_G \quad 1.536(2) + \int_0^3 1.2t dt - \int_0^3 0.2F dt = 1.536 \omega_{A2}$$

$$3.072 + 5.4 - 0.6F = 1.536 \omega_{A2}$$

$$0.6F + 1.536 \omega_{A2} = 8.47 \quad (1)$$

$$1.152 \omega_{B2}$$

Problem 2: Impulse Momentum II



$$\begin{aligned}
 \downarrow \sum M_G - 0.3906(2.667) - 0.45F &= -0.3906 \omega_{B2} \\
 -1.64 - 0.45F &= -0.3906 \omega_{B2} \\
 -0.45F + 0.3906 \omega_{B2} &= 1.04 \quad (2)
 \end{aligned}$$

$$0.6F + 1.152 \omega_{B2} = 8.47 \quad (1)$$

$$-0.45F + 0.3906 \omega_{B2} = 1.04 \quad (2)$$

$$\begin{bmatrix} 0.6 & 1.152 \\ -0.45 & 0.3906 \end{bmatrix} \begin{Bmatrix} F \\ \omega_{B2} \end{Bmatrix} = \begin{Bmatrix} 8.47 \\ 1.04 \end{Bmatrix}$$

SOLVE

$$F = 2.8$$

$$\omega_{B2} = 5.89 \text{ rad/s} \quad \curvearrowright$$

$$\omega_{A2} = 0.75 \omega_{B2} = 4.42 \text{ rad/s} \quad \downarrow$$