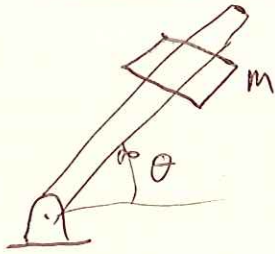


PROB. 12-66



$$m = 300^g = 0.3 \text{ kg}$$

$$r = 300 + 100 \cos\left(\frac{\pi t}{2}\right)^{\text{mm}} = 0.3 + 0.1 \cos\left(\frac{\pi t}{2}\right)^{\text{m}}$$

$$\theta = \pi(t^2 - 3t)$$

FIND  $F_r$ ,  $F_\theta$  WHEN  $t = 0$ ,  $t = \frac{1}{2}^s$

$$\Sigma F_r = m[\ddot{r} - r(\dot{\theta})^2], \quad \Sigma F_\theta = m(r\ddot{\theta} + 2\dot{r}\dot{\theta})$$

$$\dot{r} = -0.1\left(\frac{\pi}{2}\right) \cdot \sin\left(\frac{\pi t}{2}\right), \quad \ddot{r} = -0.1\left(\frac{\pi}{2}\right)^2 \cos\left(\frac{\pi t}{2}\right)$$

$$\dot{\theta} = \pi(2t - 3), \quad \ddot{\theta} = 2\pi$$

$$F_r = m \left\{ \left[ -0.1\left(\frac{\pi}{2}\right)^2 \cos\left(\frac{\pi t}{2}\right) \right] - \left[ 0.3 + 0.1 \cos\left(\frac{\pi t}{2}\right) \right] \cdot \left[ \pi(2t - 3) \right]^2 \right\}$$

$$F_r = m\pi^2 \left\{ -0.025 \cdot \cos\left(\frac{\pi t}{2}\right) - \left[ 0.3 + 0.1 \cos\left(\frac{\pi t}{2}\right) \right] (2t - 3)^2 \right\}$$

$$F_\theta = m \left\{ \left[ 0.3 + 0.1 \cdot \cos\left(\frac{\pi t}{2}\right) \right] \cdot \left[ 2\pi \right] + 2 \left[ -0.1\left(\frac{\pi}{2}\right) \sin\left(\frac{\pi t}{2}\right) \right] \cdot \left[ \pi(2t - 3) \right] \right\}$$

$$F_\theta = 2\pi m \left\{ \left[ 0.3 + 0.1 \cos\left(\frac{\pi t}{2}\right) \right] - 0.05\pi(2t - 3) \sin\left(\frac{\pi t}{2}\right) \right\}$$

AT  $t = 0$ :

$$F_r = m\pi^2 \left\{ -0.025 - (0.3 + 0.1)(-3)^2 \right\}$$

$$F_r = (0.3^{\text{kg}}) \pi^2 (-3.625) = \boxed{-10.73^{\text{N}}}$$

PROB. 12-66 CONT.

$$F_{\theta} = 2\pi m \{ (0.3 + 0.1) - 0.05 \cdot \pi(-3) \cdot \sin 0 \}$$

$$F_{\theta} = 2\pi(0.3 \text{ kg})(0.4) = 0.7539 \text{ N}$$

AT  $t = \frac{1}{2} \text{ s}$ :

$$F_r = m\pi^2 \left\{ -0.025 \cdot \cos\left(\frac{\pi}{2} \cdot \frac{1}{2}\right) - [0.3 + 0.1 \cdot \cos\left(\frac{\pi}{2} \cdot \frac{1}{2}\right)] \cdot \left[2\left(\frac{1}{2}\right) - 3\right]^2 \right\}$$

$$F_r = (0.3 \text{ kg})\pi^2 \left\{ -0.025 \cdot \cos\left(\frac{\pi}{4}\right) - [0.3 + 0.1 \cdot \cos\left(\frac{\pi}{4}\right)] \cdot 4 \right\}$$

$$F_r = -4.442 \text{ N}$$

$$F_{\theta} = 2\pi m \left\{ [0.3 + 0.1 \cdot \cos\left(\frac{\pi}{4}\right)] - 0.05\pi(1-3) \cdot \sin\left(\frac{\pi}{4}\right) \right\}$$

$$F_{\theta} = 2\pi(0.3 \text{ kg}) \left\{ [0.3 + 0.1 \cdot \cos\left(\frac{\pi}{4}\right)] + 0.1\pi \cdot \sin\left(\frac{\pi}{4}\right) \right\}$$

$$F_{\theta} = 1.117 \text{ N}$$