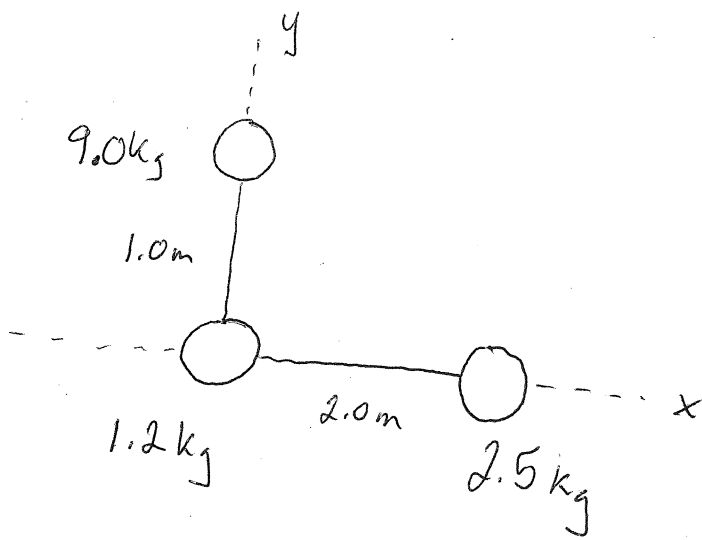


12

(7)



Determine the torque required to produce an angular acceleration of  $1.20 \frac{\text{rad}}{\text{s}^2}$  if the object is rotated

- 1) ~~about~~ the x-axis
- 2) about the y-axis
- 3) about the z-axis

Assume the objects are point masses.

$$I = m r^2$$

$$\alpha = 1.20 \frac{\text{rad}}{\text{s}^2}$$

$$\tau = I \alpha$$

1) x-axis

$$\begin{aligned} \tau &= m r^2 \alpha \\ &= 9.0 \text{ kg} (1.0 \text{ m})^2 \left( 1.20 \frac{\text{rad}}{\text{s}^2} \right) \\ &= 10.8 \text{ Nm} \\ &= \boxed{11 \text{ Nm}} \end{aligned}$$

2) y-axis

$$\begin{aligned} \tau &= m r^2 \alpha \\ &= 2.5 \text{ kg} (2.0 \text{ m})^2 1.20 \frac{\text{rad}}{\text{s}^2} \\ &= \boxed{12 \text{ Nm}} \end{aligned}$$

3) z-axis

$$\begin{aligned} \tau &= (I_1 + I_2) \alpha \\ &= \left[ 9.0 \text{ kg} (1.0 \text{ m})^2 + 2.5 \text{ kg} (2.0 \text{ m})^2 \right] 1.20 \frac{\text{rad}}{\text{s}^2} \\ &= 22.8 \text{ Nm} \\ &= \boxed{23 \text{ Nm}} \end{aligned}$$