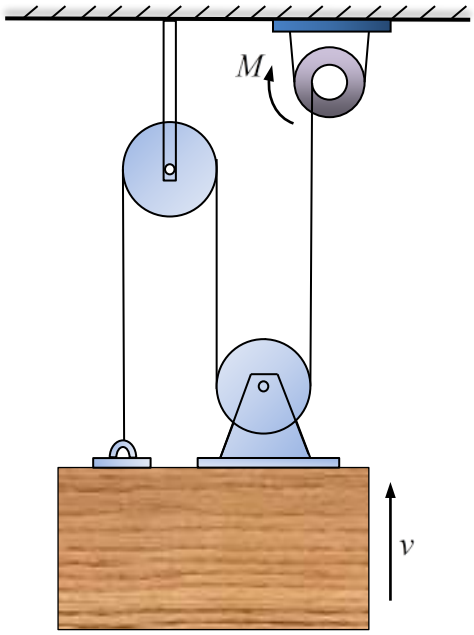
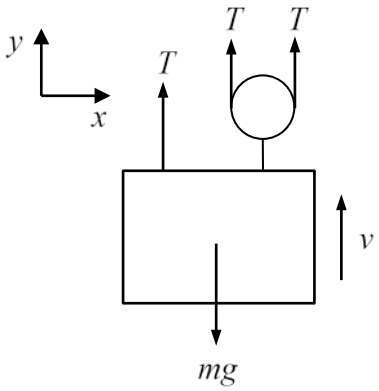
2-8. The block starts from rest and travels upward with a constant acceleration of $a = 2$ m/s^2. If the mass of the block follows a normal distribution $m \sim N(600, 20^2)$ kg, determine the distribution of power output of the motor M when $t = 5$ s. Neglect the mass of the pulleys and cable.



Solution



$$\Sigma F_y = ma_y : \; 3T - mg = ma_c$$

$$T = \left(\frac{g + a}{3} \right) m$$

And the velocity of the motor

$$v_M = 3v = 3at$$

$$P = T \cdot v_M = \left(\frac{g+a}{3} \right) m \cdot 3at$$
$$= (g+a)at \cdot m$$

Thus

$$\mu_P = (g+a)at \cdot \mu_m$$
$$\sigma_P = (g+a)at \cdot \sigma_m$$

When $t = 5$ s

$$\mu_P = 70.86 \text{ kW}$$
$$\sigma_P = 2.36 \text{ kW}$$

Therefore, $P \sim N(70.86, 2.36^2)$ kW. **Ans.**