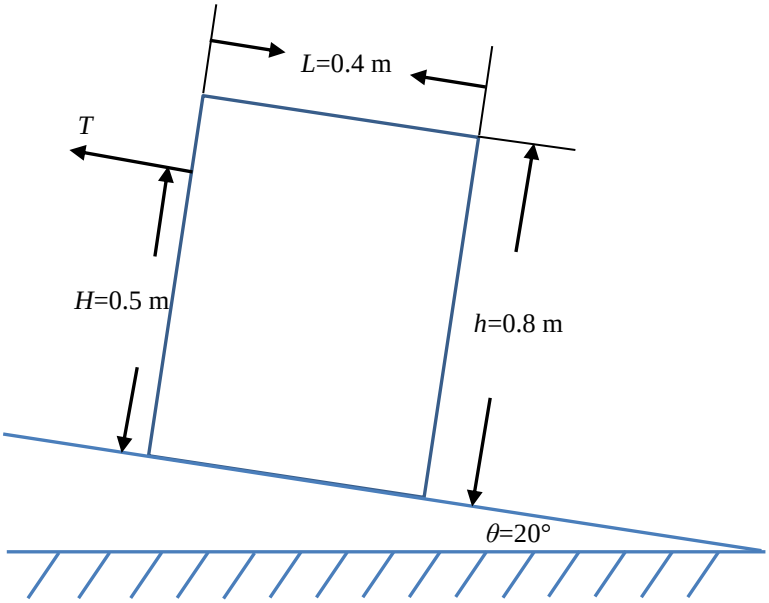
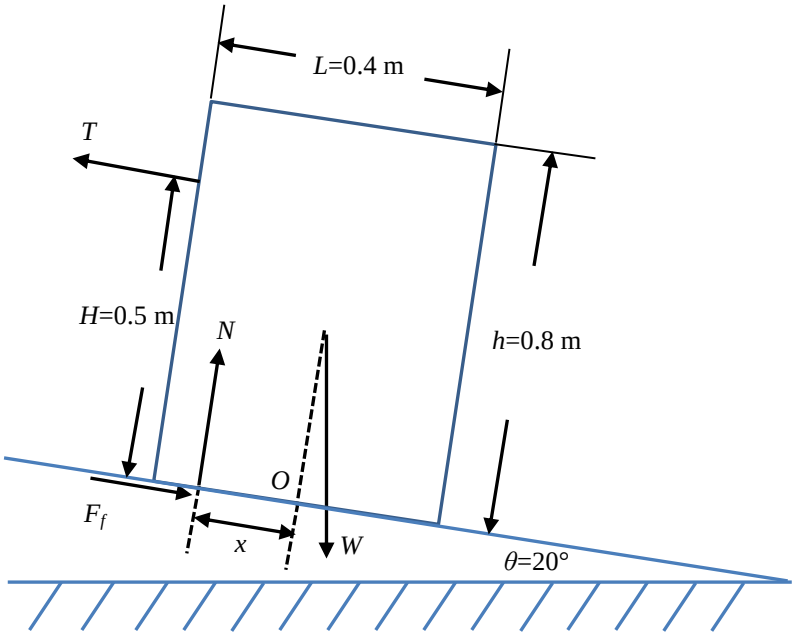
12. A 4 kg block *A* rests on the surface of a slant. The static coefficient of friction between the block and slant is $\mu_s = 0.3$. If an external force $T \sim N(25, 0.1^2)$ N is applied to pull the block, determine the probability that the block *A* may tip.



Solution



$$\sum M_O = 0; \quad T(H) = N(x) + mg(\frac{h}{2})\sin\theta = x(mg\cos\theta) + mg(\frac{h}{2})\sin\theta$$

Solve the above equation, we obtain

$$x = \frac{TH - mg(\frac{h}{2})\sin\theta}{mg\cos\theta}$$

Therefore

$$\mu_x = \frac{\mu_T H - mg(\frac{h}{2})\sin\theta}{mg\cos\theta} = 0.1934 \text{ m}$$

$$\sigma_x = \frac{\sigma_T H}{mg\cos\theta} = 0.0027$$

$$x \sim N(0.1934, 0.0027^2) \text{ m}$$

The probability that the block may tip is

$$x > L/2$$

Thus, we can construct function Y and the block might tip over when $Y>0$, where

$$Y = x - L/2$$

$$\mu_Y = \mu_x - L/2 = -6.6\times10^{-3} \text{ m}$$

$$\sigma_Y = \sigma_x = 0.0027$$

Finally, we can obtain

$$P(Y \geq 0) = 1 - P(Y < 0) = \Phi(\frac{6.6}{2.7}) = 0.75\%$$ **Ans**.