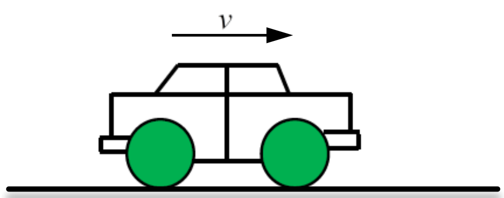
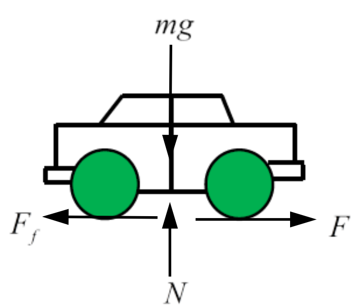
2-34. A car can accelerate uniformly on a straight-line road from 5 m/s to 20 m/s during 10 seconds. Then the car is assumed to travel with a constant velocity. The car is subjected to a normally distributed friction force $F_f \sim N(4000, 400^2)$ N . If the mass of the car is $m \sim N(2000, 10^2)$ kg , determine the maximum power supplied. Assume F_f and m are independent.





$$a = \frac{\Delta v}{\Delta t} = \frac{20-5}{10} = 1.5 \text{ m/s}^2$$

$$(+\rightarrow)\ \Sigma F_x = ma_x;\ F - F_f = ma$$

$$F = F_f + ma$$

$$P_{\max} = Fv_{\max} = (F_f + ma)v_{\max}$$

$$\mu_{P_{\max}} = (\mu_{F_f} + \mu_m a)v_{\max} = \left(4000 + 2000(1.5)\right)(20) = 140\,\text{kW}$$

$$\sigma_P = v_{\max}\sqrt{\left(\sigma_{F_f}\right)^2 + \left(\sigma_m a\right)^2} = 20\sqrt{(400)^2 + \left(10(1.5)\right)^2} = 8\text{ kW}$$

Therefore, $P_{\max} \sim N(140, 8^2)$ kW. **Ans.**