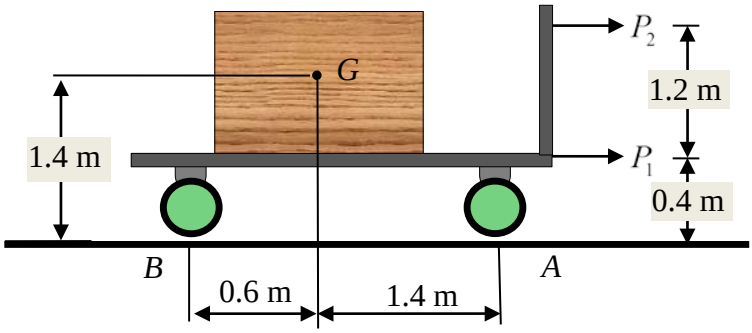
4-7. Two independently and normally distributed horizontal forces $P_1 \sim N(1000, 10^2)$ N and $P_2 \sim N(500, 5^2)$ N are applied to a cart. The total mass of the cart, including the load, is $m = 200$ kg. Find the acceleration of the cart and the normal forces acting on the wheels at points *A* and *B*. Assume the floor is smooth.



$$\Sigma F_x = m(a_G)_x$$

$$a_x = \frac{P_1 + P_2}{m}$$

$$\Sigma M_A = mg(1.4) - P_1(0.4) - P_2(1.6) - N_B(2) = -ma_x(1.4)$$

$$N_B = 0.7mg + 0.5P_1 - 0.1P_2$$

$$\Sigma F_y = m(a_G)_y$$

$$N_A + N_B - mg = 0$$

$$N_A = mg - N_B = 0.3mg - 0.5P_1 + 0.1P_2$$

$$\mu_{a_x} = \frac{\mu_{P_1} + \mu_{P_2}}{m} = 7.5 \text{ m/s}^2$$

$$\sigma_{a_x} = \frac{1}{m}\sqrt{\sigma_{P_1}^2 + \sigma_{P_2}^2} = 0.06 \text{ m/s}^2$$

$$\mu_{N_B} = 0.7mg + 0.5\mu_{P_1} - 0.1\mu_{P_2} = 1823.4 \text{ N}$$

$$\sigma_{N_B} = \sqrt{(0.5\sigma_{P_1})^2 + (-0.1\sigma_{P_2})^2} = 5.02 \text{ N}$$

$$\mu_{N_A} = 0.3mg - 0.5\mu_{P_1} + 0.1\mu_{P_2} = 138.6 \text{ N}$$

$$\sigma_{N_A} = \sqrt{(-0.5\sigma_{P_1})^2 + (0.1\sigma_{P_2})^2} = 5.02 \text{ N}$$

Therefore, $a_x \sim N(7.5, 0.06^2)$ m/s^2, $N_B \sim N\left(1823.4, 5.02^2\right)$ N, $N_A \sim N\left(138.6, 5.02^2\right)$ N. **Ans.**