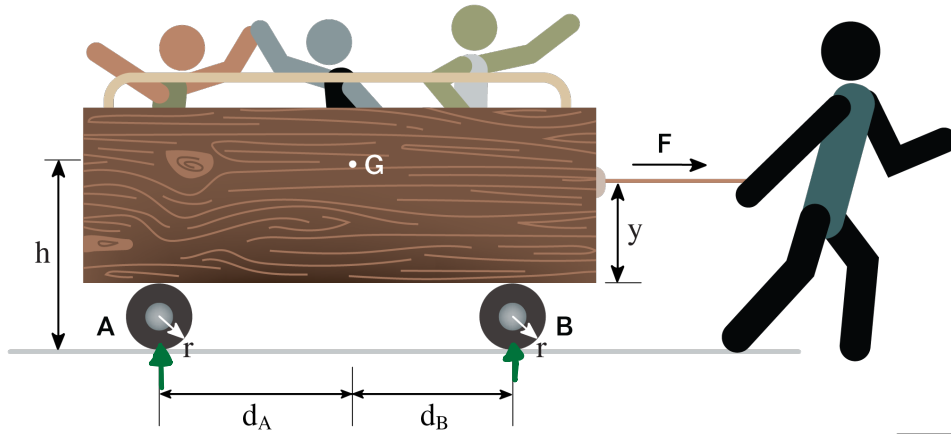


You are forced to pull a group of kindergarteners in a cart. If you apply a horizontal force of $F = 600 \text{ N}$, determine the normal force on its wheels. The cart has a total mass of $m = 160 \text{ kg}$ and has a center of mass at G . Assume the wheels have negligible mass. Wheel A has a radius of 0.2 m and is a horizontal distance of $d_A = 0.89 \text{ m}$ from G .

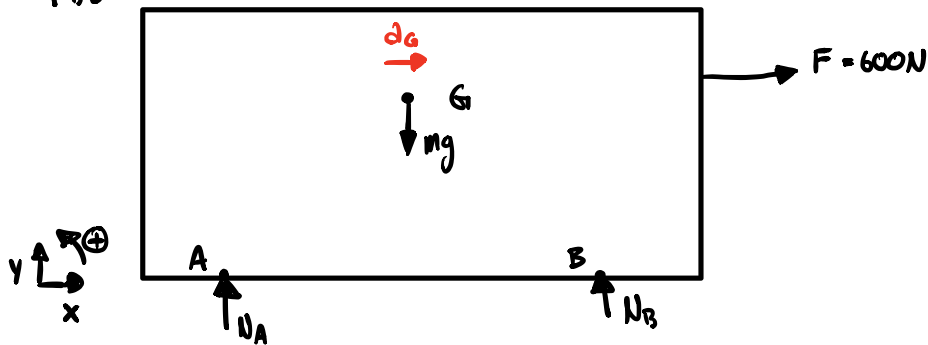
Wheel B has a radius of 0.2 m and is a horizontal distance of $d_B = 0.39 \text{ m}$ from G . You apply the horizontal force at a height $y = 0.5 \text{ m}$ from the bottom of the cart.

The center of gravity of G is located at a height $h = 1.1 \text{ m}$ from the ground.



① Diagram

FBD



$$\sum F_x = m a \quad \Rightarrow \quad m d_{Gx} = F \quad \Rightarrow \quad (160 \text{ kg}) d_{Gx} = 600 \text{ N}$$

$$\hookrightarrow d_G = 3.75 \text{ m/s}^2$$

$$\sum F_y = 0 \quad \Rightarrow \quad N_A + N_B - mg = 0 \quad \Rightarrow \quad N_A + N_B - (160 \text{ kg})(9.81 \text{ m/s}^2) = 0$$

$$\sum M_A = m a d \Rightarrow -m g h = -m g d_A + N_B (d_A + d_B) - F(y + 2r)$$

$$\Rightarrow (-160 \text{ kg})(3.75 \text{ m/s}^2)(1.1 \text{ m}) = -(160 \text{ kg})(9.81 \text{ m/s}^2)(0.89 \text{ m}) \\ + N_B (1.28 \text{ m}) - (600 \text{ N})(0.9 \text{ m})$$

$$\hookrightarrow \boxed{N_B = 997.6 \text{ N}}$$

$$\hookrightarrow \boxed{N_A = 572 \text{ N}}$$