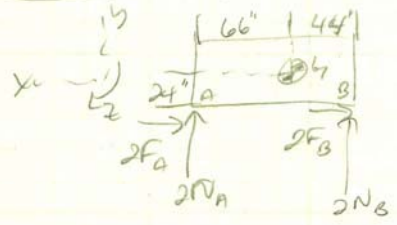
Rigid-Body Translation: Exercise

The ***3200-lb*** rear-engine car is traveling forward at a constant velocity when the brakes lock up all four wheels. The coefficient of kinetic friction is 0.8 between the tire and the road.

Ex. Rear-engine



① $\Sigma F_x = m a_{Gx}$ $\quad -2F_A - 2F_B = \frac{3200}{32.2} a_{Gx}$

② $\Sigma F_y = m a_{Gy}^{\,0}$ $\quad 2N_A + 2N_B - 3200 = 0$

$\Sigma M_G = I_G \alpha^{\,0}$ $\quad -(2F_A + 2F_B)24 + 2N_A(66) - 2N_B(44) = 0$

before skid: $F_A = F_B = 0$ So from ①: $a_{Gx} = 0$ ft/s²

② $2N_A + 2N_B - 3200 = 0$

$+$ ③ $[2N_A(66) - 2N_B(44) = 0]\ \frac{1}{44}$

$(2+3)N_A - 3200 = 0$

$N_A = 640$ lb $\quad 40\%$

② $2(640) + 2N_B - 3200 = 0$

$2N_B = 1920$

$N_B = 960$ lb $\quad 60\%$

during skid: ④ $F_A = \mu N_A = 0.8N_A$ $\quad$ ⑤ $F_B = \mu N_B = 0.8N_B$

① $-2(0.8N_A) - 2(0.8N_B) - \frac{3200}{32.2} a_{Gx} = 0$

② $2N_A + 2N_B - 3200 = 0$

3 eqs, 3 unknowns

③ $[-2(0.8N_A)24 + 2N_A(66)] + [-2(0.8N_B)24 - 2(0.8N_B)(44)] = 0$

(-38.4, 132, -38.4, -88)

② $2N_A + 2N_B - 3200 = 0$

$+$ ③ $[93.6N_A - 126.4N_B = 0]\ \frac{2}{126.4}$

$(2 + 1.48)N_A - 3200 = 0$

$N_A = 919$ lb $\quad 57.4\%$.

② $2(919) + 2N_B - 3200 = 0$

$2N_B = 1362$

$N_B = 681$ lb $\quad 42.6\%$