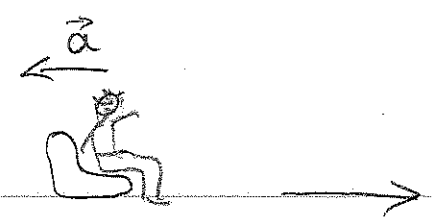
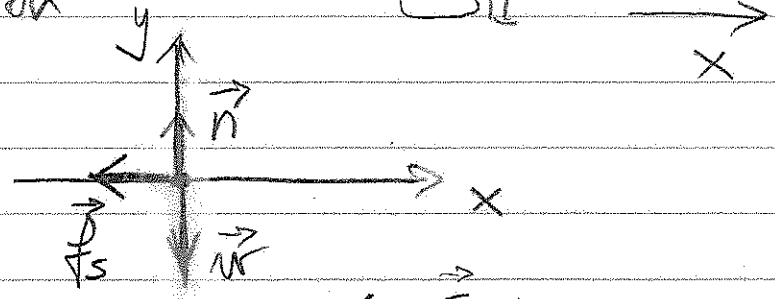
Car Seat Friction



① Identify all forces on passenger



② Determine net force

$$\Sigma F_x = n_x + w_x + (f_s)_x = (f_s)_x$$
$$\Sigma F_y = n_y + w_y + (f_s)_y = n - w = 0$$
$$\Rightarrow n = w$$

③ Determine acceleration of the car to establish whether static friction force is sufficiently large to keep passenger in the seat

$$\Sigma F_x = (f_s)_x \overset{\text{magnitude is}}{\leq} \mu_s n = \mu_s mg \overset{?}{\geq} m a_x$$

a_x from kinematics

$$(v_x)_f^2 = (v_x)_i^2 + 2 a_x \Delta x$$
$$\Rightarrow a_x = \frac{(v_x)_f^2 - (v_x)_i^2}{2\Delta x}$$

$$= \frac{0 - (20\ m/s)^2}{2(50\ m)} = -4\ m/s^2$$

is static friction large enough in magnitude?

$$\mu_s g \geq a_x \ ?$$

$$0.5\ (9.80\ m/s^2) = 4.90\ m/s^2 \geq 4\ m/s^2$$

(YES) static friction large enough