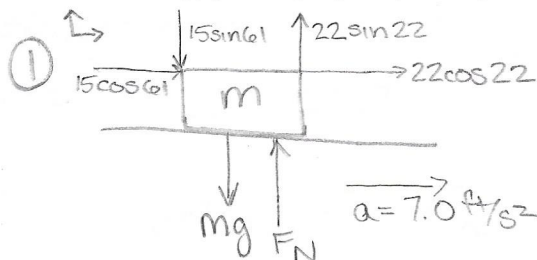


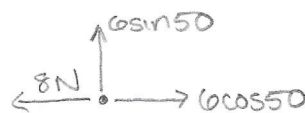
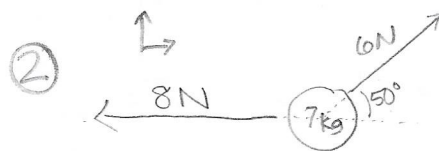
DYNAMICS WITH FRICTION WORKSHEET

KEY



$$\Sigma F_x = ma_x : 15 \cos 61 + 22 \cos 22 = m(7)$$

$$m = 3.95 \text{ slugs}$$

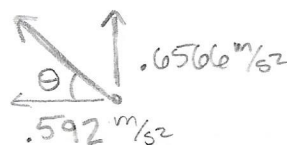


$$\Sigma F_x = ma_x : 6 \cos 50 - 8 = 7a_x$$

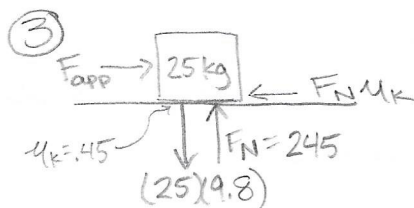
$$a_x = -.592 \text{ m/s}^2$$

$$\Sigma F_y = ma_y : 6 \sin 50 = 7a_y$$

$$a_y = .6566 \text{ m/s}^2$$



$$a = \sqrt{(.592)^2 + (.6566)^2} = .884 \text{ m/s}^2 \text{ at } \theta = \tan^{-1}(\frac{.6566}{.592}) = 48^\circ \text{ above the dir. of 8N}$$

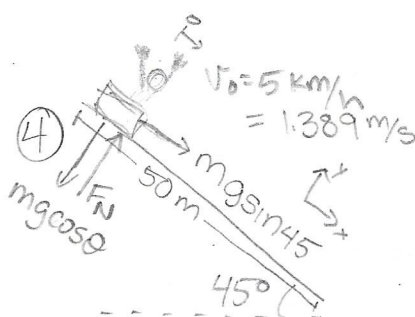


Steady speed $\Sigma F_x = 0$, so...

$$F_{app} - F_N \mu_k = 0$$

$$F_{app} = (245)(.45) = 110.25 \text{ N}$$

If μ_k is 0 and crate is already moving then no force is required. If it is not moving you would need to apply a force greater than $F_N \mu_s$, where μ_s is the coefficient of static friction. After you get it moving by overcoming the force of static friction, no additional force would be required.



$$\Sigma F_x = ma_x$$

$$mg \sin 45 = ma_x$$

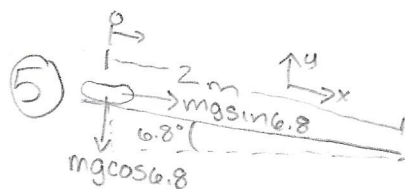
$$a_x = g \sin 45$$

Recall Big 4!

$$v^2 - v_0^2 = 2a(x - x_0)$$

$$v^2 - (1.389)^2 = 2(9.8) \sin 45 (50)$$

$$v = 26.4 \text{ m/s}$$



$$\Sigma F_x = ma_x : mg \sin 6.8 = ma_x$$

$$a_x = (9.8)(\sin 6.8)$$

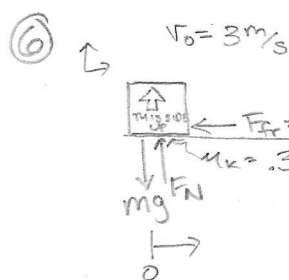
$$a_x = 1.16 \text{ m/s}^2$$

Recall Big 4!

$$x = x_0 + v_0 t + \frac{1}{2} a t^2$$

$$2 = \frac{1}{2} (1.16) t^2$$

$$t = 1.86 \text{ sec}$$



$$\Sigma F_x = ma_x : -\mu_k F_N = ma_x \Rightarrow -(.3)(mg) = ma_x$$

$$\Sigma F_y = ma_y = 0 : F_N = mg$$

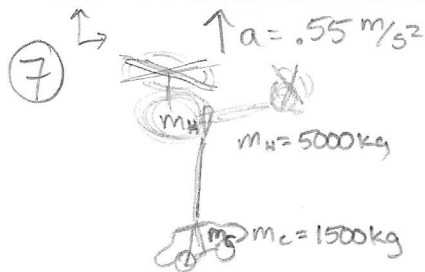
$$a_x = -(.3)(9.8)$$

$$a_x = -2.94 \text{ m/s}^2$$

Recall Big 4!

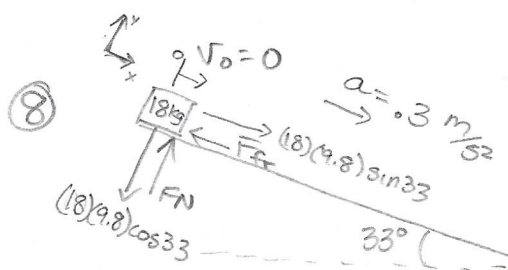
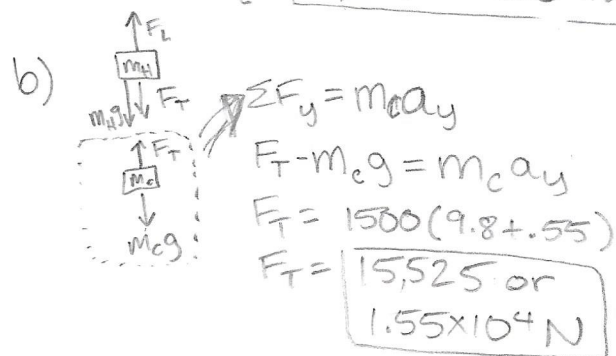
$$v^2 - v_0^2 = 2a(x - x_0)$$

$$0 - (3)^2 = 2(-2.94)(x) \Rightarrow x = 1.53 \text{ m}$$



$$\sum F_y = ma_y : F_L - (6500)(9.8) = (6500)(.55)$$

$$F_L = \boxed{67,275 \text{ or } 6.73 \times 10^4 \text{ N}}$$



$$\sum F_x = ma_x : (18)(9.8) \sin 33 - F_{fr} = 18(.3)$$

$$\sum F_y = ma_y = 0$$

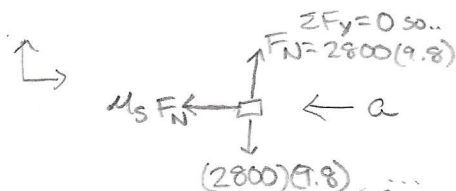
$$F_N = (18)(9.8)(\cos 33)$$

$$\boxed{F_{fr} = 90.7 \text{ N}}$$

$$F_{fr} = \mu_k F_N$$

$$90.7 = \mu_k (18)(9.8) \cos 33$$

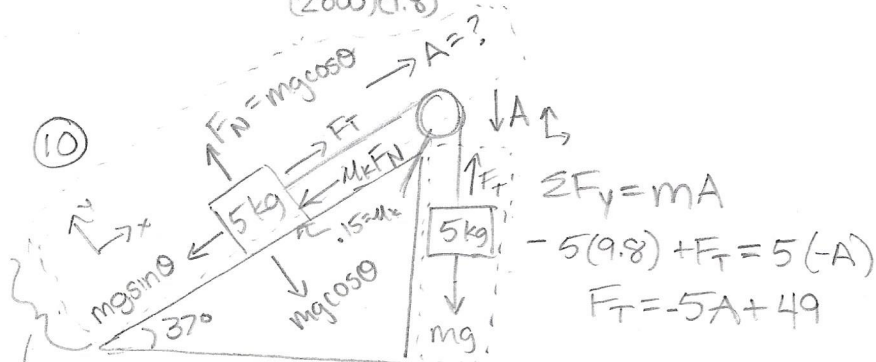
$$\boxed{\mu_k = .613}$$



$$\sum F_x = ma_x : -\mu_s F_N = m_B a_x$$

$$-(.55)(2800)(9.8) = 2800(-a_x)$$

$$\boxed{5.39 \text{ m/s}^2}$$



$$\sum F_y = mA$$

$$-5(9.8) + F_T = 5(-A)$$

$$F_T = -5A + 49$$

$$\sum F_x = mA : F_T - \mu_k F_N - mg \sin 37 = mA$$

$$-5A + 49 - (.15)(49) \cos 37 - 49 \sin 37 = 5A$$

$$13.641 = 10A \Rightarrow A = \boxed{1.37 \text{ m/s}^2}$$