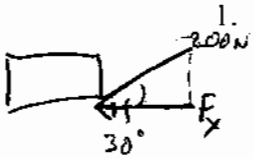
Final Review 2

1. A 20 kg wagon is pushed on a handle held at 30° with 200 N of force. If the force is applied for 3s what would be the speed of the wagon?

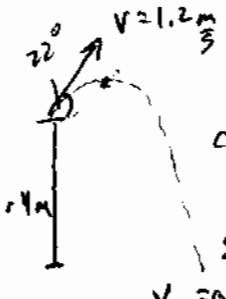


$\cos 30 = \frac{F_x}{200N}$ $\quad F_x = 173N$ $\quad Ft = mv$ $\quad 173(3s) = 20kg\,v$ $\quad v = 26\frac{m}{s}$ $\quad 2.6\times10^{1}\frac{m}{s}$

a. The wagon stops due to friction in 20 m. How long would this take?

$v_i = 51.9\frac{m}{s}$ $\quad v_f = 0$ $\quad d = 20m$ $\quad v^2 = v_i^2 + 2ad$ $\quad 0 = (26)^2 + 2a\,20m$ $\quad a = -16.9\frac{m}{s^2}$ $\quad v_f = v_i + at$ $\quad 0 = 26\frac{m}{s} + -16.9\frac{m}{s^2}t$ $\quad t = 1.54s$

2. A flee (0.01kg) jumps off a dog which is 0.4 m tall with a speed of 1.2 m/s. The flee jumps at an angle of 22°. How far from the dog does the flee land?



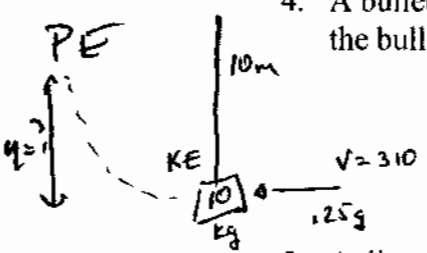
$\cos 22 = \frac{v_x}{1.2}$ $\quad v_x = 1.1$ $\quad \sin 22 = \frac{v_y}{1.2}$ $\quad v_y = 0.45\frac{m}{s}$ $\quad v^2 = v_i^2 + 2ad$ $\quad 0 = (0.45)^2 + 2(-9.8)d$ $\quad d = 0.01$ $\quad v = v_i + gt$ $\quad 0 = .45 + 9.8t$ $\quad t_1 = 0.0459s$ $\quad y = .4 + .01$ $\quad y = .41m$ $\quad y = v_{yi}t + \frac{1}{2}gt^2$ $\quad .41 = 0 + \frac{1}{2}(9.8)t^2$ $\quad t_2 = 0.289s$ $\quad x = x_v + x_0$ $\quad = (0.0459)1.1 + (0.289)1.1$ $\quad x = 3.68\times10^{-1}m$

3. A sliding box with a starting speed of 3 m/s stops in 10 m. If the box is 2 kg what would be the coefficient of friction?

$F_{NET} = F_m - F_{fr}$ $\quad F_{Net} = -F_{fr}$ $\quad ma = -\mu mg$ $\quad 2(-0.45) = -\mu(2)(9.8)$ $\quad \mu = 4.59\times10^{-2}$

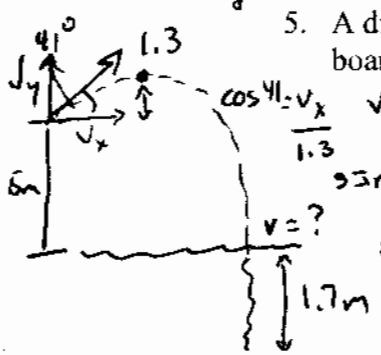
$v_i = 3\frac{m}{s}$ $\quad v_f = 0$ $\quad d = 10m$ $\quad v^2 = v_i^2 + 2ad$ $\quad 0 = (3)^2 + 2a\,10$ $\quad a = -0.45\frac{m}{s^2}$

4. A bullet (25 g) moving at 310 m/s hits a 10 kg box hanging on a 10 m rope. If the bullet stays in the box, how high will the box swing?



$m_1v_1 + m_2v_2 = v(m_1+m_2)$ $\quad (.025)310 + 10(0) = v(10 + .025)$ $\quad 7.75 = v(10.025)$ $\quad v_x = 0.773\frac{m}{s}$ $\quad KE = PE$ $\quad \frac{1}{2}mv^2 = mgh$ $\quad \frac{1}{2}(0.773)^2 = 9.8h$ $\quad h = 0.0305m$ $\quad 3.05\times10^{-2}m$

5. A diver, 60 kg, jumps off a diving board at 41° with a speed of 1.3 m/s. If the board is 5 m high what will be the speed of the diver when he hits the water.



$\cos 41 = \frac{v_x}{1.3}$ $\quad v_x = 0.981\frac{m}{s}$ $\quad \sin 41 = \frac{v_y}{1.3}$ $\quad v_y = 0.853\frac{m}{s}$ $\quad v_y^2 = v_{yi}^2 + 2ad$ $\quad 0 = (0.853)^2 + 2(9.8)d$ $\quad d = 0.0371m$ $\quad y_T = 5 + 0.037 = 5.037$ $\quad 5.04m$ $\quad v^2 = v_i^2 + 2ad$ $\quad v^2 = 0 + 2(9.8)(5.04)$ $\quad v = 9.94\frac{m}{s}$

a. If the diver stops in the water 1.7 m below the surface, what was the deceleration of the diver?

$v^2 = v_i^2 + 2ad$

$0 = (9.94)^2 + 2a\,1.7m$

$= 29.1 = 2.91\times10^{1}\frac{m}{s^2}$