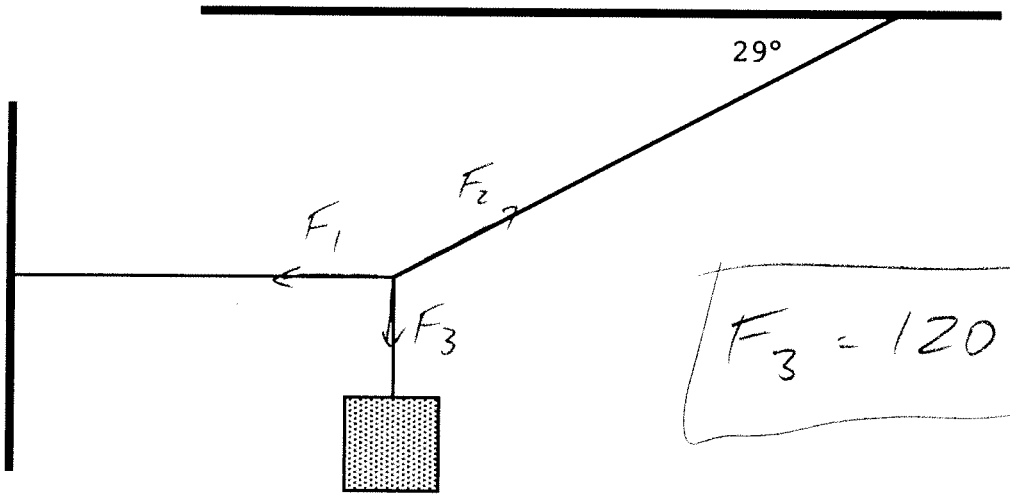
Physics 10154 - Exam #2c

Partial credit will be given provided you show all work and are solving parts of the problem correctly. Points will be deducted if you don't show your work (or if some parts are incorrect) even if you get the right answer. Clearly indicate your answer with a circle or box and remember to include correct units and significant figures.

1. (30 pts) A 120 Newton crate hangs vertically from a support line as shown below. The rope on the left is horizontal, and the rope on the right makes a 29° angle with the horizontal ceiling. What is the tension in each rope?



$F_3 = 120\ N$

$\Sigma F_x = -F_1 + F_2 \cos 29 = 0$

$\Sigma F_y = F_2 \sin 29 - F_3 = 0$

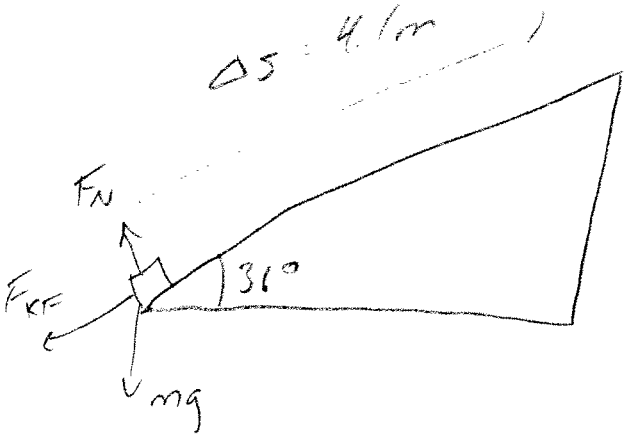
$F_2 = \frac{F_3}{\sin 29} = \frac{120}{\sin 29} = 247.5$

$F_1 = F_2 \cos 29 = 247.5 \cos 29 = 216.5$

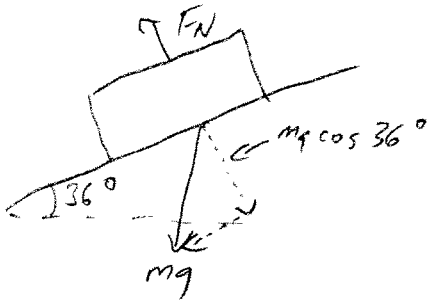
$F_1 = 220\ N \leftarrow$

$F_2 = 250\ N$ ↗

2. (40 pts) A puck of unknown mass is given an initial speed of 8.5 m/s and it slides up a ramp inclined 36° above the horizontal. The puck slides 4.1 meters up the ramp before coming to a stop. What is the coefficient of kinetic friction between the puck and the ramp?



$h = 4.1 \sin 36^\circ = 2.41$



$W_N = 0$

$W_{grav} = -mgh = -(m)(9.8)(2.41) = -23.6m$

$W_{KF} = -\mu_K F_N \Delta s$

$= -\mu_K mg\cos 36^\circ \Delta s$

$= -\mu_K m(9.8)\cos 36^\circ (4.1) = -32.5\mu_K m$

$0 - 23.6m - 32.5\mu_K m = 0 - \frac{1}{2}mv_0^2$

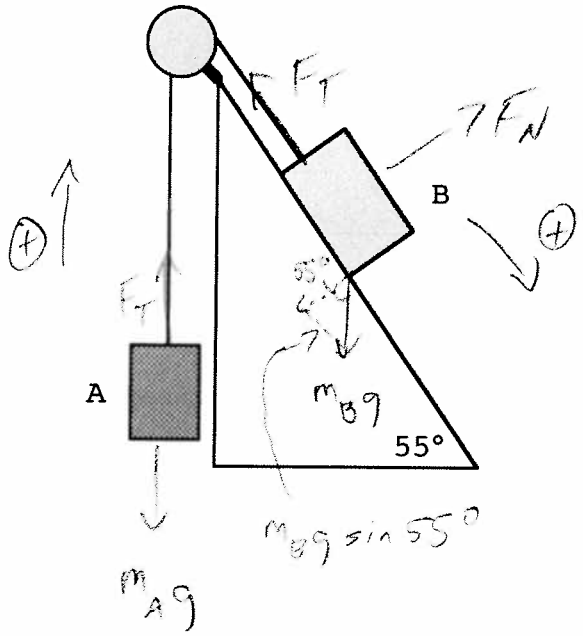
$-23.6 - 32.5\mu_K = 0 - \frac{1}{2}(8.5)^2$

$-32.5\mu_K = -36.1 + 23.6$

$-32.5\mu_K = -12.5$

$\boxed{\mu_K = 0.39}$

3. (30 pts) Below, two masses are connected by a light, frictionless pulley. The inclined surface is frictionless. Mass A is 13 kg, and mass B is 26 kg. When the system is released from rest, how many seconds elapses before mass B slides a total of 1.5 meters down the ramp?



$m_A : \Sigma F_y = F_T - m_A g = m_A a$

$m_B : \Sigma F_{\parallel} = -F_T + m_B g \sin 55° = m_B a$

$-(m_A a + m_A g) + m_B g \sin 55° = m_B a$

$-m_A g + m_B g \sin 55° = (m_A + m_B) a$

$-127.4 + 208.7 = 39a$

$a = 2.085 \ m/s^2$

$\Delta s = 1.5$
$v_0 = 0$
$v = ?$
$a = 2.085$
$t = ?$

$\Delta s = v_0 t + \frac{1}{2} a t^2$

$1.5 = 0 + \frac{1}{2}(2.085) t^2$

$t = \sqrt{\frac{3.0}{2.085}} = \boxed{1.2 \ s}$