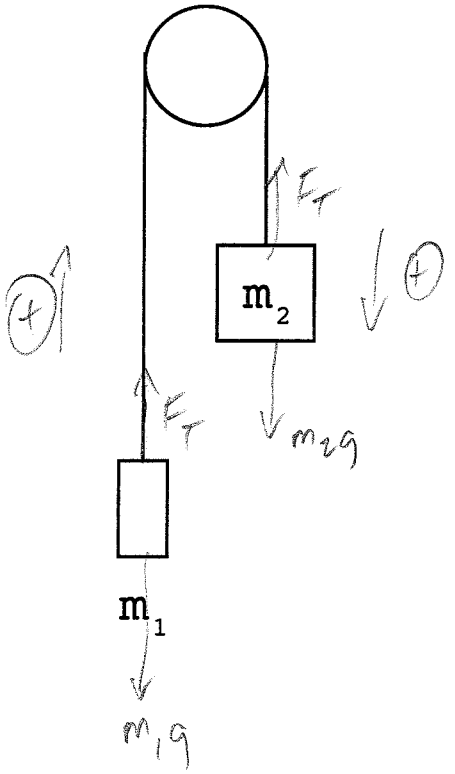
Physics 10154 - Exam #4A

Answer the following two questions. Be sure to clearly indicate your answer with a circle or box. Show all work. If I cannot see how you arrived at an answer, I will deduct points!

1. Two masses are connected by a massless string over a pulley as shown below. Mass m_2 is 2.0 meters above ground level. Both masses start at rest. m_1 = 1.0 kg. m_2 = 2.0 kg.

How long (in seconds) does it take m_2 to hit the ground?



m_1: $\Sigma F_y = F_T - m_1 g = m_1 a$

m_2: $\Sigma F_y = m_2 g - F_T = m_2 a$

From m_1: $F_T = m_1 a + m_1 g$

$m_2 g - m_1 a - m_1 g = m_2 a$

$(m_2 - m_1) g = (m_1 + m_2) a$

$$a = \frac{m_2 - m_1}{m_1 + m_2} g$$

$$= \frac{1}{3} g = 3.3\ m/s^2$$

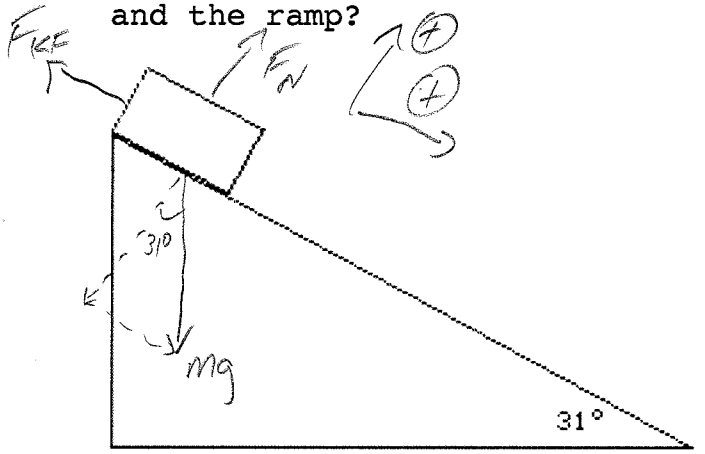
$\Delta y = +2.0$
$v_0 = 0$
$v = ?$
$a = +3.3\ m/s^2$
$t = ?$

$2.0 = 0t + 1.65t^2$

$t = 1.1$ sec

2. A 5.0 kg block is at the top of a 4.0 meter long ramp. Starting from rest, the block slides down the ramp and reaches the bottom in 2.0 seconds.

What is the coefficient of kinetic friction between the block and the ramp?



Motion on ramp:

$\Delta s = 4.0\,m$

$V_0 = 0$

$V = ?$

$a = ?$

$t = 2.0$

$$4.0 = 0t + \tfrac{1}{2}at^2$$

$$4.0 = 2a \qquad a = 2.0\ m/s^2$$

$$\Sigma F_{\parallel} = mg\sin 31^\circ - \mu_k F_N = ma$$

$$\Sigma F_{\perp} = F_N - mg\cos 31^\circ = 0$$

$$F_N = mg\cos 31^\circ$$

$$mg\sin 31^\circ - \mu_k mg\cos 31^\circ = ma$$

$$mg\sin 31^\circ - ma = \mu_k mg\cos 31^\circ$$

$$\mu_k = \frac{mg\sin 31^\circ - ma}{mg\cos 31^\circ} = \frac{25.24 - 10}{42}$$

$$= \boxed{0.36}$$