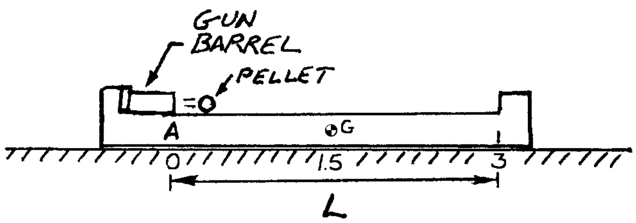
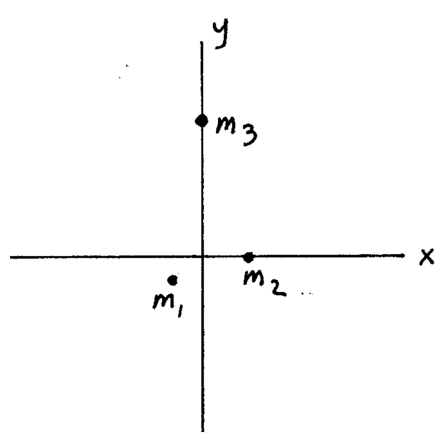
ME 104, 11/20/2002
University of California, Berkeley
Test Number Two

READ THIS! ⇒ Give answers to 3 significant digit precision. Remember to follow the hw format conventions. Explicitly state what you're solving for and how. Box your answers. Also, one word answers won't cut it. They'll get zero credit, whether correct or not. You have to convince me that you know what you're doing - that you're not just putting down a lucky guess. Make sure you adequately explain your reasoning. And please don't assume that the problem is harder than it seems. Sometimes I'm asking something simple and, if you can give me the correct answer without a lot of calculation, then do so and move on.

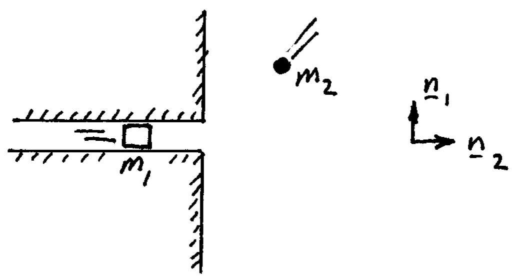
1. A pellet is fired to the right from the left end of a platform that's resting on a frictionless surface.A is located at the end of the barrel and initially is aligned with 0 position on the ground.The mass of the platform is 50 kg, the mass of the pellet is 0.4 kg, the linear impulse applied to the pellet is 4 N$\cdot$ s and $L = 3$ m. The platform's mass center, G, is located 1.5 m from A. What will the position of the point A be with respect to its initial position at $t = 5$ s? When will the pellet hit the right end of the platform? (linear momentum and applied impulse - 20 pts)



2. What is the angular momentum of the three illustrated masses about their mass center? Will the angular momentum about the mass center stay constant over time? $\underline{r}_{m_{1/O}} = (-2\underline{n}_1 - 3\underline{n}_2)$ m, $\underline{r}_{m_{2/O}} = 3\underline{n}_1$ m, $\underline{r}_{m_{3/O}} = 9\underline{n}_2$ m. $\underline{v}_{m_{1/O}} = (-1\underline{n}_1 - 1\underline{n}_2)$ m/s, $\underline{v}_{m_{2/O}} = 2\underline{n}_2$ m/s, $\underline{v}_{m_{3/O}} = 0.5\underline{n}_1$ m/s. (- 20 pts)



3. Every 10 seconds a rectangular block is ejected from a horizontal chute onto a frictionless surface. You decide to slide a mass along the surface so that it hits the block at the instant it reaches the end of the chute. Assume a coefficient of restitution $e = 0.7$. $m_1 = 1.2$ kg, $m_2 = 0.5$ kg, $\underline{v}_{m_1} = 10\underline{n}_1$ m/s, $\underline{v}_{m_2} = -10\underline{n}_1 - 10\underline{n}_2$ m/s. By what percentage will the kinetic energies of both the block and the mass be changed as a result of the collision? (oblique impact - 20 pts)



4. A snowmobile is shown below. The coefficient of friction between the front runner and the snow is 0.2. The snowmobile is traveling at 10 m/s and is accelerating at $\ddot{x} = 1.5$ m/s^2 and it has a mass of 150 kg. What is the power developed by the engine at this instant? Assume no drivetrain losses. $L = 1.1$ m, $h = 0.3$ m. (rigid body kinetics (translational) - 20 pts)