Physics 303 Quiz 5 Name SOLUTIONS

1. A projectile is aimed to as to land 200 m east of its launch point. The ground is flat. Ignore air resistance, Coriolis force, curvature of the earth, etc.

a. At some unspecified time during the flight, the projectile explodes apart into two equal masses. Both land at the same time. One mass lands 100 m east and 50 m north. Where does the other mass land?

300 m East,
50 m south

$$\frac{m_1 x_1 + m_2 x_2}{m_1 + m_2} = 200 \text{ m. for } x \qquad m_1 = m_2.$$

0 m for y.

b. Suppose the pieces have unequal mass, and the piece describe above is twice as massive as the other piece. (They still land at the same time.) Where does the other piece land?

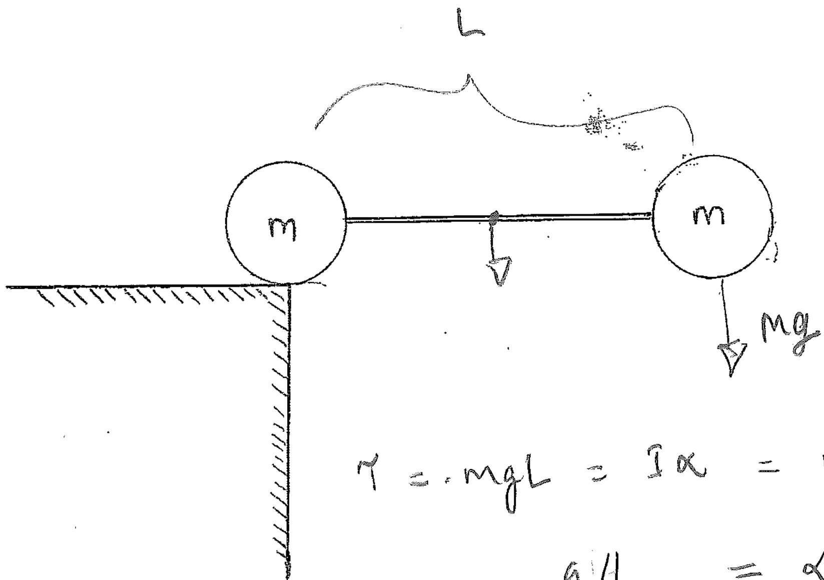
$$\frac{2m \cdot 100 + m \cdot x}{3m} = 200$$

$200 + x = 600 \qquad x = 400.$ m East

$$\frac{2m \cdot 50 + m y}{3m} = 0 \qquad y = -100 \text{ m} = 100 \text{ m South}$$

-OVER-

2. Two masses m are connected by a massless rod to make a dumbbell. The centers of the masses are a distance L apart. The dumbbell is held horizontally, with one mass on the edge of a table, and then released. Find the force exerted by the table on the left mass at the instant of release. You may treat the masses as point particles. Your answer *may* contain m, g, L.



$$\tau = mgL = I\alpha = mL^2\alpha$$

$$g/L = \alpha$$

$$a_{cm} = \alpha \frac{L}{2} = \frac{g}{2}$$

$$F = Ma = 2m \cdot \frac{g}{2} = mg$$

$$= 2mg - F_n$$

$$\boxed{F_n = mg}$$