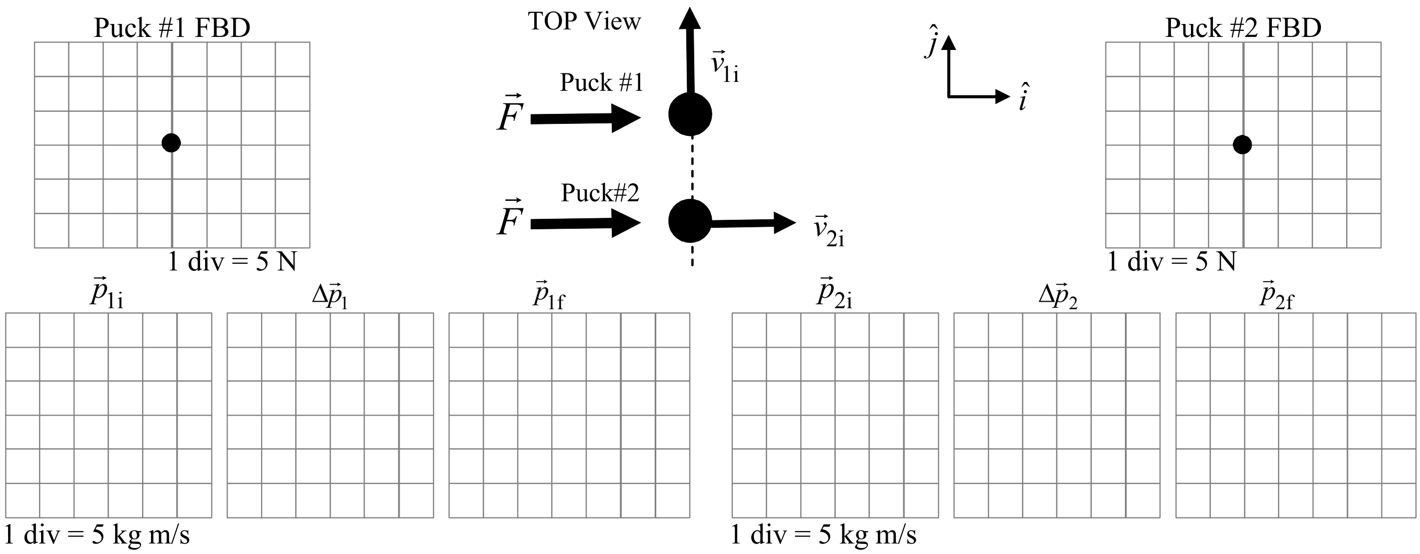
Name: ______________________________ *Recitation #8: Energy & Momentum II*

1. At time t = 0 s, two pucks sitting on a frictionless, horizontal table are each pushed by a hand force $\vec{F} = (10\hat{i})$ N. Puck #1 (2.5 kg) has an **initial velocity** $\vec{v}_{1i} = (6\hat{j})$ m/s and puck #2 (2.5 kg) has an **initial velocity** $\vec{v}_{2i} = (6\hat{i})$ m/s. Both pucks are pushed for **Δt =2 s** before the force is stopped. Draw the **free body diagrams** for the pucks using the two subscript notation. Only draw forces in the *x*-*y* plane of the table.



a. Find the **initial momenta** $\vec{p}_i$ for both pucks and draw them above.

b. Find the **change in momenta** $\Delta\vec{p}$ for both pucks and draw them above. Remember $\Delta\vec{p} = \vec{I} = \vec{F}_{net}\Delta t$.

c. Using the vector diagrams above, draw the **final momenta** $\vec{p}_f$ for both pucks.

d. Find the **initial kinetic energies** K_i of both pucks. Remember $K = \frac{m}{2}(v_x^2 + v_y^2) = \frac{1}{2m}(p_x^2 + p_y^2)$.

K_{1i} =

K_{2i} =

e. Find the **final kinetic energies** K_f of both pucks.

K_{1f} =

K_{2f} =

f. Find the **change in kinetic energies** ΔK of both pucks.

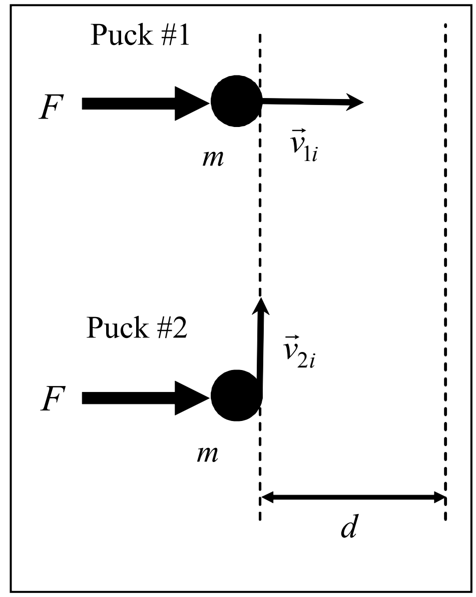
ΔK_1 =

ΔK_2 =

g. Find the **horizontal distances** $\boldsymbol{\Delta x}$ that each puck traveled in 2 s. Hint: Relate ΔK to the work done on each puck.

Δx_1 =

Δx_2 =



2. Puck #1 (mass m) and puck #2 (mass m) slide across a horizontal, frictionless table with **identical speeds**, but in **different directions**. The **same force *F*** is exerted on each puck as it travels from the first to the second dotted line.

a. At **time *t* = 0**, what is the relationship between the **initial kinetic energies** K_{1i} and K_{2i} for pucks #1 and #2? (i.e., $K_{1i} < K_{2i}$ OR $K_{1i} = K_{2i}$ OR $K_{1i} > K_{2i}$ OR insufficient information)

b. What is the relationship between the **work** W_1 and W_2 done on pucks #1 and #2 after they have traveled between the dotted lines?

c. What is the relationship between the **change in kinetic energies** ΔK_1 and ΔK_2 for pucks #1 and #2 after they have traveled between the dotted lines?

d. What is the relationship between the **final kinetic energies** K_{1f} and K_{2f} for pucks #1 and #2 at the moment each puck crosses the second dotted line?

e. What is the relationship between the **initial magnitudes** of the **momenta** p_{1i} and p_{2i} for pucks #1 and #2.

f. What is the relationship between the **magnitudes** of the **impulses** I_1 and I_2 exerted on pucks #1 and #2 at the moment each puck crosses the second dotted line?

g. What is the relationship between the **magnitudes** of the **change in momenta** Δp_1 and Δp_2 for pucks #1 and #2 at the moment each puck crosses the second dotted line?

h. What is the relationship between the **final magnitudes** of the **momenta** p_{1f} and p_{2f} for pucks #1 and #2 at the moment each puck crosses the second dotted line? Think before you answer - momentum is a vector.

i. At **ANY** given **time** when the pucks are between the dotted lines, what is the relationship between the **magnitudes** of the **momenta** p_1 and p_2 for pucks #1 and #2?