Assignment Set 1 - Read Unit 1 Ch. 1 thru Ch.3 - *Due Tue. Aug. 29, 2017*

Exercise 1 *Basic pool-shot kinetics*
Consider V_1 vs V_2 graphs for 1D-collisions between masses M_1 and M_2 described in Ch. 2 and Ch. 3.

Draw a graph of a collision with initial velocities $\mathbf{V}^{\text{IN}} = (V^{IN}_1 , V^{IN}_2) = (0.5, 0.0)$ for equal masses ($M_1 = 1 = M_2$).

For a totally inelastic *'ka-runch'* case derive final velocities $\mathbf{V}^{\text{FIN}} = (V^{FIN}_1 , V^{FIN}_2)$ from graph and plot KE ellipse†.
For a totally elastic *'ka-bong'* case do the same. Compare final kinetic energy KE values for the two cases.

† At the end of Ch.3 is shown an easy ellipse construction given ellipse radii a and b. This should not be necessary for Exercise 1 but will come in handy for Exercise 2 below as will attached graph paper.

Exercise 2 *Head-on collision kinetics*
The full V_1 vs V_2 graphs for 1D-collisions of masses M_1 and M_2 described in Ch. 2 and Ch. 3 is needed here.
Solve using tensor algebraic methods and compare results to a geometric solution on graph paper given below.

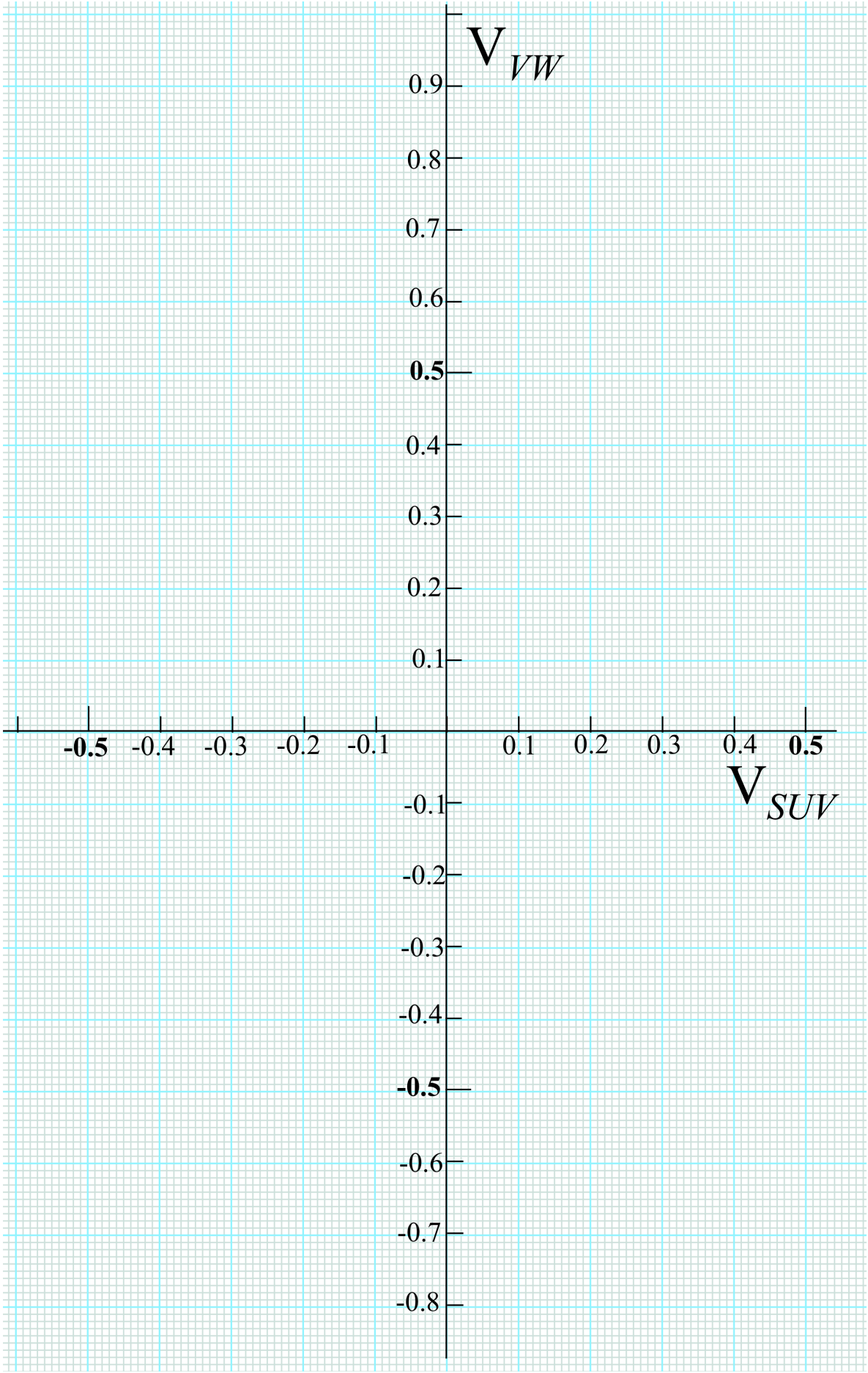
Analyze collisions for initial velocities $\mathbf{V}^{\text{IN}} = (V^{IN}_1 , V^{IN}_2) = (0.4, -0.2)$ for masses $M_1 = 5$ and $M_2 = 1$.
Derive final velocities $\mathbf{V}^{\text{FIN}} = (V^{FIN}_1 , V^{FIN}_2) = \mathbf{V}^{\text{COM}}$ for a totally inelastic *'ka-runch'* case.
Derive final velocities $\mathbf{V}^{\text{FIN}} = (V^{FIN}_1 , V^{FIN}_2)$ for totally elastic *'ka-bong'* case.
Derive *KE*=_____, *KE-ellipse* radii a_1=a_____, a_2=b=_____ for *ka-runch* case and construct its ellipse†.
Derive *KE*=_____, *KE-ellipse* radii a_1=a_____, a_2=b=_____ for *ka-bong* case and construct its ellipse†.

Derive *KE*=_____, *KE-ellipse* radii a_1=a_____, a_2=b=_____ for *ka-bong* case as viewed in COM frame.
Derive *KE*=_____, *KE-ellipse* radii a_1=a_____, a_2=b=_____ for *ka-runch* case as viewed in COM frame.

Construct resulting ellipse† for each case (if it exists).

Exercise 3 *Not-So-Head-on collision kinetics (Xtra credit)*

Analyze collisions for initial velocities $\mathbf{V}^{\text{IN}} = (V^{IN}_1 , V^{IN}_2) = (0.4, +0.2)$ for masses $M_1 = 5$ and $M_2 = 1$.
Do geometric solution on graph paper given below


V_{VW}
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
-0.1
-0.2
-0.3
-0.4
-0.5
-0.6
-0.7
-0.8
-0.5
-0.4
-0.3
-0.2
-0.1
0.1
0.2
0.3
0.4
0.5
V_{SUV}