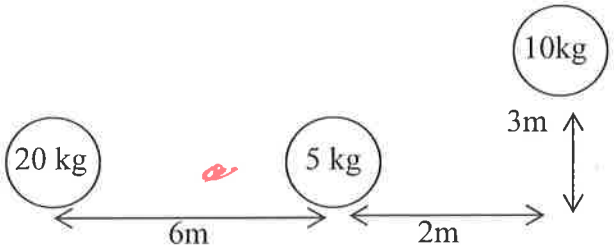
Center of Mass

1. Find the center of mass (relative to (0,0)) for the spheres with the following masses and locations : m1 = 5kg, (1,1) m2 = 10 kg, (3,1) m3 = 15kg, (1,6).

(1.67, 3.5)

2. Find the center of mass of the following particles (drawn large so they can be seen):



(3.17 m, 0.86 m)

3. An old go-kart with a mass of 300 kg is traveling in a straight line at 80 m/s. It is followed by a 4-wheeler with mass of 200 kg moving at 60 m/s. How fast is the center of mass moving?

$V_{com} = 72 \frac{m}{s}$

4. A 1500 kg VW is heading 40 m/s in a straight line. A 4000 kg Cadillac is heading directly for it at 60 m/s. Find the velocity (magnitude and direction) of the center of mass.

VW → + − ← Cadillac

$V_{com} = -32.7 \frac{m}{s}$

5. A 1500 kg car is at rest. At the instant it starts to move (with an acceleration of $3.5 m/s^2$), a truck (m= 3000kg) traveling at a constant speed of 12 m/s passes it. At t = 3 seconds:
   a. How far is the center of mass of the vehicles, relative to the starting point of the car?

29.25 m

   b. What is the speed of the center of mass of the vehicles?

11.5 m/s

6. A rock, of mass M, is dropped at t= 0 seconds. Two seconds later a stone, of mass 2M, is dropped. At t = 3 seconds (assume neither hits the ground):
   a. What is the center of mass of the rock and stone relative to the drop point?

17.97 m

   b. How fast is the center of mass going at this time?

16.3 m/s @ t = 3s

7. Calculate the Vcm before the collision and then calculate the Vcm after the collision. (Show all work for this problem)

Before collision:	Vo = 5 m/s	Vo = 0
After collision	Vf = 1 m/s	Vf = ?

$V_{com} = 1.43 \frac{m}{s}$