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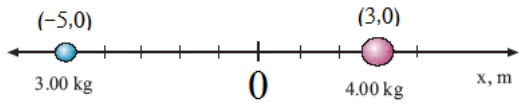
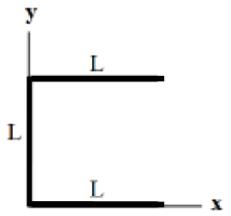
Chapter 9 "Center of mass and linear momentum"

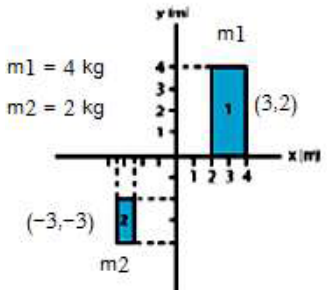
Q1. A 3.00 kg particle is located on the x axis at $x = -5.00$ m and a 4.00 kg particle is on the x axis at x = 3.00 m. Find the center of mass of this two–particle system. (x=-0.429 m)



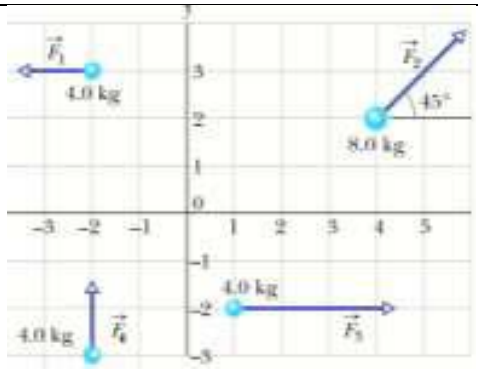
Q.1



Q.4



Q.2



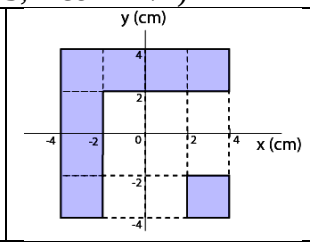
Q.3

Q2. The location of two thin flat objects of masses m_1= 4.0 kg and m_2 = 2.0 kg are shown in the figure, where the units are in m. The x and y coordinates of the center of mass of this system are: *Xcom=1m,Ycom=.33m*

Q.3 The four particles in Figure are initially at rest. Each experiences an external force. The directions are indicated, and the magnitudes are F_1 = 6.0 N, F_2 = 12 N, F_3 = 14 N, and F_4 = 6 N. In what direction does the center of mass move?(a com,x= 0.824 m/s*s, a com,y= 0.724 m/s*s, theta=41.3^0)

Q4.An object is formed by three identical uniform thin rods, each of length L and mass M, as shown in **Figure**. Determine the x and y coordinates, (x, y), of the center of mass of this object.(Xcom=L/3, Ycom=L/2)

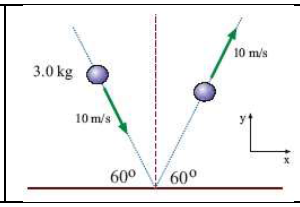
Q5: The two pieces of uniform sheets made of the same metal are placed in the x-y plane as shown in the figure. The center of mass (x_{com}, y_{com}) of this arrangement is? Ans: (-0.75, 0.75) cm



Q6. A 3.00 kg particle has a velocity of (3.0 **i** − 4.0 **j**) m/s. Find its x and y components of momentum and the magnitude of its total momentum. (Px= +9.0 kg.m/s and Py=12 kg.m/s---Ptotal=5 kg.m/s)

Q7. A 1.0 kg ball falling vertically hits a floor with a velocity of 3.0 m/s and bounces vertically up with a velocity of 2.0 m/s. If the ball is in contact with the floor for 0.1 s, what is the change in the linear momentum of the ball? (Δp= 5.0 ĵ)

Q8. A 3.0 kg ball strikes a wall with a speed of 10 m/s at an angle of 60$_o$ with the surface. It bounces off with the same speed and angle, as shown in the figure. If the ball is in contact with the wall for 0.20 s, what is the average force exerted on the ball by the wall?(=260N)

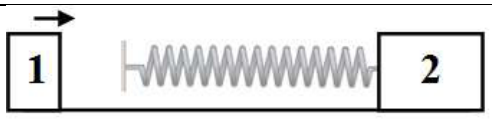


Q9. A 6.0 kg body moving with velocity v breaks up (explodes) into two equal masses. One mass travels east at 3.0 m/s and the other mass travels north at 2.0 m/s. Calculate the speed v of the 6.0 kg mass. (v =1.8m/s)

Q10. A 20.0 g bullet moving vertically upward at 1.00×10$_3$ m/s strikes and passes through the center of mass of a 10.0 kg block initially at rest. To what maximum height does the block rise after the bullet emerges from the block with a speed of 4.00×10$_2$ m/s vertically upward. Ignore air resistance.(Vbf=1.2m/s, h=7.35cm)

Q11. A mass of 10*gm* , moving horizontally with a velocity of 100*cm* / sec , strikes the bob of a pendulum and stick to it. The mass of the bob is also 10*gm*. The maximum height to which the system can be raised is (1.25cm)

Q12. A block 1 (mass 2.0 kg) is moving rightward at 9.0 m/s and block 2 (mass 4.0 kg) is at rest. The surface is frictionless, and a spring with a spring constant of 1120 N/m is fixed to block 2. When the blocks collide, the compression of the spring is maximum at the instant the blocks have the same velocity. Find the maximum compression, x_{max} in meters.(v=3m/s,Xmax=.31cm)



Q13.A2100Kg truck travelling north 41km/h turns east and accelerates to 51km/h. What are the magnitude and direction of the change in its momentum? (Δp =29750i-23917j------theta = -39^0)

Q14. A particle can slide along a track with elevated ends and a flat central part, as shown in Fig. The flat part has length L=40 cm. The curved portions of the track are frictionless, but for the flat part the coefficient of kinetic friction is m_k =0.20.The particle is released from rest at point A, which is at height h=L/2. How far from the left edge of the flat part does the particle finally stop?