

## 2D Collision Problems

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Name: \_\_\_\_\_

Date: \_\_\_\_\_

### Elastic Collisions:

Include a well drawn diagram of the before and after collision situation.

1. A 4.0 kg ball is rolling at 15 cm/s directly towards a stationary 2.0 kg ball. The collision is elastic and glancing causing the 4.0 kg ball to move at 10 cm/s at an angle of  $30^\circ$ . Determine the speed and direction of the second ball. [16.2 cm/s [ $-38.3^\circ$ ]]
2. A 2.0 kg ball is rolling at 3 cm/s directly towards a stationary 2.0 kg ball. The collision is elastic and glancing causing the first ball to move at 2.3 cm/s at an angle of  $40.5^\circ$ . Determine the speed and direction of the second ball.
3. A 2.0 kg ball is rolling at 5 cm/s towards a second ball of mass 4.0 kg moving towards the first at 2 cm/s. The two balls collide elastically in a glancing collision. The 2.0 kg ball moves away at  $70^\circ$  and speed of 4 cm/s. Determine the speed and direction of the second ball.
4. A 2.0 kg ball is rolling at 20 cm/s towards a second ball of mass 4.0 kg. The collision is elastic and glancing causing the first ball to move at an angle of  $32^\circ$  up and the other to move off at an angle of  $67^\circ$  down. What are the final velocities of the two balls? Use the method of your choice. [ $v_{2f} = 5.4$  cm/s,  $v_{1f} = 18.6$  m/s]
5. A bomb initially at **rest** on a smooth, horizontal surface is exploded into three pieces. Two pieces fly off horizontally, a 2.0 kg piece at 20 m/s at an angle of  $30^\circ$  up. A 3.0 kg piece at 12 m/s making an angle of  $30^\circ$  down. And finally, the third piece flies off horizontally at 30 m/s.
  - a) Determine the direction of motion of the third piece.
  - b) What is its mass? [2.2 kg]

### Inelastic Collisions:

6. A 2000 kg car travelling east slides into an icy intersection at 22 m/s. It collides with a 1000 kg car moving at 10 m/s south. If they become coupled together in the collision, what is their velocity immediately after impact? [15 m/s [E  $13^\circ$ S]]
7. A 15000 kg transport truck moving south at 25 m/s collides inelastically with a smaller car of mass 1000 kg moving eastward. The two objects are coupled and move together after the collision at 23.6 m/s [ $6.73^\circ$ E]. What was the eastward speed of the car before the collision? [44.2 m/s [East]]
8. Two ice skaters undergo a collision, after which their arms are intertwined and they have a common velocity moving 0.85 m/s [ $27^\circ$  S of E]. Before the collision, one skater of mass 71 kg had a velocity of 2.3 m/s moving [ $12^\circ$  N of E], while the other skater had a velocity of 1.9 m/s moving [ $52^\circ$  S of W]. What is the mass of the second skater? [55 kg]