

## PHYSICS 12

# KINEMATICS IN 2 DIMENSIONS

### Example 1:

A duck has a mass of 2.5 kg. As the duck paddles, a force of 0.10 N acts on it in a direction due east. In addition, the current of the water exerts a force of 0.20 N in a direction of  $52^\circ$  south of east. When these forces begin to act, the velocity of the duck is 0.11 m/s in a direction due east. Find the magnitude and direction of the displacement that the duck undergoes in 3.0 s while the forces are acting.

**Example 2:**

Airplane flight recorders must be able to survive catastrophic crashes. Therefore, they are typically encased in crash-resistant steel or titanium boxes that are subjected to rigorous testing. One of the tests is an impact shock test, in which the box must survive being thrown at high speeds against a barrier. A 41.0-kg box is thrown at a speed of 220 m/s and is brought to a halt in a collision that lasts for a time of 6.5 ms. What is the magnitude of the average net force that acts on the box during the collision?

**Example 3:**

At a time when mining asteroids has become feasible, astronauts have connected a line between their 3500-kg space tug and a 6200-kg asteroid. Using their tug's engine, they pull on the asteroid with force of 490 N. Initially the tug and the asteroid are at rest. 450 m apart. How much time does it take for the tug and the asteroid to meet?