

# Vectors



## MODULE 4



# What will you learn in this module?



- You will learn how to add vectors to find the resultant force acting on your Sea Perch.
- You will learn how to make your Sea Perch neutrally buoyant by adding vectors.
- You will learn how the resultant force impacts the movement of your Sea Perch as you attempt to navigate it through the course.

# Scalars vs Vectors



- Scalars are quantities where only the size is measured.
- Vectors are quantities where both the size and direction are measured.
- Can you make a list of things you have measured or learned about in science and split them into scalars and vectors?

# Force Vectors



- Forces have both size and direction so they are vectors.
- There are a number of force vectors acting on the Sea Perch.
  - Weight / Force of Gravity: the pull of the Earth's mass on the mass of the Sea Perch
  - Buoyant Force: the upward force acting on a submersed object equal to the weight of the fluid displaced by the object
  - Drag: the frictional force between a solid and a fluid
  - Force of the motors: the three motors will be used to push your Sea Perch in a variety of directions.

# Force and Motion



- According to Newton's 2nd Law, the sum of the forces is equal to the mass of the Sea Perch times the acceleration of the Sea Perch.
- The sum of the forces is also known as the resultant.
- If the resultant equals zero then the acceleration is zero.
- If the resultant is not zero then the Sea Perch is either accelerating or decelerating.

# Vector Addition



- Assume that one Sea Perch has a mass of 3 kg. Two of its motors are working so that it has a total force of 8N pushing it forward, and the drag of the water is working against it at 2N.
  - What is the resultant force acting on the Sea Perch?
  - What is the acceleration of the Sea Perch?

# Vector Addition



- One Sea Perch has a mass of 3 kg. Two of its motors are working so that it has a total force of 8N pushing it forward, and the drag of the water is working against it at 2N.

- What is the resultant force acting on the Sea Perch?

$$8 \text{ N} - 2\text{N} = 6 \text{ N, forward}$$

- What is the acceleration of the Sea Perch?

$$6 \text{ N} = (3 \text{ kg}) \times a$$

$$a = 2 \text{ m/s}^2$$