

# Motion and Forces

## Newton's laws predict the motion of most objects.

- a. *Students know* how to solve problems that involve **constant speed** and **average speed**. **Chapter 2**
- b. *Students know* that when **forces are balanced**, **no acceleration occurs**; thus an object continues to move at a constant speed or stays at rest (**Newton's 1st law**). **Chapter 4**
- c. *Students know* how to apply the law  $F = ma$  to solve one-dimensional motion problems that involve constant forces (**Newton's 2nd law**). **Chapter 4**
- d. *Students know* that when one object exerts a force on a second object, the second object always exerts a force of equal magnitude and in the opposite direction (**Newton's 3rd law**). **Chapter 4**
- e. *Students know* the relationship between the **universal law of gravitation** and the **effect of gravity** on an object at the surface of Earth. **Chapter 5**
- f. *Students know* **applying a force to an object perpendicular to the direction** of its motion causes the object to change direction but not speed. **Chapter 5**
- g. *Students know* **circular motion** requires the application of a constant force directed toward the center of the circle. **Chapter 5**
- h. *Students know* that **Newton's Law are not exact** but provide a very good approximation unless moving close to the speed of light or is small enough that quantum effects are important.
- i. *Students know* how to solve **two-dimensional trajectory problems**. **Chapter 3**
- j. *Students know* how to **resolve two dimensional vectors** into their components and calculate the magnitude and direction of a vector from its components. **Chapter 3**
- k. *Students know* how to solve two-dimensional problems involving **balanced forces** (statics). **Chapter 4**
- l. *Students know* how to solve problems in **circular motion** by using the formula for centripetal acceleration in the following form  $a = v^2/r$ . **Chapter 5**