Lesson 1

Before You Read
1. Agree
2. Disagree

Read to Learn
1. Possible answer: From my desk, I walked 10 m across the room to the classroom door.
2. Displacement measures the shortest distance between the start and end points (a straight line). Distance measures the indirect path traveled to reach the end point.
3. reference point, displacement, direction
4. The object is covering the same distance during each unit of time.
5. between seconds 4 and 5
6. a. skateboarding
7. speed, direction of movement
8. yes, because velocity changes if direction changes
9. Students should highlight words in the captions of the figure as follows: panel 1—speed; panel 2—direction; panel 3—speed and direction.
10. Velocity is the speed and direction of an object’s motion. Acceleration is a measure of how quickly the velocity of an object changes.
11. $-2 \text{ m/s}^2$
12. 7.5 km/h
13. by showing how the displacement or the speed of an object changes over a period of time
14. The bear’s speed increased.

After You Read
1. Possible answer: To get to the mall from my home, I drive 4 km east on Main Street.
2. a. direction, velocity; b. speed, velocity; c. speed, direction, velocity; d. no factors changed
Lesson 2

Before You Read
3. Disagree
4. Agree

Read to Learn
1. Forces can change an object’s speed, direction, or both.
2. applied force
3. With contact forces, the objects must touch one another. Noncontact forces can act between two objects that are not touching.
4. because Earth has much greater mass, and therefore greater gravitational force, than the pencil
5. It increases.
6. mass, distance
7. Both spheres would accelerate toward one another. The 2 billion-kg sphere would accelerate toward the 10 billion-kg sphere faster.
8. 110 N + 90 N = 200 N
9. Motion does not change.
10. 400 N + (–300 N) = 100 N
11. Unbalanced forces affect the motion of an object. Balanced forces do not.

After You Read
1. Possible answer: As I skateboarded on a flat sidewalk, friction caused the board to slow down.
2. In both diagrams, the force of gravity decreases by half from the top two objects to the bottom two objects.
3. The force of gravity decreases with an increase in distance.

Lesson 3

Before You Read
5. Disagree
6. Agree

Read to Learn
1. The object would display no motion because it would be at rest, or it would be moving with constant velocity.
2. The velocity changes, and the car accelerates upward.
3. downward
4. because the unbalanced forces don’t act in opposite directions
5. because the ball did not accelerate fast enough to overcome the forces keeping the bottles upright
6. $2 \text{ N}/0.4 \text{ kg} = 5 \text{ m/s}^2$
7. The terms are related using Newton’s second law, $a = F/m$, which lets you predict what combination of force and mass is required to get the acceleration you need.
8. The second object exerts an equal and opposite force on the first object.
9. b. 1.5 N
10. The table must be exerting an equal force upward or the bowl would move downward.

**After You Read**
1. Possible answer: As I walk, my shoes push upon the ground and the ground pushes back with equal force.
2. a. increase; b. increase; c. decrease
3. Students should record a question from their sticky notes and then write the answer.