9. Indicating Direction

9.1 *(a) How much farther does a falling object travel in 2 s if it is initial moving at 3 m/s downward, compared to how far it falls if released at rest?*
(b) How far does a object travel in 2 s if moving at a constant speed of 3 m/s?
(c) Look at equation 8.1. What is it about equation 8.1 that ensures that part (a) of this checkpoint will equal part (b)?

(a) 6 m, (b) 6 m, (c) the "extra" distance is given by $v_i \Delta t$, which is the same distance an object moves if it had no acceleration

9.2 *Show that equation 8.1 becomes equivalent to the definition of average speed if the acceleration is zero. Be sure to explain why v_i can be considered to be the same as v_{avg}.*

If the acceleration is zero then, plugging in zero for a, we get $\Delta s = v_i \Delta t$; Further, if the acceleration is zero then the speed doesn't change and the average speed is equal to the initial speed; Making that replacement and solving for the average speed gives $v_{\text{avg}} = \Delta s / \Delta t$, the same as the definition of average speed

9.3 *Suppose we started out "3 m south of the table" and moved to a position "2 m north of the table". What is our displacement?*

5 m toward the north

9.4 *Suppose I start out at a position 50 miles north of Philadelphia and end up 50 miles south of Philadelphia.*
(a) What is my initial position?
(b) What is my displacement?
(c) What is the distance between my initial and final position?

(a) 50 miles north of Philadelphia, (b) 100 miles toward the south, (c) 100 miles

9.5 *If "(2 m)" represents "two meters above the ground", what does "−(2 m)" represent?*

Two meters below the ground

9.6 *An object is moving 5 m/s toward the north.*
(a) What is the object's speed?
(b) What is the object's velocity?

(a) 5 m/s, (b) 5 m/s toward the north

9.7 *A ball is thrown up in the air. For each of the following cases, indicate whether the acceleration is zero or non-zero. If it is non-zero, indicate the direction of the acceleration (up or down) and explain your choice.*
(a) on the way up,
(b) on the way down, and
(c) when it is at its highest point?
(d) In which case(s), is the velocity's direction the same as the acceleration? What is the object doing then?
(e) In which case(s), is the velocity's direction opposite that of the acceleration? What is the object doing then?
(f) In which case(s), is the velocity zero? What is the object doing then?

(a) down, (b) down, (c) down, (d) on the way down, it is speeding up, (e) on the way up, it is slowing down, (f) at the top, it is changing directions from up to down

9.8 *It was stated that if we chose positive to be upwards, the acceleration would have to be negative.*
(a) Why would the acceleration have to be negative?
(b) Would the initial velocity have to be positive, or would it depend on whether it was initially moving upward or downward? Explain.

(a) Because the acceleration is downward and if upwards is positive then downward must be negative, (b) it would depend on whether it was initially moving upward or downward since upward would be positive and downward would be negative

9.9 *In the previous chapter, we examined situations where the initial speed was zero. How come we didn't need the quadratic formula then?*

Because if the initial speed was zero, there was no Δt term, leaving only the $(\Delta t)^2$ term; the result can be solved without resorting to the quadratic equation

9.10 *A ball is thrown straight up into the air with an initial speed of 5 m/s. We know that the ball accelerates downward at 9.8 m/s*^{2} *during the time it is in the air. How long does it take for the ball to return to its initial height?*

1.02 s

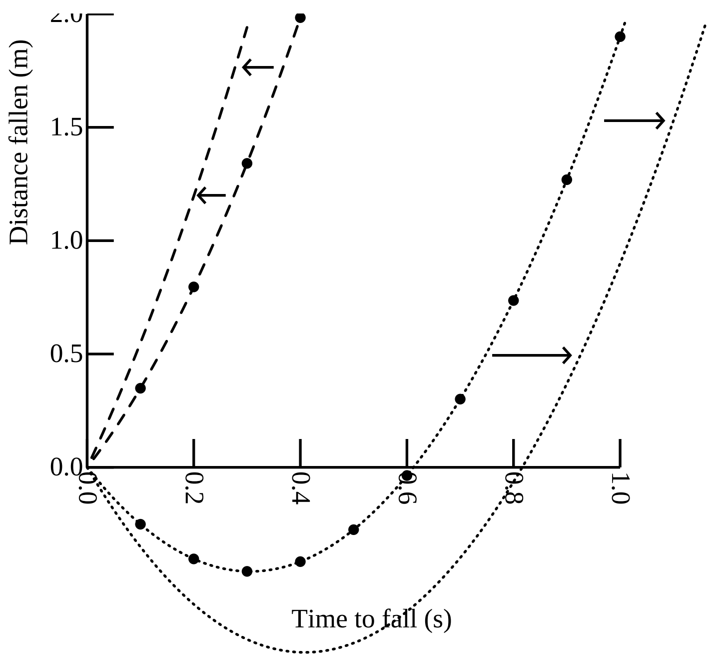
9.11 *A fan cart moves one way and then returns to its initial position. Let's suppose it reaches a point 45 cm to the north of its starting location before returning to its initial position. What is the average velocity during this time? Explain.*

Zero, the total displacement is zero so the average velocity must be zero; looked at in another way, the object must move in a positive direction as well as in a negative direction.

9.12 *(a) Suppose the object was thrown downward with a speed greater than 3 m/s. How would the graph of s vs. t differ from the dashed curve in figure 9.2? Draw an example comparing the two curves.*
(b) What if the object was thrown upward *with a speed greater than 3 m/s? How would the graph of s vs. t differ from the dotted curve in figure 9.2? Draw an example comparing the two curves.*

(a) See shift toward the left indicated by the dashed line in the figure.(b) See shift toward the right indicated by the dotted line in the figure.

9.13 *(a) Suppose an object was moving with a constant velocity of* -3 *m/s. Would a graph of v vs. t result in a flat line, a straight line with a positive slope, a straight line with a negative slope, or a curved line?*
(b) Suppose an object was moving with a constant acceleration of -3 *m/s*^{2}*. Would a graph of v vs. t result in a flat line, a straight*



line with a positive slope, a straight line with a negative slope, or a curved line?

(a) flat line, (b) straight line with a negative slope