Critical Thinking Items

3.1 Acceleration 7.

Imagine that a car is traveling from your left to your right at a constant velocity. Which two actions could the driver take that may be represented as (a) a velocity vector and an acceleration vector both pointing to the right and then (b) changing so the velocity vector points to the right and the acceleration vector points to the left?

a. (a) Push down on the accelerator and then (b) push down again on the accelerator a second time.
b. (a) Push down on the accelerator and then (b) push down on the brakes.
c. (a) Push down on the brakes and then (b) push down on the brakes a second time.
d. (a) Push down on the brakes and then (b) push down on the accelerator.

8.

A motorcycle moving at a constant velocity suddenly accelerates at a rate of 4.0\,\text{m/s}^2 to a speed of 35\,\text{m/s} in 5.0\,\text{s}. What was the initial speed of the motorcycle?

a. {-34}\,\text{m/s}
b. {-15}\,\text{m/s}
c. 15\,\text{m/s}
d. 34\,\text{m/s}

3.2 Representing Acceleration with Equations and Graphs 9.

A student is asked to solve a problem:

An object falls from a height for 2.0 s, at which point it is still 60 m above the ground. What will be the velocity of the object when it hits the ground?

Which of the following provides the correct order of kinematic equations that can be used to solve the problem?

a. First use $v^2 = v_0^2 + 2a(d - d_0)$, then use $v = v_0 + at$.
b. First use $v = v_0 + at$, then use $v^2 = v_0^2 + 2a(d - d_0)$.
c. First use $d = d_0 + v_0 t + \frac{1}{2}at^2$, then use $v = v_0 + at$.
d. First use $v = v_0 + at$, then use $d - d_0 = v_0 t + \frac{1}{2}at^2$.

10.

Skydivers are affected by acceleration due to gravity and by air resistance. Eventually, they reach a speed where the force of gravity is almost equal to the force of air resistance. As they approach that point, their acceleration decreases in magnitude to near zero.

Part A. Describe the shape of the graph of the magnitude of the acceleration versus time for a falling skydiver.

Part B. Describe the shape of the graph of the magnitude of the velocity versus time for a falling skydiver.

Part C. Describe the shape of the graph of the magnitude of the displacement versus time for a falling skydiver.

a. Part A. Begins with a nonzero y-intercept with a downward slope that levels off at zero; Part B. Begins at zero with an upward slope that decreases in magnitude until the curve levels off; Part C. Begins at zero with an upward slope that increases in magnitude until it becomes a positive constant
b. Part A. Begins with a nonzero y-intercept with an upward slope that levels off at zero; Part B. Begins at zero with an upward slope that decreases in magnitude until the curve levels off; Part C. Begins at zero with an upward slope that increases in magnitude until it becomes a positive constant
c. Part A. Begins with a nonzero y-intercept with a downward slope that levels off at zero; Part B. Begins at zero with a downward slope that decreases in magnitude until the curve levels off; Part C. Begins at zero with an upward slope that increases in magnitude until it becomes a positive constant
d. Part A. Begins with a nonzero y-intercept with an upward slope that levels off at zero; Part B. Begins at zero with a downward slope that decreases in magnitude until the curve levels off; Part C. Begins at zero with an upward slope that increases in magnitude until it becomes a positive constant

11.

Which graph in the previous problem has a positive slope?

a. Displacement versus time only
b. Acceleration versus time and velocity versus time
c. Velocity versus time and displacement versus time
d. Acceleration versus time and displacement versus time