# Monday warm-up: Kinematics, II

Prof. Jordan C. Hanson

September 9, 2024

## 1 Memory Bank

1. $v = \frac{\Delta x}{\Delta t}$ ... Average velocity.
2. $v = \frac{dx}{dt}$ ... Instantaneous velocity.
3. $a = \frac{\Delta v}{\Delta t}$ ... Average acceleration.
4. $a = \frac{dv}{dt}$ ... Average acceleration.
5. $x(t) = \frac{1}{2}at^2 + v_i t + x_i$ ... Position versus time, given constant acceleration
6. $v(t) = at + v_i$ ... Speed versus time, given constant acceleration
7. $v_f^2 = v_i^2 + 2a\Delta x$ ... Initial and final speeds, given constant acceleration and displacement

## 2 Chapter 3 - Kinematics, II

1. Suppose a running accelerates at 3 m s$^{-2}$, starting from rest. (a) *Where* will the runner reach a top speed of 10 m s$^{-1}$? (b) *When* does the runner reach top speed ?

2. Consider Fig. 1. The formula that describes the speed of the system between 0 and 20 seconds is

   - A: $v(t) = 3t$
   - B: $v(t) = 0.3t$
   - C: $v(t) = 20t$
   - D: $v(t) = 0.2t$

3. Using your formula for $v(t)$ from the previous exercise, what is the speed at $t = 10$ seconds?

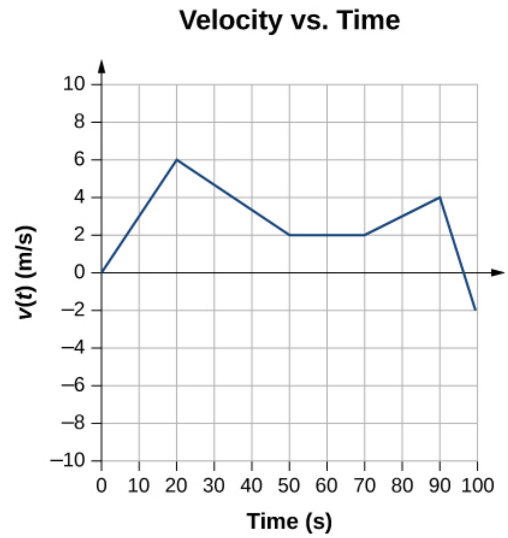


Figure 1: things

4. Consider Fig. 1. Between 50 and 70 seconds, the system is

   - A: has positive acceleration
   - B: has negative acceleration
   - C: has no acceleration
   - D: is not moving

5. Examine Fig. 1, and determine the regions with the largest positive acceleration and the largest negative acceleration. Estimate them based on the graph.