Warm Up: Unit 1 Kinematics

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1 Memory Bank

The following formulas apply to systems experience *constant acceleration*, a. That is, $a = 0$, or $a =$ constant, but it does not depend on time.

1. If $a = 0$, then $v = \frac{x_f - x_i}{t_f - t_i}$, and v is constant.
2. If $a \neq 0$, then $v(t) = at + v_i$ ... This is the velocity of a system at a time t, with acceleration (a) times time, plus initial velocity v_i.
3. If $a \neq 0$, $x(t) = \frac{1}{2}at^2 + v_i t + x_i$ ... This is the position of a system at time t, equal to one-half the acceleration (a) times time (t) squared, plus initial velocity (v_i) times time, plus initial position (x_i).

2 Chapters 2.3 - 2.5

1. Graphically, the velocity is the slope of position versus time. In Fig. 1, a system moves initially in the positive x-direction, but is experiencing constant negative acceleration. Eventually, it is moving in the negative x-direction. (a) What is the velocity (the slope) at t_0? (b) Is the average velocity between t_1 and t_6 greater than, less than, or equal to the instantaneous velocity at t_0? (c) Suppose t_1 and t_6 are equal to 0.5 and 3.5 seconds, respectively. If x_1 and x_6 are the corresponding positions, equal to 1 and 5 meters, respectively, what is the average velocity, v between t_1 and t_6?

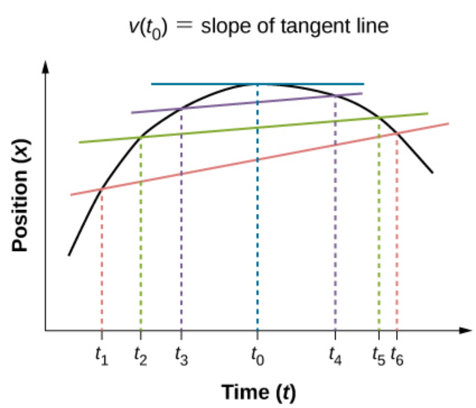

Figure 1: A system moves initially in the positive x-direction, experiencing negative acceleration.

2. From the memory bank, we see that the formula that accurately descibes the position of accelerating systems versus time is a quadratic formula. Using what you know about t_1, t_6, x_1, and x_6, determine the quadratic equations that correctly describes Fig. 1. (*Assume* $x(0) = 0$ and that a is negative).