Warm Up: Graphical Analysis of Kinematics

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1 Memory Bank

1. $v = \frac{\Delta x}{\Delta t}$ ... Average velocity.
2. $x(t) = vt + x_i$ ... Position versus time with constant velocity.
3. $a = \frac{\Delta v}{\Delta t}$ ... Acceleration is the change in velocity.
4. $v_f^2 = v_i^2 + 2a\Delta x$ ... Kinematic equation without time.

2 Graphical Analysis of Kinematics

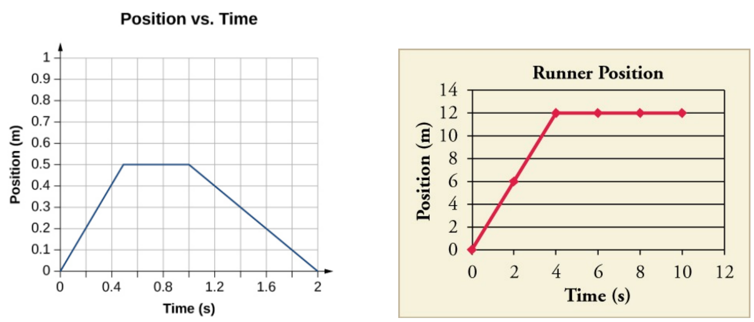

Figure 1: (Left) A graph of the displacement versus time of a system, in meters versus seconds. (Right) A graph of displacement versus time of a runner, in meters versus seconds.

1. Consider Fig. 1 (Left). (a) What is the velocity of the system between 0 and 0.5 seconds? (b) What is the velocity between 0.5 and 1.0 seconds? (c) What is the velocity between 1.0 and 2.0 seconds?

2. Write the formula $x(t)$ that describes the motion between 1.0 and 2.0 seconds.

3. Consider the motion of the runner depicted in Fig. 1 (Right). (a) What is the speed of the system after $t = 4$ seconds? (b) What is the acceleration between $t = 0$ and $t = 4$ seconds? (c) What is the speed of the runner between $t = 0$ and $t = 4$ seconds?

4. Now change the y-axis units in Fig. 1 to velocity, in meters per second. Answer parts (a)-(c) from the previous question again. For part (c), write your answer as a function of time. *Where* does the runner reach top speed?