1. In class, you learned the kinematics relations

$$x(t) = x_0 + vt + \frac{1}{2}at^2 \quad \text{and} \quad v(t) = v_0 + at$$

These relations aren't generally true, however; they are true only in a specific case. What must be true for these relations to apply?

2. Consider a basketball bouncing on the floor.

Draw position vs. time, velocity vs. time, and acceleration vs. time graphs for the ball on the next page.

Look at your graphs carefully and make sure they are self-consistent:

- Regions of constant acceleration should correspond to places where the velocity graph is a straight line (are there any?)
- Regions of constant velocity should correspond to places where the position graph is a straight line (are there any?)
- Places where the position graph is flat should correspond to v=0

- Remember, the slope of the position graph is the value of the velocity graph; the slope of the velocity graph is the value of the acceleration graph

How would these graphs be different for a bouncing bowling ball?

Note: This is a bit tricky! As with all problems in recitation, work together with your peers and ask your TA/coach for guidance if you have questions.

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A car is traveling at 30 m/s and applies its brakes to slow down to 10 m/s. If it is able to decelerate at 5 m/s^2, how far does it travel during the braking period?

a. Write expressions for the car's position and velocity as a function of time.

b. How can you translate the question “How far does it travel during the braking period?” into an algebraic statement?

c. What intermediate quantity must you find before you find the distance traveled? Find it.

d. Finally, how far does the car travel?

This is the same as the previous problem, but with the numbers removed.

A car is traveling at velocity v_0 and applies its brakes to slow down to velocity v^f. If it is able to decelerate at an acceleration a, how far does it travel during the braking period?

a. Write expressions for the car's position and velocity as a function of time.

b. How can you translate the question “How far does it travel during the braking period?” into an algebraic statement?

c. What intermediate quantity must you find before you find the distance traveled? Find it.

d. Finally, how far does the car travel?