Lesson 5: How Many Velocities can an Object Have?

5.1 Observe and Reason
Examine the Position vs. Clock Reading graph for the football player below.

1. What were the player’s positions at the points shown with triangles on the graph?
2. Describe the motion of the player in words. Act it out. Pay attention to what happened at 0 clock reading!
3. James said the football player traveled 5 yards in the negative direction. Tara said the football player moved 85 yards total. Joe said the football player traveled 5 yards. How did each person arrive at his/her answer?
4. What is the distance traveled by the football player from t = 1.0 s to t = 12.0 s? What is the path length traveled by the football player travel from t = 1.0 s to t = 12.0 s? What is the displacement of the football player travel from t = 1.0 s to t = 12.0 s?
5. Explain why the values for the quantities in 4. are written as t = 1.0 s for example as opposed to t = 1 s?
6. What is the distance traveled by the football player travel from t = 2.0 s to t = 19.0 s? What is the path length traveled by the football player from t_e = 2.0 s to t_f = 19.0 s? What is the displacement of the football player from t = 2.0 s to t = 19.0 s?

5.5 Represent and Reason
A bus filled with physics students going to Great Adventure for Physics day travels 280 km West along a straight-line path at an average velocity of 88 km/hr to the west. The bus stops for 24 min, then it travels 210 km south with an average velocity of 75 km/hr to the south.

1. Diagram and label all the pertinent information for this trip.
2. What is the average velocity for the total trip? What is the average speed for the total trip?

5.6 Represent and Reason

The position of an object is represented in the graph above.

1. Describe the motion in words.
2. What is the average velocity of the object for the different time intervals: 0 - 10 sec and 10 - 20 sec?
3. What is the average speed for the object during the entire 30 sec? What is the average velocity during that same interval?
4. What is the average speed and average velocity for the time interval from 5 sec – 25 sec?

5.7 Represent and Reason

The picture above is a diagram of a 400m outdoor track. All races begin at the start/finish line.

1. If the 1600m race is 4 laps, what is the path length raced? What is the displacement?
2. The 200 m run begins at the 200 m mark and finishes at the start/finish line, what is the path length raced? What is the magnitude (the amount) of the displacement, or distance raced?