Worksheet 1. What You Need to Know About Motion Along the *x*-axis (Part 1)

In discussing motion, there are three closely related concepts that you need to keep straight. These are:

Position: $x(t)$ – determines where the particle is located on the x-axis at a given time t.

Velocity: $v(t) = x'(t)$ – determines how fast the position is changing at a time t as well as direction of movement

acceleration: $a(t) = v'(t) = x''(t)$ – determines how fast the velocity is changing; the sign indicates if velocity is increasing or decreasing

If $x(t)$ represents the position of a particle along the x-axis at any time t, then the following statements are true.

1. "Initially" means when _____ = 0.
2. "At the origin" means _____ = 0.
3. "At rest" means _____ = 0.
4. If the velocity of the particle is positive, then the particle is moving to the _____.
5. If the velocity of the particle is _____, then the particle is moving to the left.
6. To find average velocity over a time interval, divide the change in _____ by the change in time.
7. Instantaneous velocity is the velocity at a single moment (instant!) in time.
8. If the acceleration of the particle is positive, then the _____ is increasing.
9. If the acceleration of the particle is _____, then the velocity is decreasing.
10. In order for a particle to change direction, the _____ must change signs.
11. One way to determine total distance traveled over a time interval is to find the sum of the absolute values of the differences in position between all resting points. Here's an example: If the position of a particle is given by:

$$x(t) = \frac{1}{3}t^3 - t^2 - 3t + 4,$$

find the total distance traveled on the interval $0 \le t \le 6$.