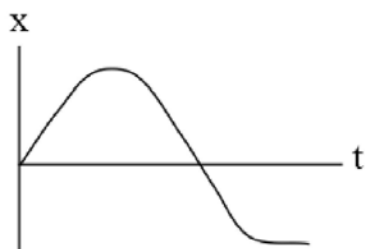Name: _____ Student ID: _____

Quiz 1 Kinematics

1. The position vs. time graph of a moving object is shown in the figure below. How many times has the direction of the object changed?

Answer: 1 time

Solution: When given a position vs. time graph and asked to determine the moments when the object changes its direction, use the following method: Identify where the tangent line on the graph is horizontal. Remember that the slope of the tangent line on the $x - t$ graph always represents the direction and magnitude of the velocity at any instant of time.
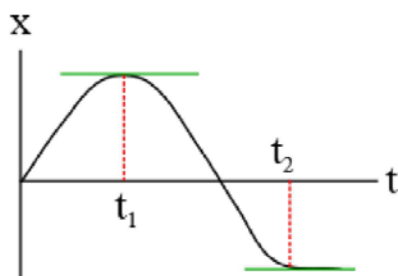
So, where these tangent lines become zero (horizontal), the object reverses its direction. In the given graph, at times t_1 and t_2, the tangents are horizontal, indicating that at these two points (positions), the direction of motion is reversed. However, note that after time t_2, the position of the object does not change, which means the object has stopped. Thus, overall, the object has changed its direction only once. *Hence, the correct answer is (a).*

2. A cart is at x = 5 m at time t = 0. The cart accelerates at 4 m/s². If the speed of the cart at t = 0 is 3 m/s, find the position of the cart at t = 2 s and also determine where the cart is when it reaches a speed of 5 m/s.

$x - x_o = v_o t + \frac{1}{2}at^2$

$x - 5 = 3(2) + \frac{1}{2}(4)(2)^2$

$x = 19 \text{ m}$

$v^2 = v_o^2 + 2a(x - x_o)$

$5^2 = 3^2 + (2)(4)(x - 5)$

$x = 7 \text{ m}$