Advanced Challenge Level 2 Problem #26 _____

A point moves along the y-axis with velocity $v(t) = 5 - 5\arctan(0.25t)$ units per second where $0 \leq t \leq 10$. Assume that a positive velocity indicates 'upward' motion and a negative velocity indicates 'downward' motion. You are also given that the point is 10 units 'above' the origin when t = 0. Answer the following questions. (Where appropriate, in addition to representing the exact value, round your answers to three significant figures.)

1. Sketch a graph of v.

2. Evaluate v(4) and v(8). Include appropriate units.

3. What is the speed of the point when t = 4 seconds? Is the speed increasing or decreasing when t = 4 seconds?

4. What is the speed of the point when t = 8 seconds? Is the speed increasing or decreasing when t = 8 seconds?

5. Find the value of t when the point reaches its 'highest' position. What is that position?

6. What is the total distance the point moves from t = 0 to t = 10 seconds?

7. How far is the point from its starting position when t = 10 seconds?

8. Let a = g(t) represent the acceleration of the point. Find an appropriate equation for this function.

9. Evaluate g(4) and g(8). Include appropriate units.

10. Let y = f(t) represent the position of the point at time t seconds. Evaluate f(4) and f(8).

Bonus: Write an equation for f and sketch its graph from t = 0 to t = 10 seconds.