Homework H1.C

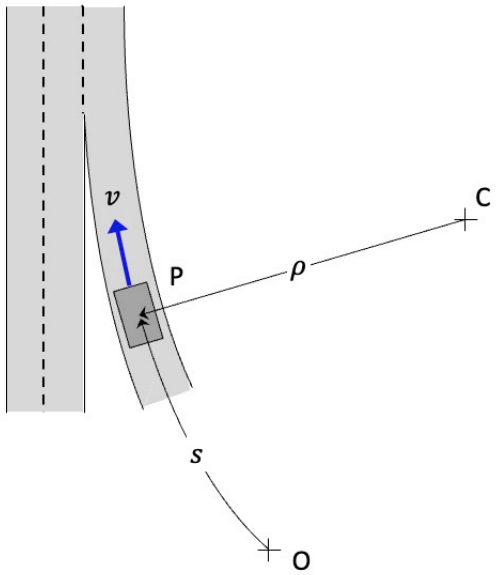
Given: An automobile P is entering a freeway along a "clothoid-shaped" entrance ramp whose radius of curvature ρ is given by $\rho = (a + bs)^{-1}$, where a and b are constants, and s is the distance traveled along the entrance ramp. The speed of P is known as a function of position s on the entrance ramp to be: $v(s) = c + ds$, where c and d are constants.

Find:

(a) Determine the velocity and acceleration vectors for P. Express these vectors in terms of their path coordinates, and in terms of, at most: s, a, b, c and d.

(b) Determine the numerical values of the velocity and acceleration vectors for P at the position at $s = 200$ ft.

(c) Make a sketch of these velocity and acceleration vectors, including the path unit vectors $\hat{e}_t$ and $\hat{e}_n$.



Use the following parameters in your work: $a = 0.005$/ft, $b = 1 \times 10^{-5}$/ft^2, $c = 25$ ft/s and $d = 0.25$/s.