

A particle moves along the y-axis so that its velocity v at time $y \geq 0$ is given by $v(t) = 1 - \tan^{-1}(e^t)$. At time $t = 0$, the particle is at $y = -1$. (Note: $\tan^{-1}x = \arctan x$)

a. Find the acceleration of the particle at time $t = 2$

b. Is the speed of the particle increasing or decreasing at time $t = 2$? Give a reason for your answer.

c. Find the time $t \geq 0$ at which the particle reaches its highest point. Justify your answer.

d. Find the position of the particle at time $t = 2$. Is the particle moving toward the origin or away from the origin at time $t = 2$? Justify your answer.