

Problem 1

Find $\frac{dr}{dt}$ when $r(t) = \tan^{-1}(t)i + t^2 \sin(t)j + 500k$.

Problem 2

Graph the circle $x = \cos(t)$, $y = \sin(t)$ and $z = t$ for $0 \leq t \leq 2\pi$. Next, define $r(t) = \cos(t)i + \sin(t)j + tk$, compute $r'(\frac{\pi}{3})$, $r'(\frac{\pi}{2})$, and $r'(\frac{3\pi}{2})$ and plot these tangent vectors on the curve you've drawn.

Problem 3

Suppose a particle's position vector at time t is given by the equation

$$r(t) = 2t \mathbf{i} + \ln(\ln(t^2 + e^2)) \mathbf{j} + \frac{1}{1 + t^2} \mathbf{k}.$$

Find the particle's velocity and acceleration vectors. Determine the speed of the particle at $t = 0$.