1. The temperature at the point \((x, y, z)\) is given by

\[ T(x, y, z) = 4 + x^3y + xz + y^2z^2 \]

A particle travels along the helix parametrized by

\[ \mathbf{r}(t) = (\cos(t), \sin(t), t) \]

What is the rate of change of the temperature along the particle’s path when \(t = 0\)?

rate of change: ________________
2. At the point $P = (-3, 4)$, the function $f(x, y)$ has gradient $\nabla f(P) = \langle 1, 2 \rangle$. What is the rate of change of $f$ at the point $P$ in the direction 45 degrees north of west?

rate of change: ________________