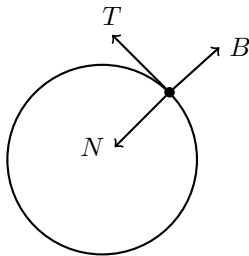


Question 2

For the circle $\vec{r}(t) = \langle a \cos t, a \sin t, h \rangle$ with $a > 0$, compute $\mathbf{T}, \mathbf{N}, \mathbf{B}$. Explain why $\mathbf{N}$ is independent of a and why $\mathbf{B}$ is constant.

Question 2 – Solution

Strategy The parameter changes angular position while a changes only the circle's scale.



Computation $\vec{r}' = a \langle -\sin t, \cos t, 0 \rangle$, so

$$\mathbf{T} = \langle -\sin t, \cos t, 0 \rangle, \quad \mathbf{N} = \langle -\cos t, -\sin t, 0 \rangle, \quad \mathbf{B} = \langle 0, 0, 1 \rangle.$$

Interpretation The principal normal points radially inward regardless of radius. The curve lies in the fixed horizontal plane $z = h$, so the right-handed binormal is its constant upward normal.