Problem. Since $\mathbf{a} = a_{\mathbf{T}}\mathbf{T} + a_{\mathbf{N}}\mathbf{N}$, $a_{\mathbf{N}}\mathbf{N} = \mathbf{a} - a_{\mathbf{T}}\mathbf{T}$. In the class, we proved that $a_{\mathbf{N}} = v^2K > 0$, thus $a_{\mathbf{N}}\mathbf{N}$ and $\mathbf{N}$ are in the same direction. Based on these observations, continue to prove that

$$\mathbf{N} = \frac{(\mathbf{v}\cdot\mathbf{v})\,\mathbf{a} - (\mathbf{v}\cdot\mathbf{a})\,\mathbf{v}}{\|(\mathbf{v}\cdot\mathbf{v})\,\mathbf{a} - (\mathbf{v}\cdot\mathbf{a})\,\mathbf{v}\|}.$$

You can use any theorem that is in the textbook or proved in the class.