Example: Given $\vec{r}(t) = (9t+2)\vec{i} + (7-t^9)\vec{j}$, find K and $\vec{N}$.

$$\vec{v}(t) = \langle 9, -9t^8 \rangle$$

$$|\vec{v}(t)| = \sqrt{9^2 + 9^2 t^{16}} = \boxed{9\sqrt{1+t^{16}}}$$

$$\vec{T}(t) = \frac{\vec{v}(t)}{|\vec{v}(t)|} = \boxed{\left\langle \frac{1}{\sqrt{1+t^{16}}}, -\frac{t^8}{\sqrt{1+t^{16}}} \right\rangle}$$

$$\frac{d\vec{T}}{dt} = \boxed{\left\langle -8t^{15}(1+t^{16})^{-3/2}, -8t^7(1+t^{16})^{-3/2} \right\rangle}$$

$$\frac{d}{dt}\frac{1}{\sqrt{1+t^{16}}} = \frac{d}{dt}(1+t^{16})^{-1/2} = -\frac{1}{2}(1+t^{16})^{-3/2} \cdot 16t^{15} = -8t^{15}(1+t^{16})^{-3/2}$$

$$\frac{d}{dt}\frac{t^8}{\sqrt{1+t^{16}}} = \frac{8t^7\sqrt{1+t^{16}} - t^8 \cdot \frac{16t^{15}}{2\sqrt{1+t^{16}}}}{1+t^{16}} = \frac{8t^7(1+t^{16}) - 8t^8 \cdot t^{15}}{(1+t^{16})\sqrt{1+t^{16}}}$$

$$= \frac{8t^7 + 8t^{23} - 8t^{23}}{(1+t^{16})\sqrt{1+t^{16}}} = 8t^7(1+t^{16})^{-3/2}$$

$$\left|\frac{d\vec{T}}{dt}\right| = \sqrt{8^2 t^{30}(1+t^{16})^{-3} + 8^2 t^{14}(1+t^{16})^{-3}}$$

$$= \sqrt{8^2 t^{14}(1+t^{16})^{-3}(t^{16}+1)} = \sqrt{8^2 t^{14}(1+t^{16})^{-2}} = \boxed{8t^7(1+t^{16})^{-1}}$$

$$\Rightarrow K = \frac{|d\vec{T}/dt|}{|\vec{v}|} = \frac{8t^7(1+t^{16})^{-1}}{9\sqrt{1+t^{16}}} = \boxed{\frac{8}{9}t^7(1+t^{16})^{-3/2}}$$

$$\vec{N} = \frac{d\vec{T}/dt}{|d\vec{T}/dt|} = \frac{1}{8t^7(1+t^{16})^{-1}} \cdot \left\langle -8t^{15}(1+t^{16})^{-3/2}, -8t^7(1+t^{16})^{-3/2} \right\rangle$$

$$= \boxed{\left\langle -t^8(1+t^{16})^{-1/2}, -(1+t^{16})^{-1/2} \right\rangle}$$