$$\vec{r}\,'(t) = |\,\vec{r}\,'(t)\,|\,\vec{T}(t) = v(t)\vec{T}(t)$$

$$\text{Distance travelled by the particle: } s(t) = \int_a^t \ |\,\vec{r}\,'(\tau)\,| \ d\tau$$

$$\frac{ds}{dt} = |\,\vec{r}\,'(t)\,| = v(t)$$

$$\kappa(t) = \frac{|\,\vec{r}\,'(t) \times \vec{r}\,''(t)\,|}{v^3(t)}$$

$$\vec{B}(t) = \frac{\vec{r}\,'(t) \times \vec{r}\,''(t)}{|\,\vec{r}\,'(t) \times \vec{r}\,''(t)\,|}$$

$$\vec{N}(t) = \vec{B}(t) \times \vec{T}(t) = \frac{\big(\vec{r}\,'(t) \times \vec{r}\,''(t)\big) \times \vec{r}\,'(t)}{|\,\big(\vec{r}\,'(t) \times \vec{r}\,''(t)\big) \times \vec{r}\,'(t)\,|}$$

$$\tau(t) = \frac{\vec{r}\,'''(t) \bullet \big(\vec{r}\,'(t) \times \vec{r}\,''(t)\big)}{|\,\vec{r}\,'(t) \times \vec{r}\,''(t)\,|^2}$$

$$\vec{r}\,''(t) = v'(t)\vec{T}(t) + v^2(t)\kappa(t)\vec{N}(t)$$

The right-hand rule frame for a point on the curve is $\vec{T}(t)$, $\vec{N}(t)$, $\vec{B}(t)$.
Frenet-Serret Formulae. Using arc-length parameterization

$$\begin{aligned}
\frac{d}{ds}\vec{T}(s) &= && + \ \kappa(s)\vec{N}(s) && \\
\frac{d}{ds}\vec{N}(s) &= -\kappa(s)\vec{T}(s) && + && + \ \tau(s)\vec{B}(s) \\
\frac{d}{ds}\vec{B}(s) &= && - \ \tau(s)\vec{N}(s) &&
\end{aligned}$$