Curves:

$$\vec{r}(t) = (x(t), y(t), z(t))$$

$$\begin{aligned}
\text{Arclength} \quad & s(t) := \int_a^t ||\vec{r}\,'(u)||\ du \qquad \text{(measuring from } a \text{ to } t\text{)} \\
\text{Unit Tangent Vector} \quad & \vec{T}(t) := \frac{\vec{r}\,'(t)}{||\vec{r}\,'(t)||} \\
\text{Curvature Vector} \quad & \frac{d\vec{T}}{ds} = \frac{\vec{T}\,'(t)}{||\vec{r}\,'(t)||} \\
\text{Curvature} \quad & \kappa := \left|\left|\frac{d\vec{T}}{ds}\right|\right| \\
\text{Principle Unit Normal} \quad & \vec{N}(t) := \frac{1}{\kappa}\frac{d\vec{T}}{ds} = \frac{\vec{T}\,'(t)}{\left|\left|\vec{T}\,'(t)\right|\right|} \\
\text{Binormal} \quad & \vec{B}(t) := \vec{T}(t) \times \vec{N}(t) \\
\text{Normal} \quad & \vec{N}(t) = \vec{B}(t) \times \vec{T}(t)
\end{aligned}$$

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

$$\vec{a}(t) = \frac{d^2s}{dt^2}\vec{T} + \left(\frac{ds}{dt}\right)^2 \kappa\vec{N} = a_T\vec{T} + a_N\vec{N}$$

$$a_T = \frac{\vec{r}\,' \bullet \vec{r}\,''}{||\vec{r}\,'||} \qquad a_N = \frac{||\vec{r}\,' \times \vec{r}\,''||}{||\vec{r}\,'||} \qquad \kappa = \frac{||\vec{r}\,' \times \vec{r}\,''||}{||\vec{r}\,'||^3}$$

For the curve given by the graph $y = f(x)$ we have:

$$\kappa(x) = \frac{|f''(x)|}{(1 + f'(x)^2)^{3/2}}\ .$$

For the plane curve given by $\vec{r}(t) = (x(t), y(t))$ we have:

$$\kappa(t) = \frac{|x'(t)y''(t) - x''(t)y'(t)|}{(x'(t)^2 + y'(t)^2)^{3/2}}\ .$$