

Unit Tangent Vector Animation

$$\mathbf{T}(t) = \frac{1}{|\mathbf{r}'(t)|} \mathbf{r}'(t) \quad \text{where} \quad \mathbf{r}' = \frac{d\mathbf{r}}{dt}$$
$$(x(t), y(t)) = (\cos t, \sin 3t), \quad 0 \leq t < 2\pi$$

Osculating Circle Animation

$$\mathbf{N}(t) = \frac{\mathbf{T}'(t)}{|\mathbf{T}'(t)|} \quad \kappa(t) = \frac{|\mathbf{T}'(t)|}{|\mathbf{r}'(t)|} = \frac{|\mathbf{r}'(t) \times \mathbf{r}''(t)|}{|\mathbf{r}'(t)|^3}$$

$$\text{Radius of circle } R = \frac{1}{\kappa}$$