

$$8. \vec{r}(t) = 5t^2 \vec{i} - 3t \vec{j}, t=1$$

$(5, -3)$

$$\vec{v}(t) = \vec{r}'(t) = 10t \vec{i} - 3 \vec{j}$$

$$\vec{v}(1) = 10(1) \vec{i} - 3 \vec{j} \\ = 10 \vec{i} - 3 \vec{j}$$

$$\vec{a}(t) = \vec{r}''(t) = 10 \vec{i}$$

$$\vec{a}(1) = 10 \vec{i}$$

$$\vec{r}'(t) = 10t \vec{i} - 3 \vec{j}$$

$$\vec{r}'(1) = 10 \vec{i} - 3 \vec{j}$$

$$\|\vec{r}'(1)\| = \sqrt{10^2 + (-3)^2} = \sqrt{109}$$

$$\text{So } \vec{T}(t) = \frac{\vec{r}'(t)}{\|\vec{r}'(t)\|}$$

$$\vec{T}(1) = \frac{10 \vec{i} - 3 \vec{j}}{\sqrt{109}} = \frac{10}{\sqrt{109}} \vec{i} - \frac{3}{\sqrt{109}} \vec{j} = \frac{10\sqrt{109}}{109} \vec{i} - \frac{3\sqrt{109}}{109} \vec{j}$$

$$\vec{N}(1) = \frac{3\sqrt{109}}{109} \vec{i} + \frac{10\sqrt{109}}{109} \vec{j}$$