

$$5. \vec{r}(t) = \langle \underline{t}, \underline{t^2}, \underline{3t-1} \rangle \quad P(\underline{2}, \underline{4}, \underline{5})$$

$$\begin{aligned} t=2 & \quad t^2=4 & \quad 3t-1=5 \\ t=2 & \quad t=\pm 2 & \quad 3t=6 \\ & & \quad t=2 \end{aligned}$$

$$\vec{r}'(t) = \langle 1, 2t, 3 \rangle$$

$$\begin{aligned} \vec{r}'(2) &= \langle 1, 2(2), 3 \rangle \\ &= \langle 1, 4, 3 \rangle \end{aligned}$$

So $t=2$

$$\begin{aligned} \|\vec{r}'(2)\| &= \sqrt{1^2 + 4^2 + 3^2} \\ &= \sqrt{1+16+9} \\ &= \sqrt{26} \end{aligned}$$

$$\vec{T}(2) = \frac{\vec{r}'(2)}{\|\vec{r}'(2)\|} = \frac{\langle 1, 4, 3 \rangle}{\sqrt{26}} = \frac{1}{\sqrt{26}} \langle 1, 4, 3 \rangle = \frac{\sqrt{26}}{26} \langle 1, 4, 3 \rangle$$

$\begin{matrix} \uparrow & \uparrow & \uparrow \\ a & b & c \end{matrix}$

$$x = at + x_1 \quad y = bt + y_1 \quad z = ct + z_1$$

$$x = 1t + 2 \quad y = 4t + 4 \quad z = 3t + 5$$

$$\boxed{x = t + 2 \quad y = 4t + 4 \quad z = 3t + 5}$$

$$6. \vec{r}(t) = t^2 \vec{i} + 5t \vec{j}, \quad t=3$$

$$\vec{r}'(t) = 2t \vec{i} + 5 \vec{j}$$

$$\begin{aligned} \vec{r}'(3) &= 2(3) \vec{i} + 5 \vec{j} \\ &= 6 \vec{i} + 5 \vec{j} \end{aligned}$$

$$\begin{aligned} \|\vec{r}'(3)\| &= \sqrt{6^2 + 5^2} \\ &= \sqrt{36 + 25} \\ &= \sqrt{61} \end{aligned}$$

$$\begin{aligned} \vec{T}(3) &= \frac{\vec{r}'(3)}{\|\vec{r}'(3)\|} \\ &= \frac{6 \vec{i} + 5 \vec{j}}{\sqrt{61}} \end{aligned}$$

$$\vec{T}(3) = \frac{6}{\sqrt{61}} \vec{i} + \frac{5}{\sqrt{61}} \vec{j}$$

$$\vec{N}(3) = \frac{5}{\sqrt{61}} \vec{i} - \frac{6}{\sqrt{61}} \vec{j}$$

$$\boxed{\vec{N}(3) = \frac{5\sqrt{61}}{61} \vec{i} - \frac{6\sqrt{61}}{61} \vec{j}}$$

