5. $\vec{r}(t) = \langle t, t^2, 3t-1 \rangle$ $P(2,4,5)$ (x_1, y_1, z_1)

$t=2$ $t^2=4$ $3t-1=5$

$t=2$ $t=\pm 2$ $3t=6$

$t=2$

So $t=2$

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

$\vec{r}\,'(2) = \langle 1, 2(2), 3 \rangle$

$= \langle 1, 4, 3 \rangle$

$\|\vec{r}\,'(2)\| = \sqrt{1^2+4^2+3^2}$

$= \sqrt{1+16+9}$

$= \sqrt{26}$

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

a b c

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

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

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

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

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

$\vec{r}\,'(3) = 2(3) \vec{i} + 5 \vec{j}$

$= 6\vec{i} + 5\vec{j}$

$\|\vec{r}\,'(3)\| = \sqrt{6^2+5^2}$

$= \sqrt{36+25}$

$= \sqrt{61}$

$(9, 15)$

$\vec{T}(3) = \dfrac{\vec{r}\,'(3)}{\|\vec{r}\,'(3)\|}$

$= \dfrac{6\vec{i} + 5\vec{j}}{\sqrt{61}}$

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

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

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

$\vec{T}$

$\vec{N}$