3. $\vec{r}(t) = t^2\vec{i} + 5t\vec{j} + t\vec{k}$ $P(0, 0, 0)$ $t^2 = 0$ $5t = 0$ $t = 0$

$x_1 \; y_1 \; z_1$ $t = 0$ $t = 0$ $t = 0$

so $t = 0$

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

$\vec{r}\,'(0) = 2(0)\vec{i} + 5\vec{j} + \vec{k}$

$\vec{r}\,'(0) = 5\vec{j} + \vec{k}$

$\|\vec{r}\,'(0)\| = \sqrt{5^2 + 1^2} = \sqrt{26}$

$\vec{T}(t) = \dfrac{\vec{r}\,'}{\|\vec{r}\,'\|} = \dfrac{5\vec{j} + \vec{k}}{\sqrt{26}} = \dfrac{1}{\sqrt{26}}\langle 0, 5, 1\rangle$

$= \boxed{\dfrac{\sqrt{26}}{26}\langle 0, 5, 1\rangle}$

a b c

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

$x = 0t + 0$ $y = 5t + 0$ $z = 1t + 0$

$x = 0$ $y = 5t$ $z = t$

4. $\vec{r}(t) = \langle 2\cos t, 2\sin t, 3\rangle$ $P(\sqrt{3}, 1, 3)$

$x_1 \; y_1 \; z_1$

$2\cos t = \sqrt{3}$ $2\sin t = 1$ $3 = 3$

$\cos t = \dfrac{\sqrt{3}}{2}$ $\sin t = \dfrac{1}{2}$

so $t = \dfrac{\pi}{6}$

$\vec{r}\,'(t) = \langle -2\sin t, 2\cos t, 0\rangle$

$\vec{r}\,'(\frac{\pi}{6}) = \langle -2\sin\frac{\pi}{6}, 2\cos\frac{\pi}{6}, 0\rangle$

$= \langle -2(\frac{1}{2}), 2(\frac{\sqrt{3}}{2}), 0\rangle$

$= \langle -1, \sqrt{3}, 0\rangle$

$\|\vec{r}\,'(\frac{\pi}{6})\| = \sqrt{(-1)^2 + (\sqrt{3})^2 + 0^2}$

$= \sqrt{1+3}$

$= 2$

$\vec{T}(\frac{\pi}{6}) = \dfrac{\vec{r}\,'(\frac{\pi}{6})}{\|\vec{r}\,'(\frac{\pi}{6})\|} = \dfrac{\langle -1, \sqrt{3}, 0\rangle}{2} = \boxed{\dfrac{1}{2}\langle -1, \sqrt{3}, 0\rangle}$

a b c

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

$x = -1t + \sqrt{3}$ $y = \sqrt{3}t + 1$ $z = 0t + 3$

$x = -t + \sqrt{3}$ $y = \sqrt{3}t + 1$ $z = 3$