$r(t) = \langle 2, 3, 1 \rangle + t\langle 6, -2, 0 \rangle$

$r(t) = \langle 6t+2, -2t+3, 1 \rangle$

$r(t) = \langle \cos t, \sin t, 1 \rangle$

circle in $z=1$

$r(t) = \langle \cos t, \sin t, t \rangle$

$r(t) = \langle 2\cos t, \sin t, t \rangle$

Find a vector function for $0 \le t \le 1$

① from $\langle 2,3,1\rangle$ to $\langle 6,1,5\rangle$

$r(t) = \langle 2,3,1\rangle + t\langle 4,-2,4\rangle$

$= \langle 2+4t,\ 3-2t,\ 1+4t\rangle$

② from $\langle 6,1,5\rangle$ to $(2,3,1)$

$r(t) = \langle 6,1,5\rangle + t\langle -4,2,-4\rangle$

$r(t) = \langle 6-4t,\ 1+2t,\ 5-4t\rangle$

③ from $(6,1,5)$ to $(2,3,1)$, then back to $(6,1,5)$

$r(t) = \langle 16\left(t-\frac{1}{2}\right)^2+2,\ -8\left(t-\frac{1}{2}\right)^2+3,\ 16\left(t-\frac{1}{2}\right)^2+1\rangle$

$(6,1,5) + \sin(\pi t)(-4,2,-4)$

$r(t) = \langle t,\ t^2,\ t^3\rangle$

$\frac{dr}{dt} = \langle 1, 2t, 3t^2\rangle = r'(t)$

$T(t) = \frac{r'(t)}{|r'(t)|}$ * unit tangent

$T(t) = \frac{\langle 1,\ 2t,\ 3t^2\rangle}{\sqrt{1+4t^2+9t^4}}$

$= \left\langle \frac{1}{\sqrt{1+4t^2+9t^4}}, \frac{2t}{\sqrt{1+4t^2+9t^4}}, \frac{3t^2}{\sqrt{1+4t^2+9t^4}} \right\rangle$

$r(t) = \langle \cos t, \sin t, 6 \rangle$

$r'(t) = \langle -\sin t, \cos t, 0 \rangle$

$|r'(t)| = 1$

$T(t) = \langle -\sin t, \cos t, 0 \rangle$

$r''(t) = \langle -\cos t, -\sin t, 0 \rangle$