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1. $x = \cos t$, $y = \sin t$, $z = t^2 + 1$; $(1, 0, 1)$

$\cos t = 1$, $\sin t = 0$, $t^2 + 1 = 1$

$t = 0$

$r(t) = \langle \cos t, \sin t, t^2 + 1 \rangle$

$r'(t) = \langle -\sin t, \cos t, 2t \rangle$

when $t = 0$ $\Rightarrow$ $r'(t) = \langle 0, -1, 0 \rangle$

$\langle 1, 0, 1 \rangle + t \langle 0, -1, 0 \rangle = \langle 1, -t, 1 \rangle$

$x = 1$, $y = -t$, $z = 1$

2. $r'(t) = t\mathbf{i} + 2\mathbf{j} + (t+1)\mathbf{k}$

$\int r'(t) = \int t\mathbf{i}\, dt + \int 2\mathbf{j}\, dt + \int (t+1)\mathbf{k}\, dt$

$r(t) = \frac{1}{2}t^2 \mathbf{i} + 2t\mathbf{j} + (\frac{1}{2}t^2 + t)\mathbf{k} + C$

$r(0) = \mathbf{i} + \mathbf{j} + \mathbf{k} + C = \mathbf{i} + 2\mathbf{j} + 3\mathbf{k}$

$C = \mathbf{j} + 2\mathbf{k}$

$r(t) = \frac{1}{2}t^2 \mathbf{i} + 2t\mathbf{j} + (\frac{1}{2}t^2 + t)\mathbf{k} + \mathbf{j} + 2\mathbf{k}$

$= \frac{1}{2}t^2 \mathbf{i} + (2t+1)\mathbf{j} + (\frac{1}{2}t^2 + t + 2)\mathbf{k}$