Math241 **Quiz #3 (1:50-2:40pm)** **Fall 2024** **Name:**

1. Find a parametric equation of the tangent line to the curve $\mathbf{r}(t) = \langle e^t, 2t+2, \cos t \rangle$ at the point $P_0(1, 2, 1)$.

Solution. "One point" is given. All we need is "one direction". At P_0, $t = 0$. $\mathbf{r}'(t) = \langle e^t, 2, -\sin t \rangle$. This gives the information about "one direction":

$$\mathbf{v} = \mathbf{r}'(0) = \langle 1, 2, 0 \rangle$$

So the parametric equation of the tangent line is

$$\begin{cases} x = 1 + t \\ y = 2 + 2t \\ z = 1 + 0 \cdot t = 1 \end{cases}$$

2. Compute the length of the curve $\mathbf{r}(t) = \langle \cos t, \sin t, t \rangle$ over $0 \leq t \leq 2\pi$.

Solution. $\mathbf{r}'(t) = \rangle - \sin t, \cos t, 1 \rangle$ and

$$\|\mathbf{r}'(t)\| = \sqrt{\sin^2 t + \cos^2 t + 1} = \sqrt{2}$$

$$s = \int_0^{2\pi} \|\mathbf{r}'(t)\| dt = \int_0^{2\pi} \sqrt{2} dt = 2\sqrt{2}\pi$$