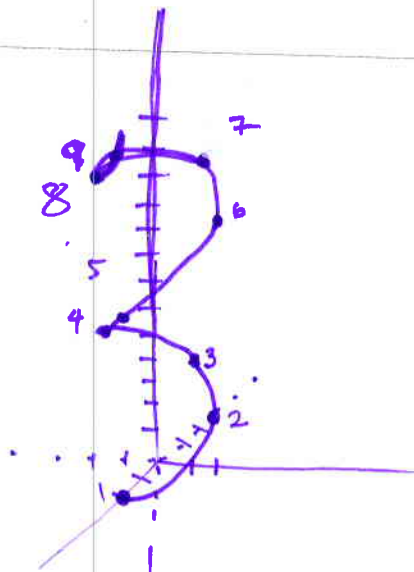


Instructions: Show all work. Use exact answers unless specifically asked to round. Be sure to complete all parts of each question.

1. Sketch the curve $\vec{r}(t) = 2 \cos t \hat{i} + 2 \sin t \hat{j} + t \hat{k}$ on the interval $0 \leq t \leq 4\pi$.

t	x	y	z
0	2	0	0
$\pi/2$	0	2	$\pi/2 \sim 1.57$
π	-2	0	$\pi \sim 3.14$
$3\pi/2$	0	-2	$3\pi/2 \sim 4.7$
2π	2	0	$2\pi \sim 6.28$
$5\pi/2$	0	2	$5\pi/2 \sim 7.8$
3π	-2	0	$3\pi \sim 9.4$
$7\pi/2$	0	-2	$7\pi/2 \sim 11$
4π	2	0	$4\pi \sim 12.56$



2. For the vector-valued functions $\vec{r}(t) = 2 \cos t \hat{i} + 2 \sin t \hat{j} + t \hat{k}$ and $\vec{u}(t) = t^3 \hat{i} + e^t \hat{j} - \frac{1}{t} \hat{k}$, perform the indicated operations.

a. $\vec{r}'(t) = -2 \sin t \hat{i} + 2 \cos t \hat{j} + \hat{k}$

b. $\int \vec{u}(t) dt = \left(\frac{1}{4}t^4 + C_1\right) \hat{i} + (e^t + C_2) \hat{j} + (-\ln t + C_3) \hat{k}$

c. $\vec{r}(t) \cdot \vec{u}(t) = 2t^3 \cos t + 2e^t \sin t - 1$

d. $\|\vec{r}(t)\| = \sqrt{4 \cos^2 t + 4 \sin^2 t + t^2} = \sqrt{4 + t^2}$