

13.3, number 1: Find the length of the curve

$$\vec{r}(t) = (2 \cos t) \vec{i} + (2 \sin t) \vec{j} + \sqrt{5t} \vec{k},$$

for $0 \leq t \leq \pi$.

Answer: The length of the curve is

$$\begin{aligned} \int_0^\pi |\vec{r}'(t)| dt &= \int_0^\pi | -2 \sin t \vec{i} + 2 \cos t \vec{j} + \sqrt{5} \vec{k} | dt \\ &= \int_0^\pi \sqrt{4 \sin^2 t + 4 \cos^2 t + 5} dt \\ &= \int_0^\pi \sqrt{9} dt \\ &= \boxed{3\pi}. \end{aligned}$$