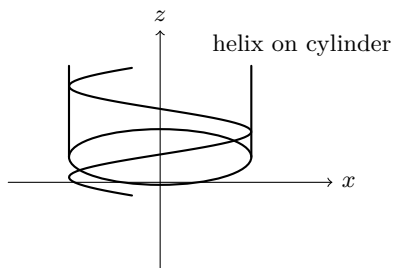


Question 9

Construct a vector function for a helix that lies on the cylinder $(x - 2)^2 + (y + 1)^2 = 9$, begins at $(5, -1, 0)$ when $t = 0$, rises 4 units during each counterclockwise revolution, and makes two revolutions.

Question 9 – Solution

Strategy Use the cylinder center and radius for the circular components, then choose a linear height matching the pitch.



Construction Counterclockwise motion from the rightmost point is

$$x = 2 + 3 \cos t, \quad y = -1 + 3 \sin t.$$

One revolution is $\Delta t = 2\pi$ and should raise z by 4, so $z = (2/\pi)t$. Two revolutions require $0 \leq t \leq 4\pi$. Thus

$$\boxed{\vec{r}(t) = \langle 2 + 3 \cos t, -1 + 3 \sin t, 2t/\pi \rangle}, \quad 0 \leq t \leq 4\pi.$$

Verification The cylinder equation is identically 9, and the final height is 8.