4. Practice Parameterizing

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Lecture due Oct 5, 2021 20:30 IST

Practice

Helix

3/3 points (graded)

In lecture, we saw the parametric equations for a helix whose “helical axis" was the z-axis. The “helical axis" is the line around which the particle orbits.

Find the parametric equations $\vec{r}\,(t) = \begin{pmatrix} x\,(t) \\ y\,(t) \\ z\,(t) \end{pmatrix}$ for a particle whose trajectory is a helix whose helical axis is the y-axis, and such that $\vec{r}\,(0) = \begin{pmatrix} 1 \\ 0 \\ 0 \end{pmatrix}$.

$x\,(t) =$ cos t ✔ **Answer:** cos t

$y\,(t) =$ t ✔ **Answer:** t

$z\,(t) =$ sin t ✔ **Answer:** sin t

Solution:

We need the point to trace out a circle in the x-z-plane. Therefore, either $x\,(t) = \cos t$ or $x\,(t) = \sin t$. Since we were given $x\,(0) = 1$ we choose $x\,(t) = \cos t$ and $z\,(t) = \sin t$. Then we choose $y\,(t) = t$ so that point moves along the y-axis.

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Answers are displayed within the problem

Crossing the plane

3/3 points (graded)

Let ℓ be the line in 3D that is parallel to the vector $\begin{pmatrix} 1 \\ -1 \\ -1 \end{pmatrix}$ and passing through the point $(1, 0, 1)$.

Find the point (x, y, z) where the line ℓ intersects the plane $12x + 19y - 4z = -10$.

$x =$ 7 ✔ **Answer:** 7

$y =$ -6 ✔ **Answer:** -6

$z =$ -5 ✔ **Answer:** -5

Solution:

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One possible parametric equation for ℓ is $\vec{r}\,(t) = \begin{pmatrix} 1+t \\ -t \\ 1-t \end{pmatrix}$. Now we solve the equation $\vec{r}\,(t) \cdot \begin{pmatrix} 12 \\ 19 \\ -4 \end{pmatrix} = -10$. In the end $t = 6$. Then the answer is $\vec{r}\,(6) = \begin{pmatrix} 7 \\ -6 \\ -5 \end{pmatrix}$.

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Answers are displayed within the problem

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