9. Practice Points in 3D

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Lecture due Oct 5, 2021 20:30 IST

Practice

Points in 3D

1/1 point (graded)

Let $P_0 = (1, 2, 5)$ and $P_1 = (-2, 1, 6)$. Consider the plane given by $-x - 3y + z = 12$.

Are P_0 and P_1 on the same side of the plane, opposite sides, or is one in the plane?

- (●) They are on the same side.
- ( ) They are on opposite sides.
- ( ) One is in the plane.

✔

Solution:

We can substitute the x, y, and z values of P_0 and P_1 into the equation for the plane. For P_0, the left-hand-side becomes $-1 - 3(2) + 5 = -2$. Since $-2 < 12$, we conclude that P_0 is not the plane.

For P_1, the left-hand-side becomes $2 - 3 + 6 = 5$. Since $5 < 12$, we conclude that P_1 is also not in the plane.

Since both points led to a < 12 result, both points are in the same "half-space" described by $-x - 3y + z < 12$.

Submit You have used 1 of 1 attempt

Answers are displayed within the problem

Points and Planes

3/3 points (graded)

Let $P_0 = (1, 2, 5)$ and $P_1 = (-2, 1, 6)$. Let $P(t)$ be the position of a moving point that goes from P_0 to P_1 at constant speed, with $P(0) = P_0$ and $P(1) = P_1$. Find equations for the position $P(t) = (x(t), y(t), z(t))$ of this moving point.

$x(t) =$ 1-3*t ✔ **Answer:** -3*t+1

$y(t) =$ 2-t ✔ **Answer:** -t+2

$z(t) =$ 5+t ✔ **Answer:** t+5

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Solution:

The desired trajectory may be written as a vector as:

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$$\vec{P}(t) = P_0 + t\overrightarrow{P_0P_1} \tag{6.87}$$

We can compute $\overrightarrow{P_0P_1} = \begin{pmatrix} -3 \\ -1 \\ 1 \end{pmatrix}$. Therefore we have

$$\begin{pmatrix} x(t) \\ y(t) \\ z(t) \end{pmatrix} = \begin{pmatrix} 1 \\ 2 \\ 5 \end{pmatrix} + t\begin{pmatrix} -3 \\ -1 \\ 1 \end{pmatrix} \tag{6.88}$$

Thus,

$$\begin{pmatrix} x(t) \\ y(t) \\ z(t) \end{pmatrix} = \begin{pmatrix} 1-3t \\ 2-t \\ 5+t \end{pmatrix} \tag{6.89}$$

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Line and Plane

1/1 point (graded)

Let $P_0 = (1,2,5)$ and $P_1 = (-2,1,6)$, and consider the plane given by $-x - 3y + z = 12$. Let $P(t)$ be the position of a moving point that goes from P_0 to P_1 at constant speed, with $P(0) = P_0$ and $P(1) = P_1$.

For what value of t does $P(t)$ enter the plane?

2 ✔ **Answer:** 2

Solution:

We need to solve the equation $-x(t) - 3y(t) + z(t) = 12$. If we substitute the values for $x(t), y(t), z(t)$ found in the previous problem, we have the equation:

$$\begin{aligned} -(1-3t) - 3(2-t) + (t+5) &= 12 && (6.90)\\ 7t - 2 &= 12 && (6.91)\\ 7t &= 14 && (6.92) \end{aligned}$$

Thus we obtain $t = 2$.

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Answers are displayed within the problem

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