12.5 Equations of Lines and Planes

In order to find the equation of a line, we need:

A)

B)

____________ of line L

\[ \mathbf{r}_0 = \mathbf{r} = \mathbf{P}_0P = \] ______________ of the line L

Find parametric equations of the line containing \((5,1,3)\) and \((3,-2,4)\).

In order to find the equation of a line, we need:

A)

B)
Two lines in 3 space can interact in 3 ways:

A) **Parallel Lines** -

B) **Intersecting Lines** -

C) **Skew Lines** -

their direction vectors are ___ parallel and there is ___ values of $t$ and $s$ that make the lines share the same point.

Determine whether the lines $L_1$ and $L_2$ are parallel, skew or intersecting. If they intersect, find the point of intersection.

\[ L_1 \]
\[ x = 3 - t \quad x = 8 + 2s \]
\[ y = 5 + 3t \quad y = -6 - 4s \]
\[ z = -1 - 4t \quad z = 5 + s \]
Determine whether the lines $L_1$ and $L_2$ are parallel, skew or intersecting. If they intersect, find the point of intersection.

$L_1 \quad L_2$

\begin{align*}
    x &= 4 + t \\
    y &= -8 - 2t \\
    z &= 12t \\
\end{align*}

\begin{align*}
    x &= 3 + 2s \\
    y &= -1 + s \\
    z &= -3 - 3s \\
\end{align*}

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**Planes**

In order to find the equation of a plane, we need:

A) 
B)

- $\mathbf{r} = \mathbf{r}_0 + t\mathbf{a}$
- $\mathbf{n}$
- $\mathbf{p}_0$
- $\mathbf{r}_0$
- $\mathbf{P}$
- $\mathbf{r} = \mathbf{n} \cdot \mathbf{P}$

this vector is called the ____________ to the plane

_____________ of the plane

_____________ of the plane

_____________ of the plane

3
Determine the equation of the plane that contains the lines $L_1$ and $L_2$.

$L_1$

\[
\begin{align*}
  x &= 3 - t \\
  y &= 5 + 3t \\
  z &= -1 - 4t \\
\end{align*}
\]

$L_2$

\[
\begin{align*}
  x &= 8 + 2s \\
  y &= -6 - 4s \\
  z &= 5 + s \\
\end{align*}
\]

In order to find the equation of a plane, we need:

A) a point on the plane

B) a vector that is orthogonal to the plane

\[ \mathbf{n} = \langle a, b, c \rangle \]
Two distinct planes in 3-space either are _________ or ______________.

Find the line of intersection of the two planes

\[ x - 2y + z = 0 \]
\[ 2x + 3y - 2z = 0 \]
If two planes intersect, then you can determine the angle between them.

\[ \angle \text{ between } \overrightarrow{n_1} = \angle \text{ between } \overrightarrow{n_2} \]

\[ \cos \theta = \]

Find the angle between the planes

\[ x - 2y + z = 0 \]
\[ 2x + 3y - 2z = 0 \]

Distance between a point and a plane:

\[ D = \]