Cartesian Form of Equation of a Straight Line

Examples

1. Find the Cartesian equation of the line with equation $\boldsymbol{r} = \begin{pmatrix} 4 \\ 3 \\ -2 \end{pmatrix} + \lambda \begin{pmatrix} -1 \\ 2 \\ 5 \end{pmatrix}$.

2. Find the Cartesian equation of the line with equation $\boldsymbol{r} = \begin{pmatrix} 2 \\ 5 \\ 0 \end{pmatrix} + \lambda \begin{pmatrix} 1 \\ 3 \\ -2 \end{pmatrix}$.

3. The Cartesian equation of a line is $y = 3x + 2$. Find the vector form of the equation of the line.

4. The Cartesian equation of a line is $\frac{x-2}{3} = \frac{y+5}{1} = \frac{z}{4}$. Find the vector form of the equation of the line.

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The Equation of a Plane

The equation of a plane can be written in vector form.

Let the point R, with position vector $\boldsymbol{r}$ be an arbitrary point on the plane ∏.

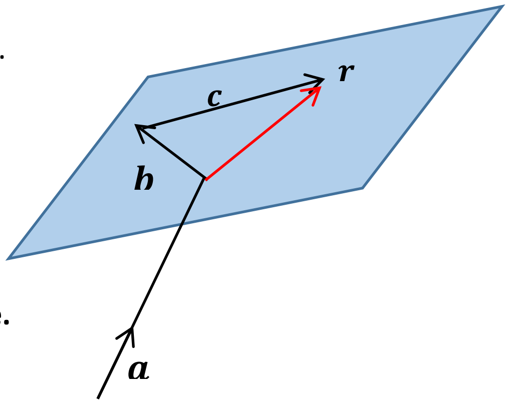
Suppose ∏ passes through the point A, with position vector **a**.

Let **b** and **c** be non-parallel vectors in the plane.

The position of the general point R can be found by

$$r = \boldsymbol{a} + \lambda\boldsymbol{b} + \mu\boldsymbol{c}$$

This is one of several ways of writing the equation of a plane.



Example

A plane Π passes through the points $A(2,6,-1),\ B(7,2,-1),\ C(4,2,5)$

Find the equation of the plane Π in the form $\boldsymbol{a} + \lambda\boldsymbol{b} + \mu\boldsymbol{c}$

Example

Verify that the point P with position vector $\begin{pmatrix} 2 \\ 2 \\ -1 \end{pmatrix}$ lies in the plane with vector equation

$$r = \begin{pmatrix} 3 \\ 4 \\ -2 \end{pmatrix} + \lambda \begin{pmatrix} 2 \\ 1 \\ 1 \end{pmatrix} + \mu \begin{pmatrix} 1 \\ -1 \\ 2 \end{pmatrix}$$

Test Your Understanding

[June 2015 Q5] The points A, B and C have position vectors $\begin{pmatrix} 1 \\ 3 \\ 2 \end{pmatrix}$, $\begin{pmatrix} -1 \\ 0 \\ 1 \end{pmatrix}$ and $\begin{pmatrix} 2 \\ 1 \\ 0 \end{pmatrix}$ respectively.

The plane Π contains the points A, B and C.

(c) Find a vector equation of Π **(4)**