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CS21BTECH11010

Question: : 3(a) : If $(x+2)$ and $(x+3)$ are factors of x^3+ax+b, find the values of $'a'$ and $'b'$.

Solution: According to the question :
$x+2$ and $x+3$ are factors of x^3+ax+b.
Then, -2 and -3 are solutions of the equation

$$x^3+ax+b=0 \tag{1}$$

On substituting $x=-2$ int the equation (1)

$$\implies (-2)^3+a(-2)+b=0$$

$$\implies 2a-b=-8 \tag{2}$$

On substituting $x=-3$ in the equation (1)

$$\implies (-3)^3+a(-3)+b=0$$

$$\implies 3a-b=-27 \tag{3}$$

The system of equations ,

$$2a-b=-8$$

$$3a-b=-27$$

can be re-written in matrix form as :

$$\begin{pmatrix}2 & -1\\ 3 & -1\end{pmatrix}\begin{pmatrix}a\\ b\end{pmatrix}=\begin{pmatrix}-8\\ -27\end{pmatrix}$$

Let, ith row is a matrix be represented as R_i .
The system of equations ,

$$a_1x+b_1y=c_1$$

$$a_2x+b_2y=c_2$$

if represented as : $\begin{pmatrix}a_1 & b_1 & c_1\\ a_2 & b_2 & c_2\end{pmatrix}$
Solution of such system of equations is x_1 & y_1 where matrix is reduced using row transformation to ;

$$\begin{pmatrix}1 & 0 & x_1\\ 0 & 1 & y_1\end{pmatrix}$$

For given system of equations,

$$\begin{pmatrix}2 & -1 & -8\\ 3 & -1 & -27\end{pmatrix}$$

Transformation 1 : $R_1 \to R_2 - R_1$

$$\implies \begin{pmatrix}1 & 0 & -19\\ 3 & -1 & -27\end{pmatrix}$$

Transformation 2 : $R_2 \to 3R_1 - R_2$

$$\implies \begin{pmatrix}1 & 0 & -19\\ 0 & 1 & -30\end{pmatrix}$$

$\therefore$ The value of $a=-19$ and value of $b=-30$.

Using values of a and b, equation (1) can be re-written as :

$$x^3-19x-30=0 \tag{4}$$

This can be verified by plotting the graph of the equation

$$y=x^3-19x-30 \tag{5}$$

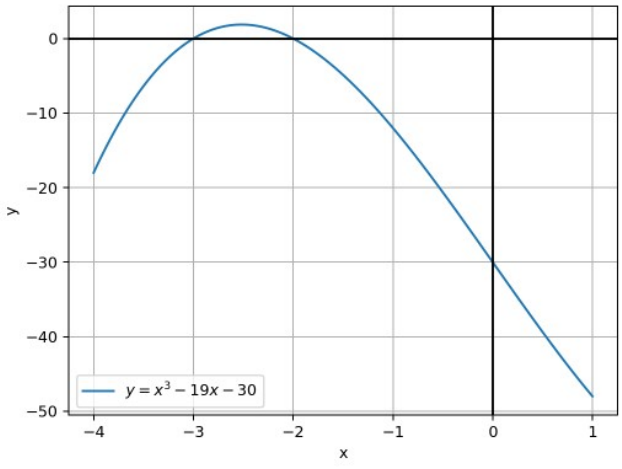

Fig. 1. Plot of $y=x^3-19x-30$ intersects X-axis at $x=-3$ & $x=-2$.