# I.C.S.E 10, 2018

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**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, $i$th 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 : $\left(\begin{array}{cc|c} a_1 & b_1 & c_1\\ a_2 & b_2 & c_2\end{array}\right)$
Solution of such system of equations is $x_1$ & $y_1$ where matrix is reduced using row transformation to ;

$$\left(\begin{array}{cc|c} 1 & 0 & x_1\\ 0 & 1 & y_1\end{array}\right)$$

For given system of equations,

$$\left(\begin{array}{cc|c} 2 & -1 & -8\\ 3 & -1 & -27\end{array}\right)$$

**Transformation 1 :** $R_1 \to R_2 - R_1$

$$\implies \left(\begin{array}{cc|c} 1 & 0 & -19\\ 3 & -1 & -27\end{array}\right)$$

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

$$\implies \left(\begin{array}{cc|c} 1 & 0 & -19\\ 0 & 1 & -30\end{array}\right)$$

$\therefore$ 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

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

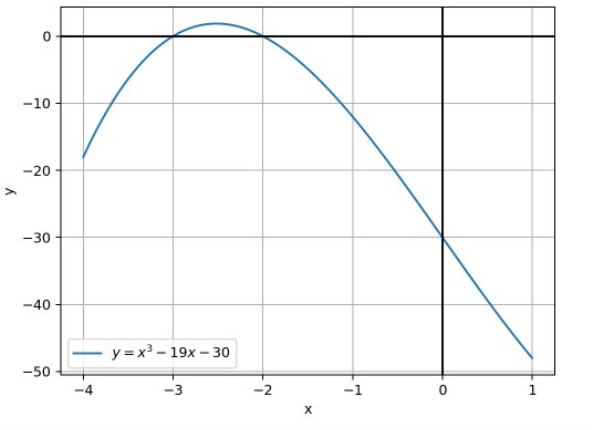


Fig. 1. Graph of equation. (5) intersects X-axis at $x=-3$ & $x=-2$

Output of python code which checks if both ’a’ and ’b’ are solutions of the equations (2) and (3)

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========== RESTART: C:\Users\DELL\Desktop\outpu.py ==========
Enter the value of 'a' : -19
Enter the value of 'b' : -30
Given values of 'a' and 'b' are solutions of equations 2a-b=-8 & 3a-b=-27
```

Fig. 2. Output of given code.