5.9.14

Namaswi-EE25BTECH11060

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On her birthday Seema decided to donate some money to children of an orphanage home. If there were 8 children less, every one would have got 10 Rupees more. However,if there were 16 children more, every one would have got 10 Rupees less. Using matrix method, find the number of children and the amount distributed by Seema. What values are reflected by Seemas decision ?

Theoritical Solution

Let, Number of children=c and Amount=a
Given,

$$ca = (c - 8)(a + 10) = (c + 16)(a - 10) \tag{1}$$

From 1,

$$10c - 8a = 80 \tag{2}$$
$$10c - 16a = -160 \tag{3}$$

Solution

From 2,

$$\begin{pmatrix} 5 \\ -4 \end{pmatrix}^{\top} \begin{pmatrix} c \\ a \end{pmatrix} = 40 \qquad (4)$$

From 3,

$$\begin{pmatrix} 5 \\ -8 \end{pmatrix}^{\top} \begin{pmatrix} c \\ a \end{pmatrix} = -80 \qquad (5)$$

$$\begin{pmatrix} 5 & -4 \\ 5 & -8 \end{pmatrix} \begin{pmatrix} c \\ a \end{pmatrix} = \begin{pmatrix} 40 \\ -80 \end{pmatrix} \qquad (6)$$

Solution

Forming argumented matrix

$$\begin{pmatrix} 5 & -4 & | & 40 \\ 5 & -8 & | & -80 \end{pmatrix} \tag{7}$$

Replace

$$R_2 \to R_2 - R_1$$

$$\begin{pmatrix} 5 & -4 & | & 40 \\ 0 & -4 & | & -120 \end{pmatrix} \tag{8}$$

Replace

$$R_2 \to R_2/-4$$

$$\begin{pmatrix} 5 & -4 & | & 40 \\ 0 & 1 & | & 30 \end{pmatrix} \tag{9}$$

Solution

Replace

$$R_1 \rightarrow R_1 + 4R_2$$

$$\begin{pmatrix} 5 & 0 & \bigg| & 160 \\ 0 & 1 & \bigg| & 30 \end{pmatrix} \tag{10}$$

Replace

$$R_1 \rightarrow R_1/5$$

$$\begin{pmatrix} 1 & 0 & \bigg| & 32 \\ 0 & 1 & \bigg| & 30 \end{pmatrix} \tag{11}$$

so,

$$c = 32 \quad a = 30 \tag{12}$$

C Code

```c
    #include <stdio.h>
int main() {
    double mat[2][3] = {
        {5, -4, 40},
        {5, -8, -80}
    };

    for (int j = 0; j < 3; j++) {
        mat[1][j] = mat[1][j] - mat[0][j];
    }
    for (int j = 0; j < 3; j++) {
        mat[1][j] = mat[1][j] / -4;
    }
```

C Code

```c
for (int j = 0; j < 3; j++) {
    mat[0][j] = mat[0][j] + 4 * mat[1][j];
}
for (int j = 0; j < 3; j++) {
    mat[0][j] = mat[0][j] / 5;
}
// Solution
double c = mat[0][2];
double a = mat[1][2];
printf("Solution:\n");
printf("Number of children (c) = %.0f\n", c);
printf("Amount (a) = %.0f\n", a);
return 0;
}
```

Python Code

```python
    import numpy as np
import matplotlib.pyplot as plt
# Define the lines as functions: m = f(c)
# Line 1: 5c - 4m = 40 -> m = (5c - 40)/4
# Line 2: 5c - 8m = -80 -> m = (5c + 80)/8

# Choose range for c
c = np.linspace(-20, 20, 400)

# Compute m for both lines
m1 = (5*c - 40)/4
m2 = (5*c + 80)/8
```

Python Code

```python
    # Plot the lines
plt.plot(c, m1, label=r'$5c - 4m = 40$', color='blue')
plt.plot(c, m2, label=r'$5c - 8m = -80$', color='red')

# Labels and title
plt.xlabel('c')
plt.ylabel('m')
plt.title('Graph of Two Lines')
plt.grid(True)
plt.legend()

# Show plot
plt.show()
```

C and Python Code

```python
    import ctypes
# Load the shared library
lib = ctypes.CDLL("./gauss_solver.so")
# Prepare C variables
c = ctypes.c_double()
a = ctypes.c_double()

# Call the function
lib.solve_system(ctypes.byref(c), ctypes.byref(a))

print(f"Number of children (c) = {c.value}")
print(f"Amount (a) = {a.value}")
```