```python
"""
                    *******GUASS ELIMINATION*******
"""  print("  print("  print("  print("  print("\n")
print("\n")  print("\n")  print("**GIVE INPUT IN THE
GIVEN BELOW FORMAT**""")**print("\nGUASS print(ELIMINATION***TO***SOLVE   ")
a13 ... a1n|b1")  print("a21 a22EQUATIONS**a2n|b2")  ********BUILT   ")
print("a31 a32 a33 .BY:HASANALI |..")    A.          MALVI*******   ")
p.r.i.n ta(n"n.|.b.n "p)rint("....  print("\n\n\n")   ************ROLL NO.:2103309**************      ")

import numpy as np n=int(input("Enter order
of square matrix:"))


                    #Using library to find determinant

                                        #Taking value of n from user


    #input of constants of equation
B=[]

    #Empty list to add rows
L=[]i
for in              #loop for each row
        range(n):

    R=[]#Emfpotryj list tion add element in row
    range(n):
                        #loop for each element in row


        print("Enter a"+str(i+1)+str(j+1)+" element:")
                                    #Taking input of each element and added to Row
        R.append(float(input()))
                #Adding row to matrix
    L.append(R)
                    #Taking input of constants
for b in range(n):

    print("Enter b"+str(b+1)+" :")
    B.append(float(input()))#Adding constant to a list



                    #Main Loop
for k in range(n-1):

                        #Assuming to be max
    Max=abs(L[k][k])
    for m in range(k,n-1):#Iterate through each column

                            #Checking Condition
        if abs(L[m+1][k])>Max:

                            #Changing Max value
            Max=L[m+1][k]
                    #Storing list to swap
            l=L[k]
            b=B[k]#Storing constants to swap
            B[k]=B[m+1]

                        #Exhchanging corresponding constant


                    #Exhchanging corresponding constant
            B[m+1]=b
            L[k]=L[m+1]#Exchanging rows


                    #Exchanging rows
            L[m+1]=l


                #Checking condition
    if L[k][k]==0:

                    #Going to next small matrix
        continue
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    else:#If condition not fulfilled

        for t in range(k+1,n):#Loop to do elimination

            if L[t][k]==0:#Checking condition

                continue #No need of operation

            else:#Condition not fulfilled

                mult=(L[t][k])/(L[k][k])#Multiplier

                L[t]=[round((L[t][j]-L[k][j]*(mult)),2) for j in range(n)] #Subtraction

                B[t]=round(B[t]-B[k]*mult,2) #Operation on constant



X=[] #List for solutions
a = np.array(L)
d = np.linalg.det(a)#Calculation of Determinant
if d==0:#Checking condition




    print("The solution does not exist.")
    #If condition is not fulfilled
else:
                        #Loop for iterating through each row
    for i in range(n):
            #Initializing sum for each row
        S=0
        for j in range(n-1,n-i-2,-1):#Iterating through non zero values of each row

                    #Checking condition
            if j==n-1-i:
                                            #Adding Solution
                X.append(round(((B[n-1-i]-S)/L[n-1-i][j]),2))
if d!=0:
            else:#Condition not satisfied

                                    #Adding Terms in each row other than the variable
                S=(S+L[n-1-i][j]*X[n-1-j])

        #Checking condition of determinant


    print("**COMPARE OUTPUT TO THE GIVEN BELOW FORMAT**")
    print("a11 a12 a13 ... a1n|x1    b1")
    print("a21 a22 a23 ... a2n|x2    b2")
     print("a31 a32 a33 ... a3n|x3 = b3")
    print("...    print("....  p|r.i.n t(".\.n"}}}") x  in
    range(n):#Iterating. .t.h raonung|hx ne ach bvna"l)ue of x




        print("x"+str(x+1)+" = ",end="")
                        #While sometimes it prints -0.0 so to avoid this
        if X[n-x-1]==-0.0:

            print(int(X[n-x-1]))

        else:#Else its okay if no problem with it


            print(X[n-x-1])

    print("**ABOVE SOLUTION IS APPROXIMATELY CALCULATED**")


"""
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                                        ROLL NO.:2103309

Correct Answer for Example with Exchanging Rows:

E1: $x_1 + x_2 + x_3 + x_4 + x_5 + x_6 + x_7 + x_8 + x_9 + x_{10} = 145$
E2: $x_1 + x_2 + x_3 + x_4 + x_5 + x_6 + x_7 + x_8 + x_9 + 2x_{10} = 150$
E3: $x_1 + x_2 + x_3 + x_4 + x_5 + x_6 + x_7 + x_8 + 2x_9 + x_{10} = 142$
E4: $x_1 + x_2 + x_3 + x_4 + x_5 + x_6 + x_7 + 2x_8 + x_9 + x_{10} = 126$
E5: $x_1 + x_2 + x_3 + x_4 + x_5 + x_6 + 2x_7 + x_8 + x_9 + x_{10} = 131$
E6: $x_1 + x_2 + x_3 + x_4 + x_5 + 2x_6 + x_7 + x_8 + x_9 + x_{10} = 128$
E7: $x_1 + x_2 + x_3 + x_4 + 2x_5 + x_6 + x_7 + x_8 + x_9 + x_{10} = 132$
E8: $x_1 + x_2 + x_3 + 2x_4 + x_5 + x_6 + x_7 + x_8 + x_9 + x_{10} = 134$
E9: $x_1 + x_2 + 2x_3 + x_4 + x_5 + x_6 + x_7 + x_8 + x_9 + x_{10} = 140$
E10: $x_1 + 2x_2 + x_3 + x_4 + x_5 + x_6 + x_7 + x_8 + x_9 + x_{10} = 147$

Variable values:

$x_1 = 22$ $x_2 = 15$

$x_3 = 9$ $x_4 = 7$ $x_5 = 3$ $x_6 = 6$ $x_7 = 1$ $x_8 = 17$ $x_9 = 25$ $x_{10} = 20$

```
a21 a22 a23 ... a2n|x2    b2
a31 a32 a33 ... a3n|b3 = b3
...         ...    |..    ..
...         ... ann|xn    bn



x1 = 3.05
x2 = 7.05
x3 = 10.33
x4 = 11.19
x5 = 12.2
x6 = 6.03
x7 = 1.83
x8 = 19.84
x9 = 14.73
x10 = 7.7
**ABOVE SOLUTION IS APPROXIMATELY CALCULATED**
>>>
```

Correct Answer for Example without Exchanging Rows:

E1: $2x_1 + x_2 + x_3 + x_4 + x_5 + x_6 + x_7 + x_8 + x_9 + x_{10} = 97$ E2: $x_1 + 2x_2 + x_3 + x_4 + x_5 + x_6 + x_7 + x_8 + x_9 + x_{10} = 101$ E3: $x_1 + x_2 + 2x_3 + x_4 + x_5 + x_6 + x_7 + x_8 + x_9 + x_{10} = 104$ E4: $x_1 + x_2 + x_3 + 2x_4 + x_5 + x_6 + x_7 + x_8 + x_9 + x_{10} = 105$ E5: $x_1 + x_2 + x_3 + x_4 + 2x_5 + x_6 + x_7 + x_8 + x_9 + x_{10} = 106$ E6: $x_1 + x_2 + x_3 + x_4 + x_5 + 2x_6 + x_7 + x_8 + x_9 + x_{10} = 100$ E7: $x_1 + x_2 + x_3 + x_4 + x_5 + x_6 + 2x_7 + x_8 + x_9 + x_{10} = 96$ E8: $x_1 + x_2 + x_3 + x_4 + x_5 + x_6 + x_7 + 2x_8 + x_9 + x_{10} = 114$ E9: $x_1 + x_2 + x_3 + x_4 + x_5 + x_6 + x_7 + x_8 + 2x_9 + x_{10} = 109$ E10: $x_1 + x_2 + x_3 + x_4 + x_5 + x_6 + x_7 + x_8 + x_9 + 2x_{10} = 102$

Variable values:

$x_1 = 3$ $x_2 = 7$ $x_3 = 10$ $x_4 = 11$ $x_5 = 12$ $x_6 = 2$ $x_7 = 1$ $x_8 = 20$ $x_9 = 15$ $x_{10} = 8$

```
a21 a22 a23 ... a2n|x2    b2
a31 a32 a33 ... a3n|x3 = b3
...          ...    |..    ..
...          ... ann|xn    bn



x1 = 22.13
x2 = 15.12
x3 = 9.41
x4 = 7.27
x5 = 3.27
x6 = 6.05
x7 = 0.76
x8 = 16.79
x9 = 24.57
x10 = 19.51
**ABOVE SOLUTION IS APPROXIMATELY CALCULATED**
>>>
```