15)

```
%inputing a matix of order 5x6
a=input('Enter a matrix and a should be 5x6 matrix')

b=a'% b is transpose of a

c=a*b %c is a  matrix made by multiplcation of a martix and it
      %     transpose
d=b*a %d is a  matrix made by multiplcation of a  transpose ofmartix and it
      %   original matrix
 disp('determinant of c is'); det(c)
  disp('determinant of d is'); det(d)
```

```
%inputing matrix of order 6x7
e=input('Enter a matrix and a should be 6x7 matrix')
f=e' % f is transpose of e
g=e*f  %g is a  matrix made by multiplcation of a martix and it
      %     transpose
h=f*e  %h is a  matrix made by multiplcation of a martix and it
      %     transpose
disp('determinant of g is'); det(g)
  disp('determinant of h is'); det(h)
```

OUTPUT

```
%inputing a matix of order 5x6
a=input('Enter a matrix and a should be 5x6  matrix')
```

```
a
```

1	2	3	4	5	6
2	5	8	6	4	5
7	B	9	4	5	6
4	5	6	1	2	3
7	B	4	2	0	3

```
b=a'% b is transpose of a
```

```
b
```

1	2	7	4	7
2	5	8	5	8
3	8	9	6	4
4	6	4	1	2
5	4	5	2	0
6	5	6	3	3

```
c=a*b %c is a  matrix made by multiplcation of a martix and it
```

```
c
```

91	UB	127	6fl	61
110	17B	208	110	113
127	20B	271	154	175
64	HB	154	91	103
61	US	175	103	142

```
      %      transpose
d-b*a %d is a  matrix made by multiplcation  of a  transpose ofmartix and  it
```

```
d
```

119	144	134	62	56	91
144	182	18B	91	8B	124
134	18B	2B6	]10	104	142
62	91	110	73	66	87
56	8B	104	66	7B	86
91	124	142	87	86	115

```
      %   original matrix
disp('determinant of c is'); det(c}
```

```
determinant of c is
ans = 17418 24
```

```
disp('determinant of d is'); det(d)
```

```
det erminant of d 1s
ans = -1.2917e - B9
```

WINDOW

OUTPUT

```
%inputing matrix of order 6x7
e=input('Enter a matrix and a should be 6x7 matrix')
```

```
e
     1     2     3     4     5     6
     2     5     8     6     4     5
     7     8     9     4     5     6

     7     8     4     3     0     3
```

```
f=e' % f is transpose of  e
```

```
f
     I     2     7     4     7
     2     5     8     5     8
     3     8     9     6     4
     4     6     4     1     2
     5     4     5     3     0
     6     5     6     3     3
```

```
g=e*f  %g is a  matrix made by multiplcation of a martix and  it
```

```
    91   11B   127    64    61
   116   17 B   26B   1IB   113
   127   2BB   271   1 54   175
    64    UB   154    91   103
    61   I]3   175   ]03   142
```

```
      %      transpose
h=f"e  %h is a  matrix made by multiplcation of a  martix and it
```

```
h
    119   14d   134    63    56    91
    144   182   18B    91    80   124
    134   180   206   *10   104   142
     62    91   HB     73    66    87
     56    80   104    66    70    86
     91   124   142    87    86   115
```

```
      %      transpose
disp('determinant of g is');  det(g)
```

```
de t enminant of g zs
ans =  17418Z4
```

```
  disp(' determinant of h is'); det(h)
```

```
de t enminant of h zs
ans = -1.2917e -09
```

WINDOW

16)

```
% Solve:
%0.543(10)-3 * X1 + 3.21 * X2 = 3.87
%4.32 * X1 + 2.31 * X2 = 4.92

a=[0.543*10^-3 3.21 ; 4.32 2.31  ]
b=[3.87;4.92]
aug=[a b] % taking is augumented matrix
rref(aug)
```

OUTPUT

```
a = 2×2
       0.0005    3.2100
       4.3200    2.3100

b = 2×1
       3.8700
       4.9200

aug = 2×3
       0.0005    3.2100    3.8700
       4.3200    2.3100    4.9200

ans = 2×3
       1.0000         0    0.4943
            0    1.0000    1.2055
```

This is final value of

So,
x1=0.4943
and
x2=1.2055

17)

```
a=input('Enter a 6x6 random matrix ')

b1=input('Enter a vector of b1 ')
aug1=[a b1]       % finding value of x for ax=b1
rref(aug1)
b2=input('Enter a vector of b2 ')
aug2=[a b2]        % finding value of x for ax=b2
rref(aug2)
b3=input('Enter a vector of b3 ')
aug3=[a b3]               % finding value of x for ax=b3
rref(aug3)
b4=input('Enter a vector of b4 ')
aug4=[a b4]            % finding value of x for ax=b4
rref(aug4)
b5=input('Enter a vector of b5 ')
aug5=[a b5]       % finding value of x for ax=b5
rref(aug5)
b6=input('Enter a vector of b6 ')
aug6=[a b6]           % finding value of x for ax=b6
rref(aug6)
```

OUTPUT

```
a=input('Enter a 6x6 random matrix ')
```

```
a = 6x6
     1     2     3     4     5     6
     2     5     8     6     4     5
     7     8     9     4     5     6
     4     5     6     1     2     3
     7     4     5     2     6     4
     7     8     2     1     0     3
```

```
b1=input('Enter a vector of b1 ')
```

```
b1 = 6x1
     1
     2
     3
     4
     5
     6
```

```
aug1=[a b1]        % finding value of x for ax=b1
```

```
aug1 = 6x7
     1     2     3     4     5     6     1
     2     5     8     6     4     5     2
     7     8     9     4     5     6     3
     4     5     6     1     2     3     4
     7     4     5     2     6     4     5
     7     8     2     1     0     3     6
```

```
rref(aug1)
```

```
ans = 6x7
    1.0000         0         0         0         0         0  -48.0000
         0    1.0000         0         0         0         0   66.9524
         0         0    1.0000         0         0         0  -18.6190
         0         0         0    1.0000         0         0  -19.8095
         0         0         0         0    1.0000         0   64.6667
         0         0         0         0         0    1.0000  -45.5238
```

This is value of X for b1

```
b2=input('Enter a vector of b2 ')
```

```
b2 = 6x1
     2
     5
     8
     7
     6
     4
```

```
aug2=[a b2]        % finding value of x for ax=b2
```

```
aug2 = 6x7
     1     2     3     4     5     6     2
     2     5     8     6     4     5     5
     7     8     9     4     5     6     8
     4     5     6     1     2     3     7
     7     4     5     2     6     4     6
     7     8     2     1     0     3     4
```

```
rref(aug2)
```

```
ans = 6x7
    1.0000         0         0         0         0         0  -17.3333
         0    1.0000         0         0         0         0   24.1429
         0         0    1.0000         0         0         0   -5.8095
         0         0         0    1.0000         0         0   -7.9048
         0         0         0         0    1.0000         0   23.3333
         0         0         0         0         0    1.0000  -16.0952
```

This is value of X for b2

```
b3=input('Enter a vector of b3 ')
```

```
b3 = 6x1
     7
     5
     1
     2
     3
     4
```

```
aug3=[a b3]                % finding value of x for ax=b3
```

```
aug3 = 6x7
     1     2     3     4     5     6     7
     2     5     8     6     4     5     5
     7     8     9     4     5     6     1
     4     5     6     1     2     3     2
     7     4     5     2     6     4     3
     7     8     2     1     0     3     4
```

```
rref(aug3)
```

```
ans = 6x7
    1.0000         0         0         0         0         0  -66.6667
         0    1.0000         0         0         0         0   91.7143
         0         0    1.0000         0         0         0  -26.0476
         0         0         0    1.0000         0         0  -26.5238
         0         0         0         0    1.0000         0   88.6667
         0         0         0         0         0    1.0000  -61.4762
```

This is value of X for b3

```
b4=input('Enter a vector of b4 ')
```

```
b4 = 6x1
     4
     5
     0
     0
     3
     2
```

```
aug4=[a b4]            % finding value of x for ax=b4
```

```
aug4 = 6x7
     1     2     3     4     5     6     4
     2     5     8     6     4     5     5
     7     8     9     4     5     6     0
     4     5     6     1     2     3     0
     7     4     5     2     6     4     3
     7     8     2     1     0     3     2
```

```
rref(aug4)
```

```
ans = 6x7
    1.0000         0         0         0         0         0  -54.3333
         0    1.0000         0         0         0         0   75.0952
         0         0    1.0000         0         0         0  -21.4286
         0         0         0    1.0000         0         0  -20.7143
         0         0         0         0    1.0000         0   73.0000
         0         0         0         0         0    1.0000  -51.6190
```

This is value of X for b4

```
b5=input('Enter a vector of b5 ')
```

```
b5 = 6x1
     0
     0
     0
     0
     0
     0
```

```
aug5=[a b5]        % finding value of x for ax=b5
```

```
aug5 = 6x7
     1     2     3     4     5     6     0
     2     5     8     6     4     5     0
     7     8     9     4     5     6     0
     4     5     6     1     2     3     0
     7     4     5     2     6     4     0
     7     8     2     1     0     3     0
```

```
rref(aug5)
```

```
ans = 6x7
     1     0     0     0     0     0     0
     0     1     0     0     0     0     0
     0     0     1     0     0     0     0
     0     0     0     1     0     0     0
     0     0     0     0     1     0     0
     0     0     0     0     0     1     0
```

This is value of X for b5

```
b6=input('Enter a vector of b6 ')
```

```
b6 = 6x1
     7
     0
     2
     0
     4
     0
```

```
aug6=[a b6]            % finding value of x for ax=b6
```

```
aug6 = 6×7
     1     2     3     4     5     6     7
     2     5     8     6     4     5     0
     7     8     9     4     5     6     2
     4     5     6     1     2     3     0
     7     4     5     2     6     4     4
     7     8     2     1     0     3     0
```

```
rref(aug6)
```

```
ans = 6×7
    1.0000         0         0         0         0         0    5.1667
         0    1.0000         0         0         0         0   -7.4524
         0         0    1.0000         0         0         0    1.4524
         0         0         0    1.0000         0         0    1.4762
         0         0         0         0    1.0000         0   -6.3333
         0         0         0         0         0    1.0000    6.3571
```

This is value of X for b6

ND WINDOW | 2 usages of "b6" found

18)

```
% Giving a matrix A which have infinitly many solution to b
% matrix =[2;0;2;1;5;1;1;6;5]

a=[1 2 3 4 5 6 7 8 ;
    7 8 9 4 5 6 0 0 ;
    1 2 3 4 5 6 4 9 ;
    2 4 6 8 10 12 1 5  ;
    4 5 7 8 6 51 10 6 ;
    1 5 78 4 5 6 2  7 ;
    7 8 9 5 1 2 2 8 ;
     3 6 9 12 15 18 21 24 ;
     5/2 5 15/2 10 25/2 15 35/2 20]
b=[2 ;0 ;2; 1; 5 ;1 ;1 ;6 ;5]
aug=[a b]
rref(aug)
```

OUTPUT

```
% Giving a matrix A which have infinitly many solution to b
% matrix =[2;0;2;1;5;1;1;6;5]

a=[1 2 3 4 5 6 7 8 ;
    7 8 9 4 5 6 0 0 ;
    1 2 3 4 5 6 4 9 ;
    2 4 6 8 10 12 1 5  ;
    4 5 7 8 6 51 10 6 ;
    1 5 78 4 5 6 2  7 ;
    7 8 9 5 1 2 2 8 ;
     3 6 9 12 15 18 21 24 ;
     5/2 5 15/2 10 25/2 15 35/2 20]
```

```
a = 9×8
    1.0000    2.0000    3.0000    4.0000    5.0000    6.0000    7.0000    8.0000
    7.0000    8.0000    9.0000    4.0000    5.0000    6.0000         0         0
    1.0000    2.0000    3.0000    4.0000    5.0000    6.0000    4.0000    9.0000
    2.0000    4.0000    6.0000    8.0000   10.0000   12.0000    1.0000    5.0000
    4.0000    5.0000    7.0000    8.0000    6.0000   51.0000   10.0000    6.0000
    1.0000    5.0000   78.0000    4.0000    5.0000    6.0000    2.0000    7.0000
    7.0000    8.0000    9.0000    5.0000    1.0000    2.0000    2.0000    8.0000
    3.0000    6.0000    9.0000   12.0000   15.0000   18.0000   21.0000   24.0000
    2.5000    5.0000    7.5000   10.0000   12.5000   15.0000   17.5000   20.0000
```

```
b=[2 ;0 ;2; 1; 5 ;1 ;1 ;6 ;5]
```

```
b = 9×1
     2
     0
     2
     1
     5
     1
     1
     6
     5
```

```
aug=[a b]
```

```
aug = 9×9
    1.0000    2.0000    3.0000    4.0000    5.0000    6.0000    7.0000    8.0000    2.0000
    7.0000    8.0000    9.0000    4.0000    5.0000    6.0000         0         0         0
    1.0000    2.0000    3.0000    4.0000    5.0000    6.0000    4.0000    9.0000    2.0000
    2.0000    4.0000    6.0000    8.0000   10.0000   12.0000    1.0000    5.0000    1.0000
    4.0000    5.0000    7.0000    8.0000    6.0000   51.0000   10.0000    6.0000    5.0000
    1.0000    5.0000   78.0000    4.0000    5.0000    6.0000    2.0000    7.0000    1.0000
    7.0000    8.0000    9.0000    5.0000    1.0000    2.0000    2.0000    8.0000    1.0000
    3.0000    6.0000    9.0000   12.0000   15.0000   18.0000   21.0000   24.0000    6.0000
    2.5000    5.0000    7.5000   10.0000   12.5000   15.0000   17.5000   20.0000    5.0000
```

```
rref(aug)
```

```
ans = 9×9
    1.0000         0         0         0         0   52.8350         0         0    4.5746
         0    1.0000         0         0         0  -55.0364         0         0   -4.7547
         0         0    1.0000         0         0    2.2014         0         0    0.1838
         0         0         0    1.0000         0    9.8350         0         0    0.6652
         0         0         0         0    1.0000    3.4587         0         0    0.3402
         0         0         0         0         0         0    1.0000         0    0.0652
         0         0         0         0         0         0         0    1.0000    0.1957
         0         0         0         0         0         0         0         0         0
         0         0         0         0         0         0         0         0         0
```

Since the augmented matrix 7 pivot entry . so,one free variable which is x6. So, infinitely many solution.

19)

```
a=input('Enter a square matrix ')

%matrix must be invertible means it is square and determinant not zer

b=length(a);
i=eye(b)% creating a indentity martrix of same order of a
aug=[a i] %Augumented a with identity matrix
rref(a) % calculatingg their reduced echelon form

rref(aug)
```

OUTPUT

```
a=input('Enter a square matrix ')
```

```
a = 2×2
     1     2
     3     8
```

```
%matrix must be invertible means it is square and determinant not zero

b=length(a);
i=eye(b)% creating a indentity martrix of same order of a
```

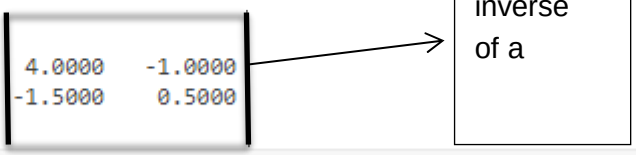
```
i = 2×2
     1     0
     0     1
```

```
aug=[a i] %Augumented a with identity matrix
```

```
aug = 2×4
     1     2     1     0
     3     8     0     1
```

```
rref(aug)
```

```
ans = 2×4
    1.0000         0    4.0000   -1.0000
         0    1.0000   -1.5000    0.5000
```



This is inverse of a

20)

```
a=[1 2 3;4 5 6] %constructing a martix a
[m, n]=size(a); % taking it size of a
b=zeros(m,1) % creating a matrix b such that it order is mx1
aug=[a b] % Augumented a and b to get x to reduced to row echleon
rref(aug)
```

OUTPUT

```
a = 2×3
     1     2     3
     4     5     6

b = 2×1
     0
     0

aug = 2×4
     1     2     3     0
     4     5     6     0

ans = 2×4
     1     0    -1     0
     0     1     2     0
```

20) Contd..>

$a|b$ is $\left[\begin{array}{ccc|c} 1 & 0 & -1 & 0 \\ 0 & 1 & 2 & 0 \end{array}\right]$ $x_3 \rightarrow$ free variable

let $x_3 = c$.

$\therefore x_2 + 2c = 0 \Rightarrow x_2 = -2c$

$x_1 - c = 0 \Rightarrow x_1 = c$

Now, $x = \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} = \begin{bmatrix} c \\ -2c \\ c \end{bmatrix}$

$\therefore$ Eq^n of x in R^3 is $\rightarrow c\begin{bmatrix} 1 \\ -2 \\ 1 \end{bmatrix}$ where $c \in R$

eT

Thank you