Contents


```
%Hashem Wahed
%Section 0132
%Matlab Project 2
```

Problem 1

```
format short;
% part a
A = [cos(pi/3) -sin(pi/3);
     sin(pi/3) cos(pi/3)];
v = [2;
     5];
rotates = A*v

% part b
B = [1/2, 3;
     0, 1];
v = [2;
     5];
scales = B*v

% part c

%first rotate and scale
rotationThenScale = B * rotates

%first scale then rotate
scaleThenRotation = A * scales

T1T2 = A*B
T2T1 = B*A

%part d
disp("The commutative property does not apply here.")
```

```
rotates =

   -3.3301
    4.2321


scales =

    16
```

```
     5


rotationThenScale =

   11.0311
    4.2321


scaleThenRotation =

    3.6699
   16.3564


T1T2 =

    0.2500    0.6340
    0.4330    3.0981


T2T1 =

    2.8481    1.0670
    0.8660    0.5000

The commutative property does not apply here.
```

Problem 2

```
format rat;

% part a
A = [7 4 -5;
     10 4 0;
     -5 -6 1];
inverseOfA = inv(A)

% part b

A = [7 4 -5 4;
     10 4 0 -8;
     -5 -6 1 3];
B = [1/47, 13/94, 5/47;
     -5/94 -9/94 -25/94;
     -10/47 11/94 -3/47];
B*A

% part c
X=[A eye(3)];
Y = rref(X)
% part d
inverse = Y(: ,5:7)
```

```
inverseOfA =

       1/47           13/94           5/47
      -5/94           -9/94         -25/94
     -10/47           11/94          -3/47


ans =

       1               0               0             -33/47
       0               1               0             -23/94
       *               0               1             -93/47


Y =

  Columns 1 through 5

       1               0               0             -33/47            1/47
       0               1               0             -23/94           -5/94
       0               0               1             -93/47          -10/47

  Columns 6 through 7

      13/94            5/47
      -9/94          -25/94
      11/94           -3/47


inverse =

       1/47           13/94           5/47
      -5/94           -9/94         -25/94
     -10/47           11/94          -3/47
```

Problem 3

```
format rat;
% part a
A = [6 4 2 2 4;
     2 2 -3 2 1;
     -1 -5 1 1 -3;
     -4 -6 1 0 -5;
     4 2 7 4 0]
% part b
determinantA = det(A)
% part c
disp("According to the properties of determinants, det(A^-1) is ")
disp("simply 1/det(A), thus det(A^-1) is -1/80")
% part d
B = [1 0 0 0 0;
     30 2 0 0 0;
     4 2 -2 0 0;
     3 7 7 2 0;
     7 -3 -8 1 1];
```

```
disp("A^-2B^2 can be split into (A^-1 * A^-1) * (B * B)")
disp("A^-1 equals -1/80 as proven earlier, and B = -8, here, due to")
disp("the matrix being lower traingular, thus we can just multiply the")
disp("diagonals. Combine it all, (-1/80)^2 * (-8)^2 = 64/6400, which is")
disp(" 1/100");
```

```
A =

     6     4     2     2     4
     2     2    -3     2     1
    -1    -5     1     1    -3
    -4    -6     1     0    -5
     4     2     7     4     0


determinantA =

   -80

According to the properties of determinants, det(A^-1) is
simply 1/det(A), thus det(A^-1) is -1/80
A^-2B^2 can be split into (A^-1 * A^-1) * (B * B)
A^-1 equals -1/80 as proven earlier, and B = -8, here, due to
the matrix being lower traingular, thus we can just multiply the
diagonals. Combine it all, (-1/80)^2 * (-8)^2 = 64/6400, which is
 1/100
```

Problem 4

```
%part a
A = [1 5 9;
     2 1 3;
     6 7 1];
B = [1 2 3;
     4 5 6;
     7 8 9];
ABsquared = (A*B)^2
AsquaredBsquared = (A^2)*(B^2)
%part b
A = [1 0 0;
     0 1 0;
     0 0 1];
B = [2 0 0;
     0 0 2;
     0 2 0];
ABsquared = (A*B)^2
AsquaredBsquared = (A^2)*(B^2)
%part c
disp("This statement is completely false. Say we have two matrices, M1")
disp("and M2, such that: ")
M1 = [1 0; 0 1]
M2 = [-1 0; 0 -1];
disp("While M1 and M2 are invertible, M1+M2 is not invertible, we can")
disp("prove this using determinants, as det(M1) and det(M2) != 0, but")
disp("det(M1 + M2) is 0.")
```

```
ABsquared =

   14403         17853         21303
    4758          5907          7056
    7758          9669         11580


AsquaredBsquared =

   10134         12411         14688
    5220          6408          7596
   11436         14076         16716


ABsquared =

       4             0             0
       0             4             0
       0             0             4


AsquaredBsquared =

       4             0             0
       0             4             0
       0             0             4

This statement is completely false. Say we have two matrices, M1
and M2, such that:

M1 =

       1             0
       0             1

While M1 and M2 are invertible, M1+M2 is not invertible, we can
prove this using determinants, as det(M1) and det(M2) != 0, but
det(M1 + M2) is 0.
```

Problem 5

```
format rat;
% part a
syms x;
A = [2*x+1 x x+2;
    x+2 -2*x -x-3;
    2*x-1 x 3*x]
%part b
solve(det(A), x)
disp("A does not have an inverse for 0, -15^(1/2)/5, and 15^(1/2)/5")
%part c
disp("the det(A^k) would not matter neither would it change anything")
disp("because det(A^k) = (det(A))^k. If we are finding out where it")
disp("does not have an inverse, it is the same answer to part b, ")
disp("because (det(A))^k = 0, square root both sides, it is det(A) = 0.")
```

```
A =

[2*x + 1,    x,   x + 2]
[  x + 2, -2*x, - x - 3]
[2*x - 1,    x,     3*x]


ans =

         0
-15^(1/2)/5
 15^(1/2)/5

A does not have an inverse for 0, -15^(1/2)/5, and 15^(1/2)/5
the det(A^k) would not matter neither would it change anything
because det(A^k) = (det(A))^k. If we are finding out where it
does not have an inverse, it is the same answer to part b,
because (det(A))^k = 0, square root both sides, it is det(A) = 0.
```
