Computer assignment - Linear Algebra

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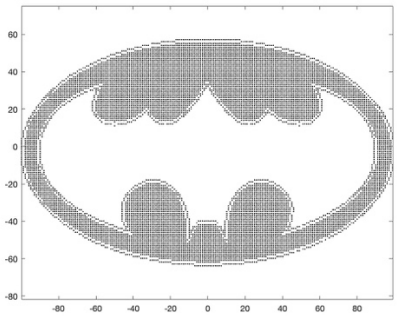
Imported code is marked in blue

Exercise 4.

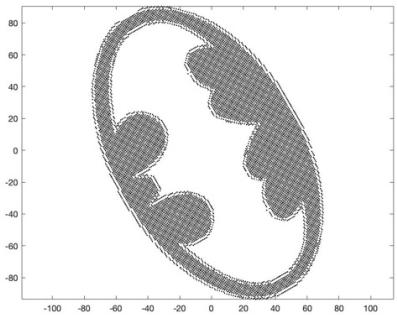
4a)

```
A = [1 0;0 -1];
C = A * B;
plot(C(1, :), C(2, :), 'k.','MarkerSize', 1)
axis equal
```



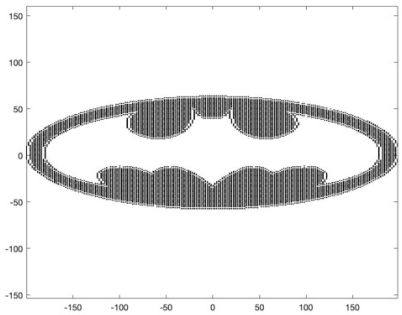
4b)

```
theta = 120*pi/180;
rot = [cos(theta) -sin(theta);sin(theta) cos(theta)];
E = rot * B;
plot(E(1, :), E(2, :), 'k.','MarkerSize', 1)
axis equal
```



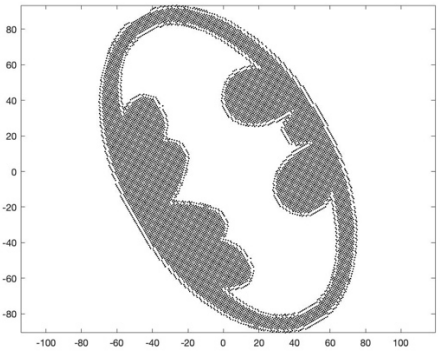
4c)

```
stretch = [2 0;0 1];
G = stretch * B;
plot(G(1, :), G(2, :), 'k.','MarkerSize', 1)
axis equal
```



4d)

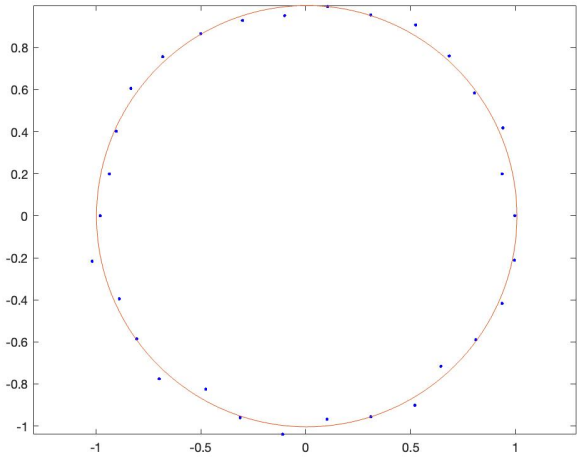
```
theta = 60*pi/180;
rot = [cos(theta) -sin(theta);sin(theta) cos(theta)];
refl_y = [-1 0;0 1];
C = rot * B;
C = refl_y * C;
plot(C(1, :), C(2, :), 'k.','MarkerSize', 1)
axis equal
```



Exercise 5.

```
rng(7)
n = 30;
center = [0 0];
radius = 1;
eps = 0.1;
r = eps * rand (n ,1) + radius - eps /2;

As = [center(1)+r.*cos(2*pi*(1: n )'/n) center(2)+r.*sin(2* pi *(1:
n)'/n)];
b = As(:,1).^2 + As(:,2).^2;
plot(As(:,1), As(:,2), "b.");
hold on
A = As * 2;
A(:,3) = ones;
c = A\b;

radius = sqrt(c(3)+(c(1))^2+(c(2)^2));

th = 0:pi/100:2*pi;
xunit = radius * cos(th) + c(1);
yunit = radius * sin(th) + c(2);
plot(xunit,yunit);
hold off
axis equal

MSE = sum((radius^2-((As(:,1)-c(1)).^2) - ((As(:,2)-c(2)).^2)).^2)/30
```

5a)
Least squared solution:
C = (0,0050, -0,0021, 1,0035)
5b)



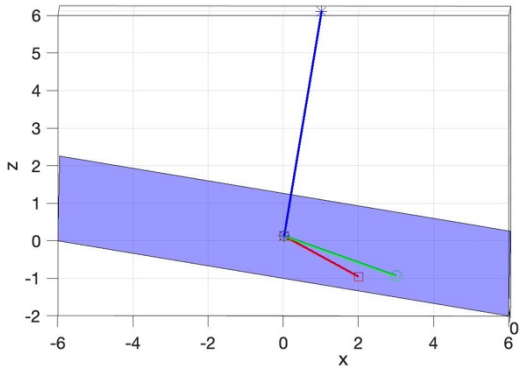
5c)
The MSE is 0,0033 and the most optimal answer is 0 because that would imply that the mean squared error being 0 thus its perfect on all points. But our solution gives us an 0,0033 mean squared error.

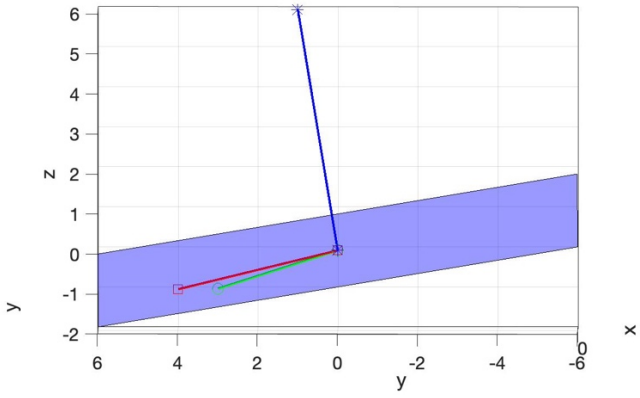
Exercise 6.

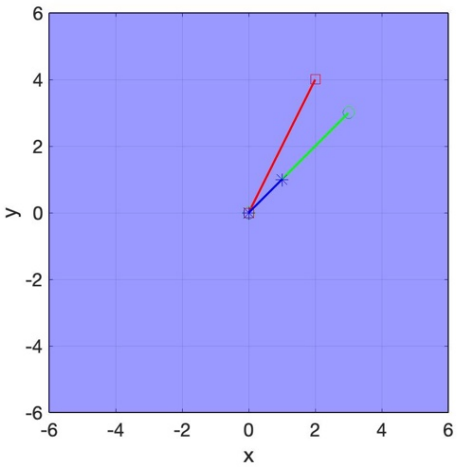
```
x1 = 6;
y1 = 6;
z1 = (-x1 - y1)/6;

x2 = 6;
y2 = -6;
z2 = (-x2 - y2)/6;

x3 = -6;
y3 = -6;
z3 = (-x3 - y3)/6;

x4 = -6;
y4 = 6;
z4 = (-x4 - y4)/6;

plot3([0 u(1)],[0 u(2)],[0 u(3)], 'g', 'LineWidth', 2)
hold on
plot3([0 v(1)],[0 v(2)],[0 v(3)], 'r', 'LineWidth', 2)
plot3([0 w(1)],[0 w(2)],[0 w(3)], 'b', 'LineWidth', 2)
hold on

plot3([0 u(1)],[0 u(2)],[0 u(3)],'g-o', 'MarkerSize', 10)
plot3([0 v(1)],[0 v(2)],[0 v(3)],'r-s', 'MarkerSize', 10)
plot3([0 w(1)],[0 w(2)],[0 w(3)],'b-*', 'MarkerSize', 10)
hold on

x = [x1;x2;x3;x4];
y = [y1;y2;y3;y4];
z = [z1;z2;z3;z4];
```

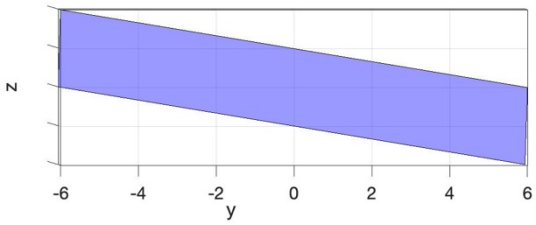
```
fill3(x, y, z, 'b', 'facealpha', 0.4)
hold off

xlabel("x")
ylabel("y")
zlabel("z")
grid on
box on
set(gca,'fontsize',16)
axis equal
```

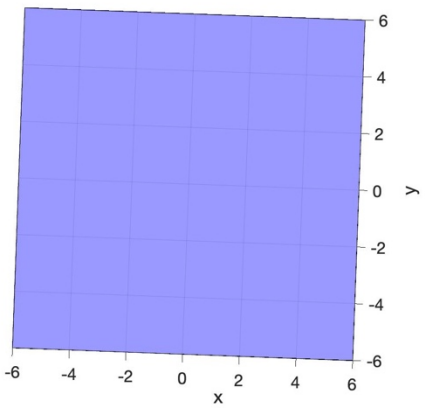
Figure from three different angles:

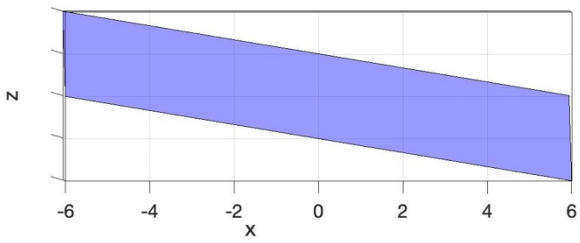


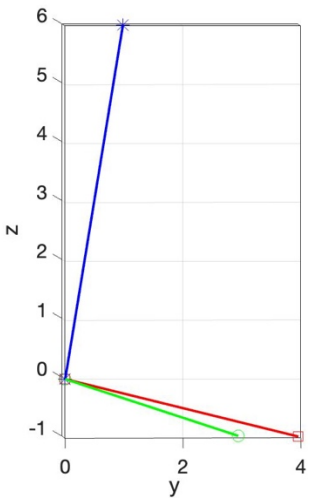


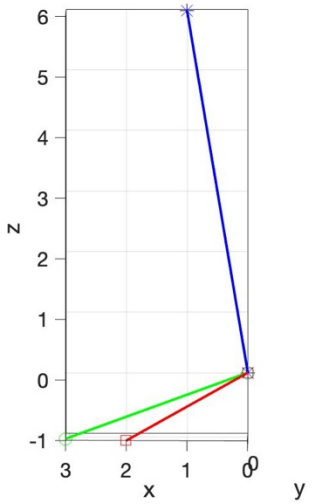


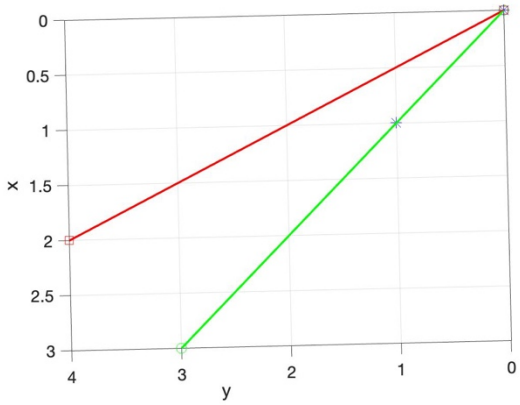







6
5
4
3
2
1
0
-1
z
0
2
4
y


6
5
4
3
2
1
0
-1
z
3
2
1
0
x
0
y


0
0.5
1
1.5
2
2.5
3
x
4
3
2
1
0
y