## Problem 5

***Option1:***

We have

There exist invertible affine map **a** such that .

There exist invertible affine map **b** such that

Now to prove that h is invertible affine map we need to find c such that:

Define c to be:

So:

*Therefore is invertible affine map.*

***Option2:***

*Define g and h:*

## Problem 6

We will show that G1, G2 and G3 definitions are satisfied:

*G1:*

*G2:*

*G3: define*

## Problem 7

Define:

*We found 2 matrices that belongs to GL(2) so that the Abelian definition is not satisfied, therefore GL(n) is not Abelian.*

## Problem 8

We will show that G1, G2 and G3 definitions are satisfied:

*G1:*

*G2:*

*G3:*

## Problem 9

Lets take a look at G2 definition:

## Problem 10

## Problem 11

We will show that G1, G2 and G3 definitions are satisfied:

*G1:*

*G2:*

*G3:*

## Problem 12

## Problem 13

We can see that the vector satisfies the following:

* for all
* for all

Therefore the matrix is the zero element.

## Problem14

A linear subspace of a linear space must contain the 0 element.

We know that if A belongs to a matrix group there exists

We also know that .

If the zero element will be chosen as A then

Therefore the zero element cannot be in the linear subset of the linear space, it cannot contain the zero element.

## Problem 15

We will show that G1, G2 and G3 definitions are satisfied:

*G1:*

*G2:*

*G3:*

Define:

## Problem 16

We will show that G1, G2 and G3 definitions are satisfied:

*G1:*

*G2:*

*G3:*

Define:

## Problem 17

Lets look at G2:

## Problem 22

## Problem 23

As we have seen in definition 9 that

Now we will show that

**Intuition:** if at (0,0) the value of is 1 and otherwise its 0, it means that it preserve only the pixel that the convolution is affecting, without any influence by other pixels (they are multiplied by 0).

Therefore