Numerical Analysis
2nd Homework

2nd Question

$$A = \begin{matrix} a_{11} & a_{12} & a_{13} \\ a_{21} & a_{22} & a_{23} \\ 0 & 0 & 1 \end{matrix}$$

$$\begin{matrix} a_{11} & a_{12} & a_{13} \\ a_{21} & a_{22} & a_{23} \\ 0 & 0 & 1 \end{matrix} * \begin{matrix} x \\ y \\ 1 \end{matrix} = \begin{matrix} x' \\ y' \\ 1 \end{matrix}$$

for x,y and x',y'

1,2	2,2
2,1	-1,4
3,1	-4,4

$$\begin{matrix} a_{11} & a_{12} & a_{13} \\ a_{21} & a_{22} & a_{23} \\ 0 & 0 & 1 \end{matrix} * \begin{matrix} 1 \\ 2 \\ 1 \end{matrix} = \begin{matrix} 2 \\ 2 \\ 1 \end{matrix}$$

$a_{11} + 2a_{12} + a_{13} = 2$
$a_{21} + 2a_{22} + a_{23} = 2$
$2a_{11} + a_{12} + a_{13} = -1$
$2a_{21} + a_{22} + a_{23} = 4$
$3a_{11} + a_{12} + a_{13} = -4$
$3a_{21} + a_{22} + a_{23} = 4$

So fro here we can get two matrices which we can use to get the values of unknowns in matrix A

$a_{11} + 2a_{12} + a_{13} = 2$ 1 2 1 | 2
$2a_{11} + a_{12} + a_{13} = -1$ ---- →   2 1 1 | -1
$3a_{11} + a_{12} + a_{13} = -4$ 3 1 1 | -4

$a_{21} + 2a_{22} + a_{23} = 2$ 1 2 1 | 2
$2a_{21} + a_{22} + a_{23} = 4$ ----- →   2 1 1 | 4
$3a_{21} + a_{22} + a_{23} = 4$ 3 1 1 | 4

Using Gaussian Elimination
$a_{11} = -3$, $a_{12} = 0$, $a_{13} = 5$
$a_{21} = 0$, $a_{22} = -2$, $a_{33} = 6$

so the resulting matrix is

$$A = \begin{matrix} -3 & 0 & 5 \\ 0 & -2 & 6 \\ 0 & 0 & 1 \end{matrix} \quad \text{so } AZ = I, \quad I = \begin{matrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{matrix} \quad Z = \begin{matrix} a & b & c \\ d & e & f \\ g & h & i \end{matrix} \quad AZ=I.$$

$$\begin{matrix} -3 & 0 & 5 \\ 0 & -2 & 6 \\ 0 & 0 & 1 \end{matrix} * \begin{matrix} a & b & c \\ d & e & f \\ g & h & i \end{matrix} = \begin{matrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{matrix}$$

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system of Equations after AZ=I

-3a + 5g =1, a = -1/3

 -2d + 6g =0 d = 0

g = 0

-3b + 5h =0, b = 0

 -2e + 6h =1 e = -1/2

h = 0

-3c+ 5i =0, c = 5/3

 -2f + 6i =0 f = 3

i= 1

$$Z = \begin{matrix} -1/3 & 0 & 5/3 \\ 0 & -1/2 & 3 \\ 0 & 0 & 1 \end{matrix}$$

So the transformation matrix is Z.