NOYAU et IMAGE

```
> A:=matrix(2,2,[-1/5,-2/5,3/5,6/5]);
```

$$A := \begin{bmatrix} \frac{-1}{5} & \frac{-2}{5} \\ \frac{3}{5} & \frac{6}{5} \end{bmatrix}$$

```
> evalm(A*A);
```

$$\begin{bmatrix} \frac{-1}{5} & \frac{-2}{5} \\ \frac{3}{5} & \frac{6}{5} \end{bmatrix}$$

```
> kernel(A);
```

$$\{[-2, 1]\}$$

```
> colspace(A);
```

$$\{[1, -3]\}$$

PUISSANCES DE MATRICES

```
> A:=(1/3)*matrix(3,3,[0,-2,-2,2,0,-1,2,1,0]);
```

$$A := \frac{1}{3}\begin{bmatrix} 0 & -2 & -2 \\ 2 & 0 & -1 \\ 2 & 1 & 0 \end{bmatrix}$$

```
> seq(evalm(A^k),k=2..5);
```

$$\begin{bmatrix} \frac{-8}{9} & \frac{-2}{9} & \frac{2}{9} \\ \frac{-2}{9} & \frac{-5}{9} & \frac{-4}{9} \\ \frac{2}{9} & \frac{-4}{9} & \frac{-5}{9} \end{bmatrix}, \begin{bmatrix} 0 & \frac{2}{3} & \frac{2}{3} \\ \frac{-2}{3} & 0 & \frac{1}{3} \\ \frac{-2}{3} & \frac{-1}{3} & 0 \end{bmatrix}, \begin{bmatrix} \frac{8}{9} & \frac{2}{9} & \frac{-2}{9} \\ \frac{2}{9} & \frac{5}{9} & \frac{4}{9} \\ \frac{-2}{9} & \frac{4}{9} & \frac{5}{9} \end{bmatrix}, \begin{bmatrix} 0 & \frac{-2}{3} & \frac{-2}{3} \\ \frac{2}{3} & 0 & \frac{-1}{3} \\ \frac{2}{3} & \frac{1}{3} & 0 \end{bmatrix}$$

```
> B:=matrix(2,2,[1,a,0,1]);
```

$$B := \begin{bmatrix} 1 & a \\ 0 & 1 \end{bmatrix}$$

```
> seq(evalm(B^k),k=2..5);
```

$$\begin{bmatrix} 1 & 2\,a \\ 0 & 1 \end{bmatrix}, \begin{bmatrix} 1 & 3\,a \\ 0 & 1 \end{bmatrix}, \begin{bmatrix} 1 & 4\,a \\ 0 & 1 \end{bmatrix}, \begin{bmatrix} 1 & 5\,a \\ 0 & 1 \end{bmatrix}$$

```
> J:=matrix(4,4,[1$16]);
```

$$J := \begin{bmatrix} 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 \end{bmatrix}$$

```
> seq(evalm(J^k),k=2..5);
```

$$\begin{bmatrix} 4 & 4 & 4 & 4 \\ 4 & 4 & 4 & 4 \\ 4 & 4 & 4 & 4 \\ 4 & 4 & 4 & 4 \end{bmatrix}, \begin{bmatrix} 16 & 16 & 16 & 16 \\ 16 & 16 & 16 & 16 \\ 16 & 16 & 16 & 16 \\ 16 & 16 & 16 & 16 \end{bmatrix}, \begin{bmatrix} 64 & 64 & 64 & 64 \\ 64 & 64 & 64 & 64 \\ 64 & 64 & 64 & 64 \\ 64 & 64 & 64 & 64 \end{bmatrix}, \begin{bmatrix} 256 & 256 & 256 & 256 \\ 256 & 256 & 256 & 256 \\ 256 & 256 & 256 & 256 \\ 256 & 256 & 256 & 256 \end{bmatrix}$$

INVERSE DE MATRICE

```
> A:=matrix(3,3,[1,0,a,1,a,-1,a,0,1]);
```

$$A := \begin{bmatrix} 1 & 0 & a \\ 1 & a & -1 \\ a & 0 & 1 \end{bmatrix}$$

```
> det(A);
```

$$a - a^3$$

MARKOV

```
> P:=matrix(3,3,[0.8,0.3,0.2,0.1,0.2,0.6,0.1,0.
> 5,0.2]);
```

$$P := \begin{bmatrix} .8 & .3 & .2 \\ .1 & .2 & .6 \\ .1 & .5 & .2 \end{bmatrix}$$

```
> X:=matrix(3,1,[1000,0,0]);
```

$$X := \begin{bmatrix} 1000 \\ 0 \\ 0 \end{bmatrix}$$

```
> evalm(P^7&*X);
```

$$\begin{bmatrix} 563.8874000 \\ 226.0691000 \\ 210.0435000 \end{bmatrix}$$

```
> I3:=matrix(3,3,[1,0,0,0,1,0,0,0,1]);
```

$$I3 := \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

```
> O3:=matrix(3,1,[0$3]);
```

$$\mathrm{O3} := \begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix}$$

```
> X:=linsolve((P-I3),O3);
```

$$X := \begin{bmatrix} \_t_{11} \\ .4117647058\ \_t_{11} \\ .3823529411\ \_t_{11} \end{bmatrix}$$