```
> with(LinearAlgebra) :
> L := Matrix([[0, 8, 15], [1/3, 0, 0], [0, 1/2, 0]])
```

$$L := \begin{bmatrix} 0 & 8 & 15 \\ \frac{1}{3} & 0 & 0 \\ 0 & \frac{1}{2} & 0 \end{bmatrix} \tag{1}$$

```
> population0 := Vector([1, 0, 1])
```

$$population0 := \begin{bmatrix} 1 \\ 0 \\ 1 \end{bmatrix} \tag{2}$$

```
> LinPowerOf10 := MatrixPower(L, 10)
```

$$LinPowerOf10 := \begin{bmatrix} \frac{97568}{243} & \frac{64700}{27} & \frac{221675}{72} \\ \frac{44335}{648} & \frac{97568}{243} & \frac{40730}{81} \\ \frac{4073}{243} & \frac{44335}{432} & \frac{400}{3} \end{bmatrix} \tag{3}$$

```
> population10 := evalf(MatrixVectorMultiply(LinPowerOf10, population0))
      #Чисельність популяції (по групах) в момент часу 10
```

$$population10 := \begin{bmatrix} 3480.333848 \\ 571.2577160 \\ 150.0946502 \end{bmatrix} \tag{4}$$

```
> λ, V := evalf(Eigenvectors(L))
```

$$\lambda, V := \begin{bmatrix} 1.981933665 \\ -0.9909668326 + 0.5285632635\,I \\ -0.9909668326 - 0.5285632635\,I \end{bmatrix}, \tag{5}$$

$$\begin{bmatrix} 23.56836625 & 4.215816838 - 6.285463953\,I & 4.215816838 + 6.285463953\,I \\ 3.963867318 & -1.981933665 + 1.057126527\,I & -1.981933665 - 1.057126527\,I \\ 1. & 1. & 1. \end{bmatrix}$$

```
> maxλ := max(Re(λ))#Швидкість зростання
```

$$maxλ := 1.981933665 \tag{6}$$

```
> for i from 1 to 3 do if λ[i] = maxλ then stablePopulation := Column(V, i);break end if end do:
      stablePopulation
```

(7)

$$\begin{bmatrix} 23.56836625 \\ 3.963867318 \\ 1. \end{bmatrix} \quad (7)$$

> $populationOf60, subPopulation := 0, population0$

$$populationOf60, subPopulation := 0, \begin{bmatrix} 1 \\ 0 \\ 1 \end{bmatrix} \quad (8)$$

> **while** $add(i, i = subPopulation) \leq 60$ **do** $populationOf60 := populationOf60 + 1;$
> $subPopulation := MatrixVectorMultiply(L, subPopulation)$ **end do**: $populationOf60$
> *#Момент часу, коли загальна кількість особин перевищить 60*

$$5 \quad (9)$$

>