

Jordansche Normalform

$$\begin{pmatrix} \lambda_1 & 1 & 0 & \cdots & 0 \\ 0 & \lambda_1 & 1 & \cdots & 0 \\ \vdots & & \ddots & \ddots & \vdots \\ \vdots & & & \lambda_1 & 1 \\ 0 & \cdots & \cdots & 0 & \lambda_1 \end{pmatrix}$$

$$B^{-1} \cdot A \cdot B = \begin{pmatrix} J_1 & & & & 0 \\ & J_2 & & & \\ & & \ddots & & \\ & & & J_\ell & \\ & & & & \ddots \\ 0 & & & & & J_m \end{pmatrix}$$

Jordansche Normalform

$$\begin{pmatrix} \lambda_2 & 1 & 0 & \cdots & 0 \\ 0 & \lambda_2 & 1 & \cdots & 0 \\ \vdots & & \ddots & \ddots & \vdots \\ \vdots & & & \lambda_2 & 1 \\ 0 & \cdots & \cdots & 0 & \lambda_2 \end{pmatrix}$$

$$B^{-1} \cdot A \cdot B = \begin{pmatrix} J_1 & & & & 0 \\ & J_2 & & & \\ & & \ddots & & \\ & & & J_\ell & \\ & & & & \ddots \\ 0 & & & & & J_m \end{pmatrix}$$

Jordansche Normalform

$$B^{-1} \cdot A \cdot B = \begin{pmatrix} J_1 & & & & 0 \\ & J_2 & & & \\ & & \ddots & & \\ & & & J_\ell & \\ 0 & & & & \ddots & \\ & & & & & J_m \end{pmatrix}$$

$$\begin{pmatrix} \lambda_\ell & 1 & 0 & \cdots & 0 \\ 0 & \lambda_\ell & 1 & \cdots & 0 \\ \vdots & & \ddots & \ddots & \vdots \\ \vdots & & & \lambda_\ell & 1 \\ 0 & \cdots & \cdots & 0 & \lambda_\ell \end{pmatrix}$$

Jordansche Normalform

$$\begin{pmatrix} \lambda_\ell & 1 & 0 & \cdots & 0 \\ 0 & \lambda_\ell & 1 & \cdots & 0 \\ \vdots & & \ddots & \ddots & \vdots \\ \vdots & & & \lambda_\ell & 1 \\ 0 & \cdots & \cdots & 0 & \lambda_\ell \end{pmatrix}$$

Jordan-Kasten

$$B^{-1} \cdot A \cdot B = \begin{pmatrix} J_1 & & & & 0 \\ & J_2 & & & \\ & & \ddots & & \\ & & & J_\ell & \\ & & & & \ddots \\ 0 & & & & & J_m \end{pmatrix}$$

Jordansche Normalform

$$B^{-1} \cdot A \cdot B = \begin{pmatrix} J_1 & & & 0 \\ & J_2 & & \\ & & \ddots & \\ & & & J_\ell \\ 0 & & & & \ddots & & J_m \end{pmatrix}$$

$$\begin{pmatrix} \lambda_\ell & 1 & 0 \\ 0 & \lambda_\ell & 1 \\ 0 & 0 & \lambda_\ell \end{pmatrix}$$

Jordan-Kasten

J_ℓ

Jordansche Normalform

$$B^{-1} \cdot A \cdot B = \begin{pmatrix} J_1 & & & & 0 \\ & J_2 & & & \\ & & \ddots & & \\ & & & J_\ell & \\ 0 & & & & \ddots & \\ & & & & & & J_m \end{pmatrix}$$

$$\begin{pmatrix} \lambda_\ell & 1 \\ 0 & \lambda_\ell \end{pmatrix}$$

Jordan-Kasten

Jordansche Normalform

Spezialfall:

$$(\lambda_\ell)$$

Jordan-Kasten

$$B^{-1} \cdot A \cdot B = \begin{pmatrix} J_1 & & & & 0 \\ & J_2 & & & \\ & & \ddots & & \\ & & & J_\ell & \\ 0 & & & & \ddots & \\ & & & & & & J_m \end{pmatrix}$$

Jordansche Normalform — Beispiel

$$\begin{pmatrix} -3 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 2 & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 2 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 2 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 2 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 2 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 2 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 5 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 5 \end{pmatrix}$$

Jordansche Normalform — Beispiel

$$\begin{pmatrix} -3 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 2 & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 2 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 2 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 2 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 2 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 2 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 5 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 5 \end{pmatrix}$$

Jordansche Normalform — Beispiel

$$\begin{pmatrix} -3 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 2 & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 2 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 2 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 2 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 2 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 2 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 5 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 5 \end{pmatrix}$$

Jordansche Normalform — Beispiel

$$\begin{pmatrix} -3 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 2 & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 2 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 2 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 2 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 2 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 2 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 5 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 5 \end{pmatrix}$$

Jordansche Normalform — Beispiel

$$\begin{pmatrix} -3 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 2 & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 2 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 2 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 2 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 2 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 2 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 5 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 5 \end{pmatrix}$$

Jordansche Normalform — Beispiel

$$\begin{pmatrix} -3 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 2 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 2 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 2 & 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 2 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 2 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 2 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 5 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 5 \end{pmatrix}$$

Jordansche Normalform — Beispiel

$$\begin{pmatrix} -3 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 2 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 2 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 2 & 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 2 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 2 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 2 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 5 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 5 \end{pmatrix}$$

Jordansche Normalform — Beispiel

$$\begin{pmatrix} -3 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 2 & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 2 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 2 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 2 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 2 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 2 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 5 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 5 \end{pmatrix}$$

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$$\begin{pmatrix} -3 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 2 & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 2 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 2 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 2 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 2 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 2 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 5 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 5 \end{pmatrix}$$

Jordansche Normalform — Beispiel

	-3	0	0	0	0	0	0	0	0	0	0	
	0	0	1	0	0	0	0	0	0	0	0	
	0	0	0	0	0	0	0	0	0	0	0	
	0	0	0	2	1	0	0	0	0	0	0	
	0	0	0	0	2	0	0	0	0	0	0	
	0	0	0	0	0	2	1	0	0	0	0	
	0	0	0	0	0	0	2	1	0	0	0	
	0	0	0	0	0	0	0	0	2	1	0	
	0	0	0	0	0	0	0	0	0	2	0	
	0	0	0	0	0	0	0	0	0	0	5	
	0	0	0	0	0	0	0	0	0	0	0	5

Eigenwert	Vielfachheit alg.	Vielfachheit geom.
$\lambda = -3$	1	1

Jordansche Normalform — Beispiel

-3	0	0	0	0	0	0	0	0	0	0	0
0	0	1	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	2	1	0	0	0	0	0	0	0
0	0	0	0	2	0	0	0	0	0	0	0
0	0	0	0	0	2	1	0	0	0	0	0
0	0	0	0	0	0	2	1	0	0	0	0
0	0	0	0	0	0	0	0	2	1	0	0
0	0	0	0	0	0	0	0	0	0	5	0
0	0	0	0	0	0	0	0	0	0	0	5

Eigenwert	Vielfachheit	
	alg.	geom.
$\lambda = -3$	1	1
$\lambda = 0$	2	1

Jordansche Normalform — Beispiel

-3	0	0	0	0	0	0	0	0	0	0	0
0	0	1	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	2	1	0	0	0	0	0	0	0
0	0	0	0	2	0	0	0	0	0	0	0
0	0	0	0	0	2	1	0	0	0	0	0
0	0	0	0	0	0	2	1	0	0	0	0
0	0	0	0	0	0	0	0	2	0	0	0
0	0	0	0	0	0	0	0	0	5	0	0
0	0	0	0	0	0	0	0	0	0	5	0

Eigenwert	Vielfachheit alg.	geom.
$\lambda = -3$	1	1
$\lambda = 0$	2	1
$\lambda = 2$	6	2

Jordansche Normalform — Beispiel

-3	0	0	0	0	0	0	0	0	0	0	0
0	0	1	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	2	1	0	0	0	0	0	0	0
0	0	0	0	2	0	0	0	0	0	0	0
0	0	0	0	0	2	1	0	0	0	0	0
0	0	0	0	0	0	2	1	0	0	0	0
0	0	0	0	0	0	0	0	2	0	0	0
0	0	0	0	0	0	0	0	0	5	0	0
0	0	0	0	0	0	0	0	0	0	5	0

Eigenwert	Vielfachheit	
	alg.	geom.
$\lambda = -3$	1	1
$\lambda = 0$	2	1
$\lambda = 2$	6	2
$\lambda = 5$	2	2