

Rozklady čtvercových matic (lin. transformací)

DÚ:

Spočtete **alespoň 7 příkladů** a z toho:

1.) Alespoň **1 příklad** ze série: **1 - 4**

2.) ... **3 příklady** ze série: **5 - 32**

(z toho min. 1 a max. 2 z př. označ. červeně.)

3.) ... **3 příklady** ze série: **33 - 40**

(z toho 1 bude př. 40)

Cvičení

$$1. \begin{pmatrix} 1 & 5 \\ 2 & 4 \end{pmatrix} \quad 2. \begin{pmatrix} 1 & -1 \\ 1 & -1 \end{pmatrix} \quad 3. \begin{pmatrix} 0 & 1 \\ -2 & 2 \end{pmatrix} \quad 4. \begin{pmatrix} -7 & 9 \\ -1 & -1 \end{pmatrix}$$

$$5. \begin{pmatrix} 3 & 7 & -3 \\ -2 & -5 & 2 \\ -4 & -10 & 3 \end{pmatrix} \quad 15. \begin{pmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ 0 & 1 & 0 \end{pmatrix} \quad 25. \begin{pmatrix} 2 & -1 & -1 \\ 2 & -1 & -2 \\ -1 & 1 & 2 \end{pmatrix}$$

$$6. \begin{pmatrix} 4 & 5 & -2 \\ -2 & -2 & 1 \\ -1 & -1 & 1 \end{pmatrix} \quad 16. \begin{pmatrix} 2 & -1 & -1 \\ 0 & -1 & 0 \\ 0 & 2 & 1 \end{pmatrix} \quad 26. \begin{pmatrix} -3 & 1 & 0 \\ 0 & -2 & 1 \\ 1 & -1 & -1 \end{pmatrix}$$

$$7. \begin{pmatrix} 4 & 8 & 10 \\ -2 & -5 & -8 \\ 1 & 4 & 7 \end{pmatrix} \quad 17. \begin{pmatrix} -1 & -2 & 2 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix} \quad 27. \begin{pmatrix} 1 & -3 & 4 \\ 4 & -7 & 8 \\ 6 & -7 & 7 \end{pmatrix}$$

$$8. \begin{pmatrix} 3 & -2 & 2 \\ 4 & -3 & 8 \\ 2 & -2 & 6 \end{pmatrix} \quad 18. \begin{pmatrix} 3 & 5 & 3 \\ -4 & -9 & -6 \\ 6 & 15 & 10 \end{pmatrix} \quad 28. \begin{pmatrix} 4 & -5 & 7 \\ 1 & -4 & 9 \\ -4 & 0 & 5 \end{pmatrix}$$

$$9. \begin{pmatrix} 3 & -2 & 3 \\ 2 & -1 & 3 \\ 0 & 0 & 1 \end{pmatrix} \quad 19. \begin{pmatrix} 1 & 2 & -2 \\ 2 & 1 & 2 \\ 0 & 0 & -1 \end{pmatrix} \quad 29. \begin{pmatrix} -1 & 1 & 1 \\ -5 & 21 & 17 \\ 6 & -26 & -21 \end{pmatrix}$$

$$10. \begin{pmatrix} -1 & 0 & -1 \\ 2 & -3 & 3 \\ 1 & -1 & 1 \end{pmatrix} \quad 20. \begin{pmatrix} 13 & -28 & 3 \\ 4 & -8 & 1 \\ -1 & 4 & 1 \end{pmatrix} \quad 30. \begin{pmatrix} 1 & 1 & -1 \\ -3 & -3 & 3 \\ -2 & -2 & 2 \end{pmatrix}$$

$$11. \begin{pmatrix} 0 & -2 & 3 \\ 2 & -4 & 3 \\ 0 & 0 & -2 \end{pmatrix} \quad 21. \begin{pmatrix} 7 & -12 & 6 \\ 10 & -19 & 10 \\ 12 & -24 & 13 \end{pmatrix} \quad 31. \begin{pmatrix} 13 & 16 & 16 \\ -5 & -7 & -6 \\ -6 & -8 & -7 \end{pmatrix}$$

$$12. \begin{pmatrix} -3 & 4 & -5 \\ -4 & 3 & -6 \\ -2 & 1 & -3 \end{pmatrix} \quad 22. \begin{pmatrix} 1 & -1 & 0 \\ 0 & 1 & -4 \\ -1 & 0 & 4 \end{pmatrix} \quad 32. \begin{pmatrix} 0 & 3 & 3 \\ -1 & 8 & 6 \\ 2 & -14 & -10 \end{pmatrix}$$

$$13. \begin{pmatrix} 0 & 1 & 1 \\ 1 & 0 & 1 \\ 1 & 1 & 0 \end{pmatrix} \quad 23. \begin{pmatrix} 4 & 4 & 0 \\ -1 & 0 & 0 \\ -2 & -4 & 2 \end{pmatrix}$$

$$14. \begin{pmatrix} 2 & 1 & 0 \\ 1 & 3 & -1 \\ -1 & 2 & 3 \end{pmatrix} \quad 24. \begin{pmatrix} 0 & 1 & 1 \\ 2 & 0 & -2 \\ 2 & 2 & 0 \end{pmatrix}$$

$$33. \begin{pmatrix} 2 & 0 & 1 & 3 \\ 0 & 2 & 2 & 1 \\ 0 & 0 & 2 & -1 \\ 0 & 0 & 0 & 2 \end{pmatrix}$$

$$34. \begin{pmatrix} 4 & 0 & 0 & 0 \\ 0 & 6 & -4 & 0 \\ 0 & 1 & 2 & 0 \\ 0 & 0 & 0 & 4 \end{pmatrix}$$

$$35. \begin{pmatrix} 3 & 2 & 0 & -2 \\ 0 & 3 & -2 & 0 \\ 0 & 2 & 3 & 0 \\ 2 & 0 & -2 & 3 \end{pmatrix}$$

$$36. \begin{pmatrix} 3 & -1 & 0 & 0 \\ 1 & 1 & 0 & 0 \\ 3 & 0 & 5 & -3 \\ 4 & -1 & 3 & -1 \end{pmatrix}$$

$$37. \begin{pmatrix} 0 & 0 & 0 & 1 \\ -1 & 0 & 1 & 0 \\ 0 & -1 & 0 & 1 \\ 0 & 0 & -1 & 0 \end{pmatrix}$$

$$38. \begin{pmatrix} 1 & 2 & 3 & 4 \\ 0 & 1 & 2 & 3 \\ 0 & 0 & 1 & 2 \\ 0 & 0 & 0 & 1 \end{pmatrix}$$

$$39. \begin{pmatrix} 3 & -1 & 0 & 0 \\ 1 & 1 & 0 & 0 \\ 0 & 0 & 3 & -1 \\ 0 & 0 & 1 & 1 \end{pmatrix}$$

$$40. \begin{pmatrix} -16 & -17 & 87 & -108 \\ 8 & 9 & -42 & 54 \\ -3 & -3 & 16 & -18 \\ -1 & -1 & 6 & -8 \end{pmatrix}$$

$$41. \begin{pmatrix} 7 & 1 & -1 & 1 \\ -1 & 9 & -1 & 1 \\ 1 & -1 & 9 & -1 \\ 1 & -1 & 1 & 7 \end{pmatrix}$$

Výsledky

A značí původní matici, A_1 matici po prvním rozkladu, A_R reálnou matici po prvním rozkladu (je-li A_1 komplexní) a A_{JNT} matici v Jordanově normálním tvaru (tj. po druhém rozkladu).

1. $A_1 = A_{JNT} = \begin{pmatrix} 6 & 0 \\ 0 & -1 \end{pmatrix}$
2. $A_1 = A, A_{JNT} = \begin{pmatrix} 0 & 1 \\ 0 & 0 \end{pmatrix}$
3. $A_1 = A_{JNT} = \begin{pmatrix} 1-i & 0 \\ 0 & 1+i \end{pmatrix}, A_R = \begin{pmatrix} 1 & -1 \\ -1 & 1 \end{pmatrix}$
4. $A_1 = A, A_{JNT} = \begin{pmatrix} -4 & 1 \\ 0 & -4 \end{pmatrix}$
5. $A_1 = A_{JNT} = \begin{pmatrix} 1 & 0 & 0 \\ 0 & -i & 0 \\ 0 & 0 & i \end{pmatrix}, A_R = \begin{pmatrix} 1 & 0 & 0 \\ 0 & 0 & -1 \\ 0 & 1 & 0 \end{pmatrix}$
6. $A_1 = A, A_{JNT} = \begin{pmatrix} 1 & 0 & 0 \\ 1 & 1 & 0 \\ 0 & 1 & 1 \end{pmatrix}$
7. $A_1 = A_{JNT} = \begin{pmatrix} 1 & 0 & 0 \\ 0 & 2 & 0 \\ 0 & 0 & 3 \end{pmatrix}$
8. $A_1 = A_{JNT} = \begin{pmatrix} 1 & 0 & 0 \\ 0 & 2 & 0 \\ 0 & 0 & 3 \end{pmatrix}$
9. $A_1 = A, A_{JNT} = \begin{pmatrix} 1 & 0 & 0 \\ 1 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix}$
10. $A_1 = A, A_{JNT} = \begin{pmatrix} -1 & 0 & 0 \\ 1 & -1 & 0 \\ 0 & 1 & -1 \end{pmatrix}$
11. $A_1 = A, A_{JNT} = \begin{pmatrix} -2 & 0 & 0 \\ 1 & -2 & 0 \\ 0 & 0 & -2 \end{pmatrix}$
12. $A_1 = A, A_{JNT} = \begin{pmatrix} -1 & 0 & 0 \\ 1 & -1 & 0 \\ 0 & 1 & -1 \end{pmatrix}$

$$13. A_1 = A_{JNT} = \begin{pmatrix} -1 & 0 & 0 \\ 0 & -1 & 0 \\ 0 & 0 & 2 \end{pmatrix}$$

$$14. A_1 = A_{JNT} = \begin{pmatrix} 2 & 0 & 0 \\ 0 & 3+i & 0 \\ 0 & 0 & 3-i \end{pmatrix}, A_R = \begin{pmatrix} 2 & 0 & 0 \\ 0 & 3 & 1 \\ 0 & -1 & 3 \end{pmatrix}$$

$$15. A_1 = A_{JNT} = \begin{pmatrix} 0 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & -1 \end{pmatrix}$$

$$16. A_1 = A_{JNT} = \begin{pmatrix} -1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 2 \end{pmatrix}$$

$$17. A_1 = A_{JNT} = \begin{pmatrix} -1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix}$$

$$18. A_1 = A_{JNT} = \begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 2 \end{pmatrix}$$

$$19. A_1 = \begin{pmatrix} 3 & 0 & 0 \\ 0 & -1 & -2 \\ 0 & 0 & -1 \end{pmatrix}, A_{JNT} = \begin{pmatrix} -1 & 0 & 0 \\ 1 & -1 & 0 \\ 0 & 0 & 3 \end{pmatrix}$$

$$20. A_1 = A, A_{JNT} = \begin{pmatrix} 2 & 0 & 0 \\ 1 & 2 & 0 \\ 0 & 1 & 2 \end{pmatrix}$$

$$21. A_1 = A_{JNT} = \begin{pmatrix} -1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix}$$

$$22. A_1 = \begin{pmatrix} 0 & 0 & 0 \\ 0 & 1 & -4 \\ 0 & 1 & 5 \end{pmatrix}, A_{JNT} = \begin{pmatrix} 0 & 0 & 0 \\ 0 & 3 & 0 \\ 0 & 1 & 3 \end{pmatrix}$$

$$23. A_1 = A, A_{JNT} = \begin{pmatrix} 2 & 0 & 0 \\ 1 & 2 & 0 \\ 0 & 0 & 2 \end{pmatrix}$$

$$24. A_1 = A, A_{JNT} = \begin{pmatrix} 0 & 0 & 0 \\ 1 & 0 & 0 \\ 0 & 1 & 0 \end{pmatrix}$$

$$25. A_1 = A, A_{JNT} = \begin{pmatrix} 1 & 0 & 0 \\ 1 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix}$$

$$26. A_1 = A, A_{JNT} = \begin{pmatrix} -2 & 0 & 0 \\ 1 & -2 & 0 \\ 0 & 1 & -2 \end{pmatrix}$$

$$27. A_1 = \begin{pmatrix} -3 & -4 & 0 \\ 1 & 1 & 0 \\ 0 & 0 & 3 \end{pmatrix}, A_{JNT} = \begin{pmatrix} -1 & 0 & 0 \\ 1 & -1 & 0 \\ 0 & 0 & 3 \end{pmatrix}$$

$$28. A_1 = A_{JNT} = \begin{pmatrix} 1 & 0 & 0 \\ 0 & 3+i & 0 \\ 0 & 0 & 3-i \end{pmatrix}, A_R = \begin{pmatrix} 1 & 0 & 0 \\ 0 & 2 & -1 \\ 0 & 9 & 2 \end{pmatrix}$$

$$29. A_1 = \begin{pmatrix} -1 & 0 & 0 \\ 0 & -6 & -4 \\ 0 & 9 & 6 \end{pmatrix}, A_{JNT} = \begin{pmatrix} -1 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 1 & 0 \end{pmatrix}$$

$$30. A_1 = A, A_{JNT} = \begin{pmatrix} 0 & 0 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}$$

$$31. A_1 = \begin{pmatrix} -3 & 0 & 0 \\ 0 & 3 & -1 \\ 0 & 4 & -1 \end{pmatrix}, A_{JNT} = \begin{pmatrix} -3 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 1 & 1 \end{pmatrix}$$

$$32. A_1 = \begin{pmatrix} 0 & 0 & 0 \\ 0 & 5 & 9 \\ 0 & -4 & -7 \end{pmatrix}, A_{JNT} = \begin{pmatrix} 0 & 0 & 0 \\ 0 & -1 & 0 \\ 0 & 1 & -1 \end{pmatrix}$$

$$33. A_1 = A, A_{JNT} = \begin{pmatrix} 2 & 0 & 0 & 0 \\ 1 & 2 & 0 & 0 \\ 0 & 1 & 2 & 0 \\ 0 & 0 & 0 & 2 \end{pmatrix}$$

$$34. A_1 = A, A_{JNT} = \begin{pmatrix} 4 & 0 & 0 & 0 \\ 0 & 4 & 0 & 0 \\ 0 & 1 & 4 & 0 \\ 0 & 0 & 0 & 4 \end{pmatrix}$$

$$35. A_1 = A_{JNT} = \begin{pmatrix} 3+2i & 0 & 0 & 0 \\ 0 & 3+2i & 0 & 0 \\ 0 & 0 & 3-2i & 0 \\ 0 & 0 & 0 & 3-2i \end{pmatrix}, A_R = \begin{pmatrix} 3 & 0 & 2 & 0 \\ 0 & 3 & 0 & 2 \\ -2 & 0 & 3 & 0 \\ 0 & -2 & 0 & 3 \end{pmatrix}$$

$$36. A_1 = A, A_{JNT} = \begin{pmatrix} 2 & 0 & 0 & 0 \\ 1 & 2 & 0 & 0 \\ 0 & 0 & 2 & 0 \\ 0 & 0 & 1 & 2 \end{pmatrix}$$

$$37. A_1 = \begin{pmatrix} 0 & 1 & 0 & 0 \\ 1 & -2i & 0 & 0 \\ 0 & 0 & 0 & -1 \\ 0 & 0 & -1 & 2i \end{pmatrix}, A_R = \begin{pmatrix} 0 & 1 & 0 & 0 \\ 1 & 0 & 0 & 2 \\ 0 & 0 & 0 & -1 \\ 0 & -2 & -1 & 0 \end{pmatrix}$$

$$A_{JNT} = \begin{pmatrix} -i & 0 & 0 & 0 \\ 1 & -i & 0 & 0 \\ 0 & 0 & i & 0 \\ 0 & 0 & 1 & i \end{pmatrix}$$

$$38. A_1 = A, A_{JNT} = \begin{pmatrix} 1 & 0 & 0 & 0 \\ 1 & 1 & 0 & 0 \\ 0 & 1 & 1 & 0 \\ 0 & 0 & 1 & 1 \end{pmatrix}$$

$$39. A_1 = A, A_{JNT} = \begin{pmatrix} 2 & 0 & 0 & 0 \\ 1 & 2 & 0 & 0 \\ 0 & 0 & 2 & 0 \\ 0 & 0 & 1 & 2 \end{pmatrix}$$

$$40. A_1 = \begin{pmatrix} -2 & 0 & 0 & 0 \\ 0 & -16 & -17 & 153 \\ 0 & 8 & 9 & -72 \\ 0 & -1 & -1 & 10 \end{pmatrix}, A_{JNT} = \begin{pmatrix} -2 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 1 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix}$$

$$41. A_1 = A, A_{JNT} = \begin{pmatrix} 8 & 0 & 0 & 0 \\ 1 & 8 & 0 & 0 \\ 0 & 0 & 8 & 0 \\ 0 & 0 & 0 & 8 \end{pmatrix}$$