# Test 2 MT01: specimen 1 of 3

**Question 1** (4 p.) The set of all linear combinations of vectors $\boldsymbol{u} = (2,1)$, $\boldsymbol{v} = (-4,-2)$ is formed by

a) all nonzero vectors from $\mathbf{R}^2$

b) all vectors from $\mathbf{R}^2$

c) all nonzero multiples of vector $\boldsymbol{v}$

d) all multiples of vector $\boldsymbol{u}$

e) vectors $\boldsymbol{u}$, $\boldsymbol{v}$, $\boldsymbol{u}+\boldsymbol{v}$, $\boldsymbol{u}-\boldsymbol{v}$

**Question 2** (4 p.) Which vector has to be added to the collection of vectors $\langle(1,0,-2),\ (2,4,8),\ (3,4,6)\rangle$ to get a basis of vector space $\mathbf{R}^3$?

a) $(-2,0,4)$ b) $(1,0,0)$

c) $(1,4,10)$ d) $(0,5,9)$

e) it is not possible to get a basis

**Question 3** (8 p.) For which $a \in \mathbf{R}$ the following system of linear equations has not a solution?

$$\begin{aligned} x - \ \ y + \ \ z &= 0 \\ 2x - 2y + az &= a \\ y + \ \ z &= a \end{aligned}$$

a) $a = 1$

b) $a = 2$

c) $a = 3$

d) $a = -1$

e) it has a solution for all $a \in \mathbf{R}$

**Question 4** (4 p.) Determine matrix $\boldsymbol{X}$ such that $2\boldsymbol{A}^{\mathrm{T}} - 2\boldsymbol{X} = -4\boldsymbol{B}$, where

$\boldsymbol{A} = \begin{pmatrix} 2, & 1 \\ -3, & 0 \\ 1, & 2 \end{pmatrix}$, $\boldsymbol{B} = \begin{pmatrix} 1, & 2, & -4 \\ 0, & 5, & 1 \end{pmatrix}$.

a) $\boldsymbol{X} = \begin{pmatrix} 8, & 2 \\ 2, & 20 \\ -4, & 8 \end{pmatrix}$ b) $\boldsymbol{X} = \begin{pmatrix} 4, & 1 \\ 1, & 10 \\ -2, & 4 \end{pmatrix}$

c) $\boldsymbol{X} = \begin{pmatrix} 8, & 2, & -4 \\ 2, & 20, & 8 \end{pmatrix}$ d) $\boldsymbol{X} = \begin{pmatrix} 4, & 1, & -7 \\ 1, & 10, & 4 \end{pmatrix}$

e) $\boldsymbol{X} = \begin{pmatrix} -1, & 5, & -5 \\ -1, & 5, & -1 \end{pmatrix}$

[Correct answers: d – e – b – d]

# Test 2 MT01: specimen 2 of 3

**Otázka 1** (4 b.) Vector $(a, 3)$ is a linear combination of vectors $(-2, 4)$, $(1, -2)$ if and only if

a) $a = 3$ b) $a = -3$ c) $a = -\frac{3}{2}$ d) $a = -\frac{2}{3}$ e) $a \in \mathbf{R}$

**Question 2** (4 p.) Determine all $a \in \mathbf{R}$, for which the following system of equations has the only solution

$$\begin{aligned} x + ay &= 1 \\ 2x - \ \ y &= 2 \end{aligned}$$

a) for all $a \in \mathbf{R}$

b) $a = 1$

c) $a = -2$

d) $a \neq 3$

e) $a \neq -\frac{1}{2}$

**Question 3** (8 p.) Given the following system of linear equations.

$$\begin{aligned} x - 2y &= 2a \\ 2x + 5y &= \ \ 1 \end{aligned}$$

A necessary and sufficient condition for $a \in \mathbf{R}$ to be $x \leqq 0$ and $y > 0$ is

a) $a \in (1, 5)$ b) $a \in \langle \frac{3}{4}, \infty)$

c) $a \in \left(\frac{1}{2}, 10\right)$ d) $a \in (-\infty, -\frac{1}{5}\rangle$

e) for none $a \in \mathbf{R}$

**Question 4** (4 p.) Determine all $a \in \mathbf{R}$ for which the dimension of the linear hull of vectors $\langle (-3, a), (1, 1), (3, a) \rangle$ is equal to two.

a) for none $a$ b) for $a \in \mathbf{R}$

c) for $a = 0$ d) for $a = 3$

e) for $a = -3$

$\Big[$Correct answers: c – e – d – b$\Big]$

# Test 2 MT01: specimen 3 of 3

**Question 1** (4 p.) Determine all $a \in \mathbf{R}$ for which the following system of linear equations has no solutions.

$$\begin{aligned} x + 4y &= 2 \\ 3x + ay &= 1 \end{aligned}$$

a) $a = 1$

b) $a = 4$

c) $a = 12$

d) $a \neq 1$

e) the system has a solution for all $a \in \mathbf{R}$

**Question 2** (4 p.) Evaluate $-3\boldsymbol{A}^2 + 2\boldsymbol{A} - \boldsymbol{E}$, where $\boldsymbol{A} = \begin{pmatrix} 3, & 1 \\ -2, & 1 \end{pmatrix}$.

a) $\begin{pmatrix} 26, & 14 \\ -28, & -2 \end{pmatrix}$

b) $\begin{pmatrix} -22, & -1 \\ -16, & -2 \end{pmatrix}$

c) $\begin{pmatrix} 0, & -2 \\ 4, & 4 \end{pmatrix}$

d) $\begin{pmatrix} 28, & 14 \\ -28, & 0 \end{pmatrix}$

e) $\begin{pmatrix} -16, & -10 \\ 20, & 4 \end{pmatrix}$

**Question 3** (8 p.) A basis of the linear hull of vectors $\langle(-1, -3, -7), (0, 1, 4)\rangle$ is formed by

a) vector $(1, 3, 7)$

b) vectors $(2, 6, 14)$, $(1, 4, 11)$

c) vectors $(1, 3, 7)$, $(0, 0, 1)$

d) vectors $(-1, -3, -7)$, $(0, 1, 8)$

e) vectors $(1, 3, 7)$, $(0, 2, 8)$, $(0, 0, 1)$

**Otázka 4** (4 b.) The inverse matrix to the matrix $\begin{pmatrix} 2, & 3, & 1 \\ 0, & a, & 2 \\ 2, & -1, & -1 \end{pmatrix}$, $a \in \mathbf{R}$, exists for

a) $a \neq 0$ b) $a \neq 1$ c) $a \neq 4$ d) $a \neq 5$ e) none $a \in \mathbf{R}$

[Correct answers: c – e – b – c]