

YHTÄLÖPARIT

- sijoituskeino
- yhteenlaskukeino
- graafisesti ←

E1
$$\begin{cases} 4x + 3y = 9 \\ 2x + 5y = 1 \end{cases}$$

yhteenlaskukeinolla

①
$$\begin{cases} 4x + 3y = 9 \\ 2x + 5y = 1 \end{cases} \begin{array}{l} \cdot 1 \\ \cdot (-2) \end{array}$$

$$\begin{array}{r} 4x + 3y = 9 \\ + \quad -4x - 10y = -2 \\ \hline -7y = 7 \quad || : (-7) \\ y = -1 \end{array}$$

sijoitetaan alempaan ②

$$\begin{array}{r} 2x + 5(-1) = 1 \\ 2x - 5 = 1 \\ 2x = 6 \quad || : 2 \\ x = 3 \end{array}$$

V:
$$\begin{cases} x = 3 \\ y = -1 \end{cases}$$

Tai
$$\underline{\underline{\begin{cases} x = 3 \\ y = -1 \end{cases}}}$$

E2
$$\begin{cases} 6x + 5y = 0 \\ 3x - 10y = -5 \end{cases}$$

sijoituskeinolla
Ratka. ylempi x

$$\begin{array}{r} 6x = -5y \quad || : 6 \\ x = -\frac{5}{6}y \end{array}$$

sij. alempi yht.

$$\begin{array}{r} 3(-\frac{5}{6}y) - 10y = -5 \\ -\frac{15}{6}y - 10y = -5 \\ -2\frac{1}{2}y - 10y = -5 \\ -12\frac{1}{2}y = -5 \quad || : (-\frac{25}{2}) \\ y = \frac{-5}{-\frac{25}{2}} = -x \cdot \frac{2}{25} \\ y = \frac{2}{5} \end{array}$$

sij. alempi yht.

$$\begin{array}{r} 3x - 10 \cdot \frac{2}{5} = -5 \\ \vdots \\ x = -\frac{1}{3} \end{array}$$

V:
$$\underline{\underline{\begin{cases} x = -\frac{1}{3} \\ y = \frac{2}{5} \end{cases}}}$$

E3
$$\begin{cases} ① \quad 2x - 3y - 2z = 6 \\ ② \quad x + 2y + 3z = 8 \\ ③ \quad 3x - y - 2z = 5 \end{cases}$$

hävitetään z (sama muuttuja)
1 2 2 1 2 3

$$\begin{cases} 2x - 3y - 2z = 6 \quad \cdot 3 \\ x + 2y + 3z = 8 \quad \cdot 2 \end{cases}$$

$$\begin{cases} 2x - 3y - 2z = 6 \quad \cdot (-1) \\ 3x - y - 2z = 5 \quad \cdot 1 \end{cases}$$

$$\begin{array}{r} 6x - 9y - 6z = 18 \\ + \quad 2x + 4y + 6z = 16 \\ \hline ④ \quad 8x - 5y = 34 \end{array}$$

$$\begin{array}{r} -2x + 3y + 2z = -6 \\ + \quad 3x - y - 2z = 5 \\ \hline ⑤ \quad x + 2y = -1 \end{array}$$

$$\begin{cases} ④ \quad 8x - 5y = 34 \\ ⑤ \quad x + 2y = -1 \end{cases} \quad \cdot (-8)$$

$$\begin{cases} 8x - 5y = 34 \\ -8x - 10y = 8 \end{cases}$$

$$y = -2$$

sij. yht. ⑤ $\Rightarrow x$
sij. x ja y mihin tahansa 1, 2 tai 3

V:
$$\begin{cases} x = 3 \\ y = -2 \\ z = 3 \end{cases}$$

E3

$$\begin{cases} \textcircled{1} 2x - 3y + 5z + 4 = 0 \\ \textcircled{2} 3x + y + 2z - 5 = 0 \end{cases}$$

$$\begin{cases} 2x - 3y = -5z - 4 \\ 3x + y = 2z + 5 \end{cases} \begin{array}{l} \cdot 1 \\ \cdot 3 \end{array}$$

$$+ \begin{cases} 2x - 3y = -5z - 4 \\ 9x + 3y = -6z + 15 \end{cases}$$

$$11x = -11z + 11 \quad || : 11$$

$$x = -z + 1$$

$$y = ?$$

sij. yht. $\textcircled{2}$

$$3x + y + 2z - 5 = 0$$

$$y = -3x - 2z + 5$$

$$= -3(-z + 1) - 2z + 5$$

$$= \underline{3z} - \underline{3} - \underline{2z} + \underline{5}$$

$$y = z + 2$$

$$2x - 5 = 3 \quad | +5$$

$$z \in \mathbb{R}$$

$$V: \begin{cases} x = -z + 1 \\ y = z + 2 \\ z \in \mathbb{R} \end{cases}$$