

Algebra - Lineares Gleichungssystem

Aufgaben und Lösungen

<http://www.fersch.de>

©Klemens Fersch

31. März 2018

Inhaltsverzeichnis

1	Einsetzverfahren (2)	2
1.1	Aufgaben	2
1.2	Lösungen	4
2	Gleichsetzungsverfahren (2)	17
2.1	Aufgaben	17
2.2	Lösungen	19
3	Additionsverfahren (2)	33
3.1	Aufgaben	33
3.2	Lösungen	35
4	Determinantenverfahren (2)	47
4.1	Aufgaben	47
4.2	Lösungen	49
5	Determinantenverfahren (3)	56
5.1	Aufgaben	56
5.2	Lösungen	58

1 Einsetzverfahren (2)

$$I \quad a1 \cdot x + b1 \cdot y = c1$$

$$II \quad a2 \cdot x + b2 \cdot y = c2$$

- Gleichung I oder II nach x oder y auflösen
- Term in die andere Gleichung einsetzen
- Gleichung nach der Unbekannten auflösen
- Zweite Unbekannte berechnen

$$I \quad 3x + 5y = 19$$

$$II \quad 7x + 5y = 31$$

I nach x auflösen

$$3x + 5y = 19$$

$$3x + 5y = 19 \quad / - 5y$$

$$3x = 19 - 5y \quad / : 3$$

$$x = 6\frac{1}{3} - 1\frac{2}{3}y$$

I in II

$$7(6\frac{1}{3} - 1\frac{2}{3}y) + 5y = 31$$

$$44\frac{1}{3} - 11\frac{2}{3}y + 5y = 31 \quad / - 44\frac{1}{3}$$

$$-11\frac{2}{3}y + 5y = 31 - 44\frac{1}{3}$$

$$-6\frac{2}{3}y = -13\frac{1}{3} \quad / : (-6\frac{2}{3})$$

$$y = \frac{-13\frac{1}{3}}{-6\frac{2}{3}}$$

$$y = 2$$

$$x = 6\frac{1}{3} - 1\frac{2}{3}y$$

$$x = 6\frac{1}{3} - 1\frac{2}{3} \cdot 2$$

$$x = 3$$

$$L = \{3/2\}$$

$$I \quad 3x + 5y = 19$$

$$II \quad 7x + 5y = 31$$

I nach y auflösen

$$3x + 5y = 19$$

$$3x + 5y = 19 \quad / - 3x$$

$$5y = 19 - 3x \quad / : 5$$

$$y = 3\frac{4}{5} - \frac{3}{5}x$$

I in II

$$7x + 5(3\frac{4}{5} - \frac{3}{5}x) = 31$$

$$19 - 3x + 5x = 31 \quad / - 19$$

$$-3x + 5x = 31 - 19$$

$$4x = 12 \quad / : 4$$

$$x = \frac{12}{4}$$

$$x = 3$$

$$y = 3\frac{4}{5} - \frac{3}{5}x$$

$$y = 3\frac{4}{5} - \frac{3}{5} \cdot 3$$

$$y = 2$$

$$L = \{3/2\}$$

1.1 Aufgaben

Um eigene Aufgaben zu lösen, klicken Sie hier: [Neue Rechnung](#)

Gegeben:

$$a1 \cdot x + b1 \cdot y = c1$$

$$a2 \cdot x + b2 \cdot y = c2$$

Gesucht:

x und y

$$(1) \quad \begin{aligned} 3x + 5y &= 19 \\ 7x + 5y &= 31 \end{aligned}$$

$$(8) \quad \begin{aligned} 8x - 3y &= 10 \\ 12x - 5y &= 24 \end{aligned}$$

$$(2) \quad \begin{aligned} 1x + 1y &= 10 \\ 1x - 1y &= 4 \end{aligned}$$

$$(9) \quad \begin{aligned} -\frac{1}{2}x + 1y &= 2 \\ \frac{1}{2}x - 3y &= -3 \end{aligned}$$

$$(3) \quad \begin{aligned} 9x - 2y &= 5 \\ 5x - 2y &= 1 \end{aligned}$$

$$(10) \quad \begin{aligned} -1x + 1y &= 3 \\ \frac{1}{2}x - 4y &= 5 \end{aligned}$$

$$(4) \quad \begin{aligned} 9x - 2y &= 1 \\ -3x - 3y &= -7 \end{aligned}$$

$$(11) \quad \begin{aligned} 1\frac{1}{5}x - 1\frac{1}{3}y &= 5\frac{1}{3} \\ 2\frac{1}{2}x - \frac{1}{4}y &= 12\frac{3}{8} \end{aligned}$$

$$(5) \quad \begin{aligned} 1x + 3y &= 9 \\ 3x - 2y &= -6 \end{aligned}$$

$$(12) \quad \begin{aligned} \frac{2}{3}x - \frac{5}{7}y &= \frac{2}{3} \\ 1x + 1y &= 10\frac{2}{3} \end{aligned}$$

$$(6) \quad \begin{aligned} 7x + 1\frac{1}{2}y &= 1 \\ 2x - 5y &= 22 \end{aligned}$$

$$(13) \quad \begin{aligned} 1\frac{1}{2}x - 2y &= 9 \\ \frac{2}{5}x + \frac{1}{3}y &= 5 \end{aligned}$$

$$(7) \quad \begin{aligned} 4x - 5y &= 43 \\ -3x - 7y &= 0 \end{aligned}$$

$$(14) \quad \begin{aligned} 2x + 3y &= 4 \\ \frac{1}{5}x - \frac{1}{5}y &= 12 \end{aligned}$$

$$(21) \quad \begin{aligned} 2x - 7y &= -8 \\ 7x - 1y &= -9 \end{aligned}$$

$$(15) \quad \begin{aligned} 1x + 2y &= -4 \\ -1x + 2y &= 5 \end{aligned}$$

$$(22) \quad \begin{aligned} -7x + 9y &= -3 \\ 5x - 6y &= -4 \end{aligned}$$

$$(16) \quad \begin{aligned} 2x + 4y &= 4 \\ -\frac{1}{2}x + 3y &= 3 \end{aligned}$$

$$(23) \quad \begin{aligned} 2x + 2y &= 1\frac{7}{10} \\ 3x + 6y &= 3 \end{aligned}$$

$$(17) \quad \begin{aligned} -\frac{1}{2}x + 4y &= 6 \\ -2x - 8y &= 2 \end{aligned}$$

$$(24) \quad \begin{aligned} 3x + 5y &= 8 \\ 9x + 0y &= 7 \end{aligned}$$

$$(18) \quad \begin{aligned} 1x + 1y &= 1 \\ 2x + 2y &= 2 \end{aligned}$$

$$(25) \quad \begin{aligned} 3x + 6y &= 8 \\ 9x + 0y &= 9 \end{aligned}$$

$$(19) \quad \begin{aligned} 1x + 1y &= 2 \\ 3x + 3y &= 3 \end{aligned}$$

$$(26) \quad \begin{aligned} 3x + 6y &= 8 \\ 9x + 0y &= 9 \end{aligned}$$

$$(20) \quad \begin{aligned} -1\frac{4}{5}x + 1\frac{1}{3}y &= -1 \\ -\frac{2}{3}x + \frac{1}{9}y &= 9 \end{aligned}$$

1.2 Lösungen

Aufgabe (1)

$I \quad 3x + 5y = 19$ $II \quad 7x + 5y = 31$ <p>I nach x auflösen</p> $3x + 5y = 19$ $3x + 5y = 19 \quad / - 5y$ $3x = 19 - 5y \quad / : 3$ $x = 6\frac{1}{3} - 1\frac{2}{3}y$ <p>I in II</p> $7(6\frac{1}{3} - 1\frac{2}{3}y) + 5y = 31$ $44\frac{1}{3} - 11\frac{2}{3}y + 5y = 31 \quad / - 44\frac{1}{3}$ $-11\frac{2}{3}y + 5y = 31 - 44\frac{1}{3}$ $-6\frac{2}{3}y = -13\frac{1}{3} \quad / : (-6\frac{2}{3})$ $y = \frac{-13\frac{1}{3}}{-6\frac{2}{3}}$ $y = 2$ $x = 6\frac{1}{3} - 1\frac{2}{3}y$ $x = 6\frac{1}{3} - 1\frac{2}{3} \cdot 2$ $x = 3$ $L = \{3/2\}$	$I \quad 3x + 5y = 19$ $II \quad 7x + 5y = 31$ <p>I nach y auflösen</p> $3x + 5y = 19$ $3x + 5y = 19 \quad / - 3x$ $5y = 19 - 3x \quad / : 5$ $y = 3\frac{4}{5} - \frac{3}{5}x$ <p>I in II</p> $7x + 5(3\frac{4}{5} - \frac{3}{5}x) = 31$ $19 - 3x + 5x = 31 \quad / - 19$ $-3x + 5x = 31 - 19$ $4x = 12 \quad / : 4$ $x = \frac{12}{4}$ $x = 3$ $y = 3\frac{4}{5} - \frac{3}{5}x$ $y = 3\frac{4}{5} - \frac{3}{5} \cdot 3$ $y = 2$ $L = \{3/2\}$
--	---

Aufgabe (2)

$I \quad 1x + 1y = 10$ $II \quad 1x - 1y = 4$ <p>I nach x auflösen</p> $1x + 1y = 10$ $1x + 1y = 10 \quad / - 1y$ $1x = 10 - 1y \quad / : 1$ $x = 10 - 1y$ <p>I in II</p> $1(10 - 1y) + -1y = 4$ $10 - 1y - 1y = 4 \quad / - 10$ $-1y - 1y = 4 - 10$ $-2y = -6 \quad / : (-2)$ $y = \frac{-6}{-2}$ $y = 3$ $x = 10 - 1y$ $x = 10 - 1 \cdot 3$ $x = 7$ $L = \{7/3\}$	$I \quad 1x + 1y = 10$ $II \quad 1x - 1y = 4$ <p>I nach y auflösen</p> $1x + 1y = 10$ $1x + 1y = 10 \quad / - 1x$ $1y = 10 - 1x \quad / : 1$ $y = 10 - 1x$ <p>I in II</p> $1x + -1(10 - 1x) = 4$ $-10 + 1x - 1x = 4 \quad / - (-10)$ $+1x - 1x = 4 - (-10)$ $2x = 14 \quad / : 2$ $x = \frac{14}{2}$ $x = 7$ $y = 10 - 1x$ $y = 10 - 1 \cdot 7$ $y = 3$ $L = \{7/3\}$
---	---

Aufgabe (3)

$$\begin{array}{l}
 I \quad 9x - 2y = 5 \\
 II \quad 5x - 2y = 1 \\
 \text{I nach x auflösen} \\
 9x - 2y = 5 \\
 9x - 2y = 5 \quad / + 2y \\
 9x = 5 + 2y \quad / : 9 \\
 x = \frac{5}{9} + \frac{2}{9}y \\
 \text{I in II} \\
 5\left(\frac{5}{9} + \frac{2}{9}y\right) - 2y = 1 \\
 2\frac{7}{9} + 1\frac{1}{9}y - 2y = 1 \quad / - 2\frac{7}{9} \\
 +1\frac{1}{9}y - 2y = 1 - 2\frac{7}{9} \\
 -\frac{8}{9}y = -1\frac{7}{9} \quad / : \left(-\frac{8}{9}\right) \\
 y = \frac{-1\frac{7}{9}}{-\frac{8}{9}} \\
 y = 2 \\
 x = \frac{5}{9} + \frac{2}{9}y \\
 x = \frac{5}{9} + \frac{2}{9} \cdot 2 \\
 x = 1 \\
 L = \{1/2\}
 \end{array}$$

$$\begin{array}{l}
 I \quad 9x - 2y = 5 \\
 II \quad 5x - 2y = 1 \\
 \text{I nach y auflösen} \\
 9x - 2y = 5 \\
 9x - 2y = 5 \quad / - 9x \\
 -2y = 5 - 9x \quad / : (-2) \\
 y = -2\frac{1}{2} + 4\frac{1}{2}x \\
 \text{I in II} \\
 5x + -2\left(-2\frac{1}{2} + 4\frac{1}{2}x\right) = 1 \\
 5 - 9x - 2x = 1 \quad / - 5 \\
 -9x - 2x = 1 - 5 \\
 -4x = -4 \quad / : (-4) \\
 x = \frac{-4}{-4} \\
 x = 1 \\
 y = -2\frac{1}{2} + 4\frac{1}{2}x \\
 y = -2\frac{1}{2} + 4\frac{1}{2} \cdot 1 \\
 y = 2 \\
 L = \{1/2\}
 \end{array}$$

Aufgabe (4)

$$\begin{array}{l}
 I \quad 9x - 2y = 1 \\
 II \quad -3x - 3y = -7 \\
 \text{I nach x auflösen} \\
 9x - 2y = 1 \\
 9x - 2y = 1 \quad / + 2y \\
 9x = 1 + 2y \quad / : 9 \\
 x = \frac{1}{9} + \frac{2}{9}y \\
 \text{I in II} \\
 -3\left(\frac{1}{9} + \frac{2}{9}y\right) - 3y = -7 \\
 -\frac{1}{3} - \frac{2}{3}y - 3y = -7 \quad / - \left(-\frac{1}{3}\right) \\
 -\frac{2}{3}y - 3y = -7 - \left(-\frac{1}{3}\right) \\
 -3\frac{2}{3}y = -6\frac{2}{3} \quad / : \left(-3\frac{2}{3}\right) \\
 y = \frac{-6\frac{2}{3}}{-3\frac{2}{3}} \\
 y = 1\frac{9}{11} \\
 x = \frac{1}{9} + \frac{2}{9}y \\
 x = \frac{1}{9} + \frac{2}{9} \cdot 1\frac{9}{11} \\
 x = \frac{17}{33} \\
 L = \left\{\frac{17}{33}/1\frac{9}{11}\right\}
 \end{array}$$

$$\begin{array}{l}
 I \quad 9x - 2y = 1 \\
 II \quad -3x - 3y = -7 \\
 \text{I nach y auflösen} \\
 9x - 2y = 1 \\
 9x - 2y = 1 \quad / - 9x \\
 -2y = 1 - 9x \quad / : (-2) \\
 y = -\frac{1}{2} + 4\frac{1}{2}x \\
 \text{I in II} \\
 -3x + -3\left(-\frac{1}{2} + 4\frac{1}{2}x\right) = -7 \\
 1\frac{1}{2} - 13\frac{1}{2}x - 3x = -7 \quad / - 1\frac{1}{2} \\
 -13\frac{1}{2}x - 3x = -7 - 1\frac{1}{2} \\
 -16\frac{1}{2}x = -8\frac{1}{2} \quad / : \left(-16\frac{1}{2}\right) \\
 x = \frac{-8\frac{1}{2}}{-16\frac{1}{2}} \\
 x = \frac{17}{33} \\
 y = -\frac{1}{2} + 4\frac{1}{2}x \\
 y = -\frac{1}{2} + 4\frac{1}{2} \cdot \frac{17}{33} \\
 y = 1\frac{9}{11} \\
 L = \left\{\frac{17}{33}/1\frac{9}{11}\right\}
 \end{array}$$

Aufgabe (5)

$I \quad 1x + 3y = 9$ $II \quad 3x - 2y = -6$ <p>I nach x auflösen</p> $1x + 3y = 9$ $1x + 3y = 9 \quad / - 3y$ $1x = 9 - 3y \quad / : 1$ $x = 9 - 3y$ <p>I in II</p> $3(9 - 3y) + -2y = -6$ $27 - 9y - 2y = -6 \quad / - 27$ $-9y - 2y = -6 - 27$ $-11y = -33 \quad / : (-11)$ $y = \frac{-33}{-11}$ $y = 3$ $x = 9 - 3y$ $x = 9 - 3 \cdot 3$ $x = 0$ $L = \{0/3\}$	$I \quad 1x + 3y = 9$ $II \quad 3x - 2y = -6$ <p>I nach y auflösen</p> $1x + 3y = 9$ $1x + 3y = 9 \quad / - 1x$ $3y = 9 - 1x \quad / : 3$ $y = 3 - \frac{1}{3}x$ <p>I in II</p> $3x + -2(3 - \frac{1}{3}x) = -6$ $-6 + \frac{2}{3}x - 2x = -6 \quad / - (-6)$ $+\frac{2}{3}x - 2x = -6 - (-6)$ $3\frac{2}{3}x = 0 \quad / : 3\frac{2}{3}$ $x = \frac{0}{3\frac{2}{3}}$ $x = 0$ $y = 3 - \frac{1}{3}x$ $y = 3 - \frac{1}{3} \cdot 0$ $y = 3$ $L = \{0/3\}$
--	---

Aufgabe (6)

$I \quad 7x + 1\frac{1}{2}y = 1$ $II \quad 2x - 5y = 22$ <p>I nach x auflösen</p> $7x + 1\frac{1}{2}y = 1$ $7x + 1\frac{1}{2}y = 1 \quad / - 1\frac{1}{2}y$ $7x = 1 - 1\frac{1}{2}y \quad / : 7$ $x = \frac{1}{7} - \frac{3}{14}y$ <p>I in II</p> $2(\frac{1}{7} - \frac{3}{14}y) + -5y = 22$ $\frac{2}{7} - \frac{3}{7}y - 5y = 22 \quad / - \frac{2}{7}$ $-\frac{3}{7}y - 5y = 22 - \frac{2}{7}$ $-5\frac{3}{7}y = 21\frac{5}{7} \quad / : (-5\frac{3}{7})$ $y = \frac{21\frac{5}{7}}{-5\frac{3}{7}}$ $y = -4$ $x = \frac{1}{7} - \frac{3}{14}y$ $x = \frac{1}{7} - \frac{3}{14} \cdot (-4)$ $x = 1$ $L = \{1/-4\}$	$I \quad 7x + 1\frac{1}{2}y = 1$ $II \quad 2x - 5y = 22$ <p>I nach y auflösen</p> $7x + 1\frac{1}{2}y = 1$ $7x + 1\frac{1}{2}y = 1 \quad / - 7x$ $1\frac{1}{2}y = 1 - 7x \quad / : 1\frac{1}{2}$ $y = \frac{2}{3} - 4\frac{2}{3}x$ <p>I in II</p> $2x + -5(\frac{2}{3} - 4\frac{2}{3}x) = 22$ $-3\frac{1}{3} + 23\frac{1}{3}x - 5x = 22 \quad / - (-3\frac{1}{3})$ $+23\frac{1}{3}x - 5x = 22 - (-3\frac{1}{3})$ $25\frac{1}{3}x = 25\frac{1}{3} \quad / : 25\frac{1}{3}$ $x = \frac{25\frac{1}{3}}{25\frac{1}{3}}$ $x = 1$ $y = \frac{2}{3} - 4\frac{2}{3}x$ $y = \frac{2}{3} - 4\frac{2}{3} \cdot 1$ $y = -4$ $L = \{1/-4\}$
---	--

Aufgabe (7)

$ \begin{aligned} I & 4x - 5y = 43 \\ II & -3x - 7y = 0 \\ \text{I nach x auflösen} \\ 4x - 5y &= 43 \\ 4x - 5y &= 43 \quad / + 5y \\ 4x &= 43 + 5y \quad / : 4 \\ x &= 10\frac{3}{4} + 1\frac{1}{4}y \\ \text{I in II} \\ -3(10\frac{3}{4} + 1\frac{1}{4}y) + -7y &= 0 \\ -32\frac{1}{4} - 3\frac{3}{4}y - 7y &= 0 \quad / - (-32\frac{1}{4}) \\ -3\frac{3}{4}y - 7y &= 0 - (-32\frac{1}{4}) \\ -10\frac{3}{4}y &= 32\frac{1}{4} \quad / : (-10\frac{3}{4}) \\ y &= \frac{32\frac{1}{4}}{-10\frac{3}{4}} \\ y &= -3 \\ x &= 10\frac{3}{4} + 1\frac{1}{4}y \\ x &= 10\frac{3}{4} + 1\frac{1}{4} \cdot (-3) \\ x &= 7 \\ L &= \{7/ -3\} \end{aligned} $	$ \begin{aligned} I & 4x - 5y = 43 \\ II & -3x - 7y = 0 \\ \text{I nach y auflösen} \\ 4x - 5y &= 43 \\ 4x - 5y &= 43 \quad / - 4x \\ -5y &= 43 - 4x \quad / : (-5) \\ y &= -8\frac{3}{5} + \frac{4}{5}x \\ \text{I in II} \\ -3x + -7(-8\frac{3}{5} + \frac{4}{5}x) &= 0 \\ 60\frac{1}{5} - 5\frac{3}{5}x - 7x &= 0 \quad / - 60\frac{1}{5} \\ -5\frac{3}{5}x - 7x &= 0 - 60\frac{1}{5} \\ -8\frac{3}{5}x &= -60\frac{1}{5} \quad / : (-8\frac{3}{5}) \\ x &= \frac{-60\frac{1}{5}}{-8\frac{3}{5}} \\ x &= 7 \\ y &= -8\frac{3}{5} + \frac{4}{5}x \\ y &= -8\frac{3}{5} + \frac{4}{5} \cdot 7 \\ y &= -3 \\ L &= \{7/ -3\} \end{aligned} $
---	--

Aufgabe (8)

$ \begin{aligned} I & 8x - 3y = 10 \\ II & 12x - 5y = 24 \\ \text{I nach x auflösen} \\ 8x - 3y &= 10 \\ 8x - 3y &= 10 \quad / + 3y \\ 8x &= 10 + 3y \quad / : 8 \\ x &= 1\frac{1}{4} + \frac{3}{8}y \\ \text{I in II} \\ 12(1\frac{1}{4} + \frac{3}{8}y) + -5y &= 24 \\ 15 + 4\frac{1}{2}y - 5y &= 24 \quad / - 15 \\ +4\frac{1}{2}y - 5y &= 24 - 15 \\ -\frac{1}{2}y &= 9 \quad / : (-\frac{1}{2}) \\ y &= \frac{9}{-\frac{1}{2}} \\ y &= -18 \\ x &= 1\frac{1}{4} + \frac{3}{8}y \\ x &= 1\frac{1}{4} + \frac{3}{8} \cdot (-18) \\ x &= -5\frac{1}{2} \\ L &= \{-5\frac{1}{2}/ -18\} \end{aligned} $	$ \begin{aligned} I & 8x - 3y = 10 \\ II & 12x - 5y = 24 \\ \text{I nach y auflösen} \\ 8x - 3y &= 10 \\ 8x - 3y &= 10 \quad / - 8x \\ -3y &= 10 - 8x \quad / : (-3) \\ y &= -3\frac{1}{3} + 2\frac{2}{3}x \\ \text{I in II} \\ 12x + -5(-3\frac{1}{3} + 2\frac{2}{3}x) &= 24 \\ 16\frac{2}{3} - 13\frac{1}{3}x - 5x &= 24 \quad / - 16\frac{2}{3} \\ -13\frac{1}{3}x - 5x &= 24 - 16\frac{2}{3} \\ -1\frac{1}{3}x &= 7\frac{1}{3} \quad / : (-1\frac{1}{3}) \\ x &= \frac{7\frac{1}{3}}{-1\frac{1}{3}} \\ x &= -5\frac{1}{2} \\ y &= -3\frac{1}{3} + 2\frac{2}{3}x \\ y &= -3\frac{1}{3} + 2\frac{2}{3} \cdot (-5\frac{1}{2}) \\ y &= -18 \\ L &= \{-5\frac{1}{2}/ -18\} \end{aligned} $
--	--

Aufgabe (9)

$$\begin{array}{l}
 I \quad -\frac{1}{2}x + 1y = 2 \\
 II \quad \frac{1}{2}x - 3y = -3 \\
 \text{I nach x auflösen} \\
 -\frac{1}{2}x + 1y = 2 \\
 -\frac{1}{2}x + 1y = 2 \quad / -1y \\
 -\frac{1}{2}x = 2 - 1y \quad / : \left(-\frac{1}{2}\right) \\
 x = -4 + 2y \\
 \text{I in II} \\
 \frac{1}{2}(-4 + 2y) + -3y = -3 \\
 -2 + 1y - 3y = -3 \quad / -(-2) \\
 +1y - 3y = -3 - (-2) \\
 -2y = -1 \quad / : (-2) \\
 y = \frac{-1}{-2} \\
 y = \frac{1}{2} \\
 x = -4 + 2y \\
 x = -4 + 2 \cdot \frac{1}{2} \\
 x = -3 \\
 L = \{-3/\frac{1}{2}\}
 \end{array}$$

$$\begin{array}{l}
 I \quad -\frac{1}{2}x + 1y = 2 \\
 II \quad \frac{1}{2}x - 3y = -3 \\
 \text{I nach y auflösen} \\
 -\frac{1}{2}x + 1y = 2 \\
 -\frac{1}{2}x + 1y = 2 \quad / + \frac{1}{2}x \\
 1y = 2 + \frac{1}{2}x \quad / : 1 \\
 y = 2 + \frac{1}{2}x \\
 \text{I in II} \\
 \frac{1}{2}x + -3(2 + \frac{1}{2}x) = -3 \\
 -6 - 1\frac{1}{2}x - 3x = -3 \quad / -(-6) \\
 -1\frac{1}{2}x - 3x = -3 - (-6) \\
 -1x = 3 \quad / : (-1) \\
 x = \frac{3}{-1} \\
 x = -3 \\
 y = 2 + \frac{1}{2}x \\
 y = 2 + \frac{1}{2} \cdot (-3) \\
 y = \frac{1}{2} \\
 L = \{-3/\frac{1}{2}\}
 \end{array}$$

Aufgabe (10)

$$\begin{array}{l}
 I \quad -1x + 1y = 3 \\
 II \quad \frac{1}{2}x - 4y = 5 \\
 \text{I nach x auflösen} \\
 -1x + 1y = 3 \\
 -1x + 1y = 3 \quad / -1y \\
 -1x = 3 - 1y \quad / : (-1) \\
 x = -3 + 1y \\
 \text{I in II} \\
 \frac{1}{2}(-3 + 1y) + -4y = 5 \\
 -\frac{1}{2} + \frac{1}{2}y - 4y = 5 \quad / -(-\frac{1}{2}) \\
 +\frac{1}{2}y - 4y = 5 - (-\frac{1}{2}) \\
 -3\frac{1}{2}y = 6\frac{1}{2} \quad / : (-3\frac{1}{2}) \\
 y = \frac{6\frac{1}{2}}{-3\frac{1}{2}} \\
 y = -1\frac{6}{7} \\
 x = -3 + 1y \\
 x = -3 + 1 \cdot (-1\frac{6}{7}) \\
 x = -4\frac{6}{7} \\
 L = \{-4\frac{6}{7}/ -1\frac{6}{7}\}
 \end{array}$$

$$\begin{array}{l}
 I \quad -1x + 1y = 3 \\
 II \quad \frac{1}{2}x - 4y = 5 \\
 \text{I nach y auflösen} \\
 -1x + 1y = 3 \\
 -1x + 1y = 3 \quad / + 1x \\
 1y = 3 + 1x \quad / : 1 \\
 y = 3 + 1x \\
 \text{I in II} \\
 \frac{1}{2}x + -4(3 + 1x) = 5 \\
 -12 - 4x - 4x = 5 \quad / -(-12) \\
 -4x - 4x = 5 - (-12) \\
 -3\frac{1}{2}x = 17 \quad / : (-3\frac{1}{2}) \\
 x = \frac{17}{-3\frac{1}{2}} \\
 x = -4\frac{6}{7} \\
 y = 3 + 1x \\
 y = 3 + 1 \cdot (-4\frac{6}{7}) \\
 y = -1\frac{6}{7} \\
 L = \{-4\frac{6}{7}/ -1\frac{6}{7}\}
 \end{array}$$

Aufgabe (11)

$I \quad 1\frac{1}{5}x - 1\frac{1}{3}y = 5\frac{1}{3}$ $II \quad 2\frac{1}{2}x - \frac{1}{4}y = 12\frac{3}{8}$ <p>I nach x auflösen</p> $1\frac{1}{5}x - 1\frac{1}{3}y = 5\frac{1}{3}$ $1\frac{1}{5}x - 1\frac{1}{3}y = 5\frac{1}{3} \quad / + 1\frac{1}{3}y$ $1\frac{1}{5}x = 5\frac{1}{3} + 1\frac{1}{3}y \quad / : 1\frac{1}{5}$ $x = 4\frac{4}{9} + 1\frac{1}{9}y$ <p>I in II</p> $2\frac{1}{2}(4\frac{4}{9} + 1\frac{1}{9}y) - \frac{1}{4}y = 12\frac{3}{8}$ $11\frac{1}{9} + 2\frac{7}{9}y - \frac{1}{4}y = 12\frac{3}{8} \quad / - 11\frac{1}{9}$ $+ 2\frac{7}{9}y - \frac{1}{4}y = 12\frac{3}{8} - 11\frac{1}{9}$ $2\frac{19}{36}y = 1\frac{19}{72} \quad / : 2\frac{19}{36}$ $y = \frac{1\frac{19}{72}}{2\frac{19}{36}}$ $y = \frac{1}{2}$ $x = 4\frac{4}{9} + 1\frac{1}{9}y$ $x = 4\frac{4}{9} + 1\frac{1}{9} \cdot \frac{1}{2}$ $x = 5$ $L = \{5/\frac{1}{2}\}$	$I \quad 1\frac{1}{5}x - 1\frac{1}{3}y = 5\frac{1}{3}$ $II \quad 2\frac{1}{2}x - \frac{1}{4}y = 12\frac{3}{8}$ <p>I nach y auflösen</p> $1\frac{1}{5}x - 1\frac{1}{3}y = 5\frac{1}{3}$ $1\frac{1}{5}x - 1\frac{1}{3}y = 5\frac{1}{3} \quad / - 1\frac{1}{5}x$ $-1\frac{1}{3}y = 5\frac{1}{3} - 1\frac{1}{5}x \quad / : (-1\frac{1}{3})$ $y = -4 + \frac{9}{10}x$ <p>I in II</p> $2\frac{1}{2}x + -\frac{1}{4}(-4 + \frac{9}{10}x) = 12\frac{3}{8}$ $1 - \frac{9}{40}x - \frac{1}{4}x = 12\frac{3}{8} \quad / - 1$ $-\frac{9}{40}x - \frac{1}{4}x = 12\frac{3}{8} - 1$ $2\frac{11}{40}x = 11\frac{3}{8} \quad / : 2\frac{11}{40}$ $x = \frac{11\frac{3}{8}}{2\frac{11}{40}}$ $x = 5$ $y = -4 + \frac{9}{10}x$ $y = -4 + \frac{9}{10} \cdot 5$ $y = \frac{1}{2}$ $L = \{5/\frac{1}{2}\}$
--	--

Aufgabe (12)

$I \quad \frac{2}{3}x - \frac{5}{7}y = \frac{2}{3}$ $II \quad 1x + 1y = 10\frac{2}{3}$ <p>I nach x auflösen</p> $\frac{2}{3}x - \frac{5}{7}y = \frac{2}{3}$ $\frac{2}{3}x - \frac{5}{7}y = \frac{2}{3} \quad / + \frac{5}{7}y$ $\frac{2}{3}x = \frac{2}{3} + \frac{5}{7}y \quad / : \frac{2}{3}$ $x = 1 + 1\frac{1}{14}y$ <p>I in II</p> $1(1 + 1\frac{1}{14}y) + 1y = 10\frac{2}{3}$ $1 + 1\frac{1}{14}y + 1y = 10\frac{2}{3} \quad / - 1$ $+ 1\frac{1}{14}y + 1y = 10\frac{2}{3} - 1$ $2\frac{1}{14}y = 9\frac{2}{3} \quad / : 2\frac{1}{14}$ $y = \frac{9\frac{2}{3}}{2\frac{1}{14}}$ $y = 4\frac{2}{3}$ $x = 1 + 1\frac{1}{14}y$ $x = 1 + 1\frac{1}{14} \cdot 4\frac{2}{3}$ $x = 6$ $L = \{6/4\frac{2}{3}\}$	$I \quad \frac{2}{3}x - \frac{5}{7}y = \frac{2}{3}$ $II \quad 1x + 1y = 10\frac{2}{3}$ <p>I nach y auflösen</p> $\frac{2}{3}x - \frac{5}{7}y = \frac{2}{3}$ $\frac{2}{3}x - \frac{5}{7}y = \frac{2}{3} \quad / - \frac{2}{3}x$ $-\frac{5}{7}y = \frac{2}{3} - \frac{2}{3}x \quad / : (-\frac{5}{7})$ $y = -\frac{14}{15} + \frac{14}{15}x$ <p>I in II</p> $1x + 1(-\frac{14}{15} + \frac{14}{15}x) = 10\frac{2}{3}$ $-\frac{14}{15} + \frac{14}{15}x + 1x = 10\frac{2}{3} \quad / - (-\frac{14}{15})$ $+\frac{14}{15}x + 1x = 10\frac{2}{3} - (-\frac{14}{15})$ $1\frac{14}{15}x = 11\frac{3}{5} \quad / : 1\frac{14}{15}$ $x = \frac{11\frac{3}{5}}{1\frac{14}{15}}$ $x = 6$ $y = -\frac{14}{15} + \frac{14}{15}x$ $y = -\frac{14}{15} + \frac{14}{15} \cdot 6$ $y = 4\frac{2}{3}$ $L = \{6/4\frac{2}{3}\}$
--	--

Aufgabe (13)

$$\begin{array}{l}
I \quad 1\frac{1}{2}x - 2y = 9 \\
II \quad \frac{2}{5}x + \frac{1}{3}y = 5 \\
\text{I nach x auflösen} \\
1\frac{1}{2}x - 2y = 9 \\
1\frac{1}{2}x - 2y = 9 \quad / + 2y \\
1\frac{1}{2}x = 9 + 2y \quad / : 1\frac{1}{2} \\
x = 6 + 1\frac{1}{3}y \\
\text{I in II} \\
\frac{2}{5}(6 + 1\frac{1}{3}y) + \frac{1}{3}y = 5 \\
2\frac{2}{5} + \frac{8}{15}y + \frac{1}{3}y = 5 \quad / - 2\frac{2}{5} \\
+\frac{8}{15}y + \frac{1}{3}y = 5 - 2\frac{2}{5} \\
\frac{13}{15}y = 2\frac{3}{5} \quad / : \frac{13}{15} \\
y = \frac{2\frac{3}{5}}{\frac{13}{15}} \\
y = 3 \\
x = 6 + 1\frac{1}{3}y \\
x = 6 + 1\frac{1}{3} \cdot 3 \\
x = 10 \\
L = \{10/3\}
\end{array}$$

$$\begin{array}{l}
I \quad 1\frac{1}{2}x - 2y = 9 \\
II \quad \frac{2}{5}x + \frac{1}{3}y = 5 \\
\text{I nach y auflösen} \\
1\frac{1}{2}x - 2y = 9 \\
1\frac{1}{2}x - 2y = 9 \quad / - 1\frac{1}{2}x \\
-2y = 9 - 1\frac{1}{2}x \quad / : (-2) \\
y = -4\frac{1}{2} + \frac{3}{4}x \\
\text{I in II} \\
\frac{2}{5}x + \frac{1}{3}(-4\frac{1}{2} + \frac{3}{4}x) = 5 \\
-1\frac{1}{2} + \frac{1}{4}x + \frac{1}{3}x = 5 \quad / - (-1\frac{1}{2}) \\
+\frac{1}{4}x + \frac{1}{3}x = 5 - (-1\frac{1}{2}) \\
\frac{13}{20}x = 6\frac{1}{2} \quad / : \frac{13}{20} \\
x = \frac{6\frac{1}{2}}{\frac{13}{20}} \\
x = 10 \\
y = -4\frac{1}{2} + \frac{3}{4}x \\
y = -4\frac{1}{2} + \frac{3}{4} \cdot 10 \\
y = 3 \\
L = \{10/3\}
\end{array}$$

Aufgabe (14)

$$\begin{array}{l}
I \quad 2x + 3y = 4 \\
II \quad \frac{1}{3}x - \frac{1}{5}y = 12 \\
\text{I nach x auflösen} \\
2x + 3y = 4 \\
2x + 3y = 4 \quad / - 3y \\
2x = 4 - 3y \quad / : 2 \\
x = 2 - 1\frac{1}{2}y \\
\text{I in II} \\
\frac{1}{3}(2 - 1\frac{1}{2}y) - \frac{1}{5}y = 12 \\
\frac{2}{3} - \frac{1}{2}y - \frac{1}{5}y = 12 \quad / - \frac{2}{3} \\
-\frac{1}{2}y - \frac{1}{5}y = 12 - \frac{2}{3} \\
-\frac{7}{10}y = 11\frac{1}{3} \quad / : (-\frac{7}{10}) \\
y = \frac{11\frac{1}{3}}{-\frac{7}{10}} \\
y = -16\frac{4}{21} \\
x = 2 - 1\frac{1}{2}y \\
x = 2 - 1\frac{1}{2} \cdot (-16\frac{4}{21}) \\
x = 26\frac{2}{7} \\
L = \{26\frac{2}{7} / -16\frac{4}{21}\}
\end{array}$$

$$\begin{array}{l}
I \quad 2x + 3y = 4 \\
II \quad \frac{1}{3}x - \frac{1}{5}y = 12 \\
\text{I nach y auflösen} \\
2x + 3y = 4 \\
2x + 3y = 4 \quad / - 2x \\
3y = 4 - 2x \quad / : 3 \\
y = 1\frac{1}{3} - \frac{2}{3}x \\
\text{I in II} \\
\frac{1}{3}x + -\frac{1}{5}(1\frac{1}{3} - \frac{2}{3}x) = 12 \\
-\frac{4}{15} + \frac{2}{15}x - \frac{1}{5}x = 12 \quad / - (-\frac{4}{15}) \\
+\frac{2}{15}x - \frac{1}{5}x = 12 - (-\frac{4}{15}) \\
\frac{7}{15}x = 12\frac{4}{15} \quad / : \frac{7}{15} \\
x = \frac{12\frac{4}{15}}{\frac{7}{15}} \\
x = 26\frac{2}{7} \\
y = 1\frac{1}{3} - \frac{2}{3}x \\
y = 1\frac{1}{3} - \frac{2}{3} \cdot 26\frac{2}{7} \\
y = -16\frac{4}{21} \\
L = \{26\frac{2}{7} / -16\frac{4}{21}\}
\end{array}$$

Aufgabe (15)

$I \quad 1x + 2y = -4$ $II \quad -1x + 2y = 5$ <p>I nach x auflösen</p> $1x + 2y = -4$ $1x + 2y = -4 \quad / - 2y$ $1x = -4 - 2y \quad / : 1$ $x = -4 - 2y$ <p>I in II</p> $-1(-4 - 2y) + 2y = 5$ $4 + 2y + 2y = 5 \quad / - 4$ $+2y + 2y = 5 - 4$ $4y = 1 \quad / : 4$ $y = \frac{1}{4}$ $y = \frac{1}{4}$ $x = -4 - 2y$ $x = -4 - 2 \cdot \frac{1}{4}$ $x = -4 \frac{1}{2}$ $L = \{-4 \frac{1}{2} / \frac{1}{4}\}$	$I \quad 1x + 2y = -4$ $II \quad -1x + 2y = 5$ <p>I nach y auflösen</p> $1x + 2y = -4$ $1x + 2y = -4 \quad / - 1x$ $2y = -4 - 1x \quad / : 2$ $y = -2 - \frac{1}{2}x$ <p>I in II</p> $-1x + 2(-2 - \frac{1}{2}x) = 5$ $-4 - 1x + 2x = 5 \quad / - (-4)$ $-1x + 2x = 5 - (-4)$ $-2x = 9 \quad / : (-2)$ $x = \frac{9}{-2}$ $x = -4 \frac{1}{2}$ $y = -2 - \frac{1}{2}x$ $y = -2 - \frac{1}{2} \cdot (-4 \frac{1}{2})$ $y = \frac{1}{4}$ $L = \{-4 \frac{1}{2} / \frac{1}{4}\}$
--	---

Aufgabe (16)

$I \quad 2x + 4y = 4$ $II \quad -\frac{1}{2}x + 3y = 3$ <p>I nach x auflösen</p> $2x + 4y = 4$ $2x + 4y = 4 \quad / - 4y$ $2x = 4 - 4y \quad / : 2$ $x = 2 - 2y$ <p>I in II</p> $-\frac{1}{2}(2 - 2y) + 3y = 3$ $-1 + 1y + 3y = 3 \quad / - (-1)$ $+1y + 3y = 3 - (-1)$ $4y = 4 \quad / : 4$ $y = \frac{4}{4}$ $y = 1$ $x = 2 - 2y$ $x = 2 - 2 \cdot 1$ $x = 0$ $L = \{0/1\}$	$I \quad 2x + 4y = 4$ $II \quad -\frac{1}{2}x + 3y = 3$ <p>I nach y auflösen</p> $2x + 4y = 4$ $2x + 4y = 4 \quad / - 2x$ $4y = 4 - 2x \quad / : 4$ $y = 1 - \frac{1}{2}x$ <p>I in II</p> $-\frac{1}{2}x + 3(1 - \frac{1}{2}x) = 3$ $3 - 1\frac{1}{2}x + 3x = 3 \quad / - 3$ $-1\frac{1}{2}x + 3x = 3 - 3$ $-2x = 0 \quad / : (-2)$ $x = \frac{0}{-2}$ $x = 0$ $y = 1 - \frac{1}{2}x$ $y = 1 - \frac{1}{2} \cdot 0$ $y = 1$ $L = \{0/1\}$
---	---

Aufgabe (17)

$I \quad -\frac{1}{2}x + 4y = 6$ $II \quad -2x - 8y = 2$ <p>I nach x auflösen</p> $-\frac{1}{2}x + 4y = 6$ $-\frac{1}{2}x + 4y = 6 \quad / -4y$ $-\frac{1}{2}x = 6 - 4y \quad / : (-\frac{1}{2})$ $x = -12 + 8y$ <p>I in II</p> $-2(-12 + 8y) + -8y = 2$ $24 - 16y - 8y = 2 \quad / -24$ $-16y - 8y = 2 - 24$ $-24y = -22 \quad / : (-24)$ $y = \frac{-22}{-24}$ $y = \frac{11}{12}$ $x = -12 + 8y$ $x = -12 + 8 \cdot \frac{11}{12}$ $x = -4\frac{2}{3}$ $L = \{-4\frac{2}{3} / \frac{11}{12}\}$	$I \quad -\frac{1}{2}x + 4y = 6$ $II \quad -2x - 8y = 2$ <p>I nach y auflösen</p> $-\frac{1}{2}x + 4y = 6$ $-\frac{1}{2}x + 4y = 6 \quad / + \frac{1}{2}x$ $4y = 6 + \frac{1}{2}x \quad / : 4$ $y = 1\frac{1}{2} + \frac{1}{8}x$ <p>I in II</p> $-2x + -8(1\frac{1}{2} + \frac{1}{8}x) = 2$ $-12 - 1x - 8x = 2 \quad / -(-12)$ $-1x - 8x = 2 - (-12)$ $-3x = 14 \quad / : (-3)$ $x = \frac{14}{-3}$ $x = -4\frac{2}{3}$ $y = 1\frac{1}{2} + \frac{1}{8}x$ $y = 1\frac{1}{2} + \frac{1}{8} \cdot (-4\frac{2}{3})$ $y = \frac{11}{12}$ $L = \{-4\frac{2}{3} / \frac{11}{12}\}$
---	--

Aufgabe (18)

$I \quad 1x + 1y = 1$ $II \quad 2x + 2y = 2$ <p>I nach x auflösen</p> $1x + 1y = 1$ $1x + 1y = 1 \quad / -1y$ $1x = 1 - 1y \quad / : 1$ $x = 1 - 1y$ <p>I in II</p> $2(1 - 1y) + 2y = 2$ $2 - 2y + 2y = 2 \quad / -2$ $-2y + 2y = 2 - 2$ <p>$L = unendlich$</p>	$I \quad 1x + 1y = 1$ $II \quad 2x + 2y = 2$ <p>I nach y auflösen</p> $1x + 1y = 1$ $1x + 1y = 1 \quad / -1x$ $1y = 1 - 1x \quad / : 1$ $y = 1 - 1x$ <p>I in II</p> $2x + 2(1 - 1x) = 2$ $2 - 2x + 2x = 2 \quad / -2$ $-2x + 2x = 2 - 2$ <p>$L = unendlich$</p>
--	--

Aufgabe (19)

$I \quad 1x + 1y = 2$ $II \quad 3x + 3y = 3$ <p>I nach x auflösen</p> $1x + 1y = 2$ $1x + 1y = 2 \quad / -1y$ $1x = 2 - 1y \quad / : 1$ $x = 2 - 1y$ <p>I in II</p> $3(2 - 1y) + 3y = 3$ $6 - 3y + 3y = 3 \quad / -6$ $-3y + 3y = 3 - 6$ <p>$L = \{\}$</p>	$I \quad 1x + 1y = 2$ $II \quad 3x + 3y = 3$ <p>I nach y auflösen</p> $1x + 1y = 2$ $1x + 1y = 2 \quad / -1x$ $1y = 2 - 1x \quad / : 1$ $y = 2 - 1x$ <p>I in II</p> $3x + 3(2 - 1x) = 3$ $6 - 3x + 3x = 3 \quad / -6$ $-3x + 3x = 3 - 6$ <p>$L = \{\}$</p>
---	---

Aufgabe (20)

$$\begin{array}{l}
 I \quad -1\frac{4}{5}x + 1\frac{1}{3}y = -1 \\
 II \quad -\frac{2}{3}x + \frac{1}{9}y = 9 \\
 \text{I nach x auflösen} \\
 -1\frac{4}{5}x + 1\frac{1}{3}y = -1 \\
 -1\frac{4}{5}x + 1\frac{1}{3}y = -1 \quad / -1\frac{1}{3}y \\
 -1\frac{4}{5}x = -1 - 1\frac{1}{3}y \quad / : (-1\frac{4}{5}) \\
 x = \frac{5}{9} + \frac{20}{27}y \\
 \text{I in II} \\
 -\frac{2}{3}(\frac{5}{9} + \frac{20}{27}y) + \frac{1}{9}y = 9 \\
 -\frac{10}{27} - \frac{40}{81}y + \frac{1}{9}y = 9 \quad / -(-\frac{10}{27}) \\
 -\frac{40}{81}y + \frac{1}{9}y = 9 - (-\frac{10}{27}) \\
 -\frac{31}{81}y = 9\frac{10}{27} \quad / : (-\frac{31}{81}) \\
 y = \frac{9\frac{10}{27}}{-\frac{31}{81}} \\
 y = -24\frac{15}{31} \\
 x = \frac{5}{9} + \frac{20}{27}y \\
 x = \frac{5}{9} + \frac{20}{27} \cdot (-24\frac{15}{31}) \\
 x = -17\frac{18}{31} \\
 L = \{-17\frac{18}{31} / -24\frac{15}{31}\}
 \end{array}$$

$$\begin{array}{l}
 I \quad -1\frac{4}{5}x + 1\frac{1}{3}y = -1 \\
 II \quad -\frac{2}{3}x + \frac{1}{9}y = 9 \\
 \text{I nach y auflösen} \\
 -1\frac{4}{5}x + 1\frac{1}{3}y = -1 \\
 -1\frac{4}{5}x + 1\frac{1}{3}y = -1 \quad / +1\frac{4}{5}x \\
 1\frac{1}{3}y = -1 + 1\frac{4}{5}x \quad / : 1\frac{1}{3} \\
 y = -\frac{3}{4} + 1\frac{7}{20}x \\
 \text{I in II} \\
 -\frac{2}{3}x + \frac{1}{9}(-\frac{3}{4} + 1\frac{7}{20}x) = 9 \\
 -\frac{1}{12} + \frac{3}{20}x + \frac{1}{9}x = 9 \quad / -(-\frac{1}{12}) \\
 +\frac{3}{20}x + \frac{1}{9}x = 9 - (-\frac{1}{12}) \\
 -\frac{31}{60}x = 9\frac{1}{12} \quad / : (-\frac{31}{60}) \\
 x = \frac{9\frac{1}{12}}{-\frac{31}{60}} \\
 x = -17\frac{18}{31} \\
 y = -\frac{3}{4} + 1\frac{7}{20}x \\
 y = -\frac{3}{4} + 1\frac{7}{20} \cdot (-17\frac{18}{31}) \\
 y = -24\frac{15}{31} \\
 L = \{-17\frac{18}{31} / -24\frac{15}{31}\}
 \end{array}$$

Aufgabe (21)

$$\begin{array}{l}
 I \quad 2x - 7y = -8 \\
 II \quad 7x - 1y = -9 \\
 \text{I nach x auflösen} \\
 2x - 7y = -8 \\
 2x - 7y = -8 \quad / +7y \\
 2x = -8 + 7y \quad / : 2 \\
 x = -4 + 3\frac{1}{2}y \\
 \text{I in II} \\
 7(-4 + 3\frac{1}{2}y) - 1y = -9 \\
 -28 + 24\frac{1}{2}y - 1y = -9 \quad / -(-28) \\
 +24\frac{1}{2}y - 1y = -9 - (-28) \\
 23\frac{1}{2}y = 19 \quad / : 23\frac{1}{2} \\
 y = \frac{19}{23\frac{1}{2}} \\
 y = \frac{38}{47} \\
 x = -4 + 3\frac{1}{2}y \\
 x = -4 + 3\frac{1}{2} \cdot \frac{38}{47} \\
 x = -1\frac{8}{47} \\
 L = \{-1\frac{8}{47} / \frac{38}{47}\}
 \end{array}$$

$$\begin{array}{l}
 I \quad 2x - 7y = -8 \\
 II \quad 7x - 1y = -9 \\
 \text{I nach y auflösen} \\
 2x - 7y = -8 \\
 2x - 7y = -8 \quad / -2x \\
 -7y = -8 - 2x \quad / : (-7) \\
 y = 1\frac{1}{7} + \frac{2}{7}x \\
 \text{I in II} \\
 7x + -1(1\frac{1}{7} + \frac{2}{7}x) = -9 \\
 -1\frac{1}{7} - \frac{2}{7}x - 1x = -9 \quad / -(-1\frac{1}{7}) \\
 -\frac{2}{7}x - 1x = -9 - (-1\frac{1}{7}) \\
 6\frac{5}{7}x = -7\frac{6}{7} \quad / : 6\frac{5}{7} \\
 x = \frac{-7\frac{6}{7}}{6\frac{5}{7}} \\
 x = -1\frac{8}{47} \\
 y = 1\frac{1}{7} + \frac{2}{7}x \\
 y = 1\frac{1}{7} + \frac{2}{7} \cdot (-1\frac{8}{47}) \\
 y = \frac{38}{47} \\
 L = \{-1\frac{8}{47} / \frac{38}{47}\}
 \end{array}$$

Aufgabe (22)

$$\begin{array}{l}
I \quad -7x + 9y = -3 \\
II \quad 5x - 6y = -4 \\
\text{I nach x auflösen} \\
-7x + 9y = -3 \\
-7x + 9y = -3 \quad / -9y \\
-7x = -3 - 9y \quad / : (-7) \\
x = \frac{3}{7} + 1\frac{2}{7}y \\
\text{I in II} \\
5(\frac{3}{7} + 1\frac{2}{7}y) + -6y = -4 \\
2\frac{1}{7} + 6\frac{3}{7}y - 6y = -4 \quad / -2\frac{1}{7} \\
+6\frac{3}{7}y - 6y = -4 - 2\frac{1}{7} \\
\frac{3}{7}y = -6\frac{1}{7} \quad / : \frac{3}{7} \\
y = \frac{-6\frac{1}{7}}{\frac{3}{7}} \\
y = -14\frac{1}{3} \\
x = \frac{3}{7} + 1\frac{2}{7}y \\
x = \frac{3}{7} + 1\frac{2}{7} \cdot (-14\frac{1}{3}) \\
x = -18 \\
L = \{-18 / -14\frac{1}{3}\}
\end{array}$$

$$\begin{array}{l}
I \quad -7x + 9y = -3 \\
II \quad 5x - 6y = -4 \\
\text{I nach y auflösen} \\
-7x + 9y = -3 \\
-7x + 9y = -3 \quad / +7x \\
9y = -3 + 7x \quad / : 9 \\
y = -\frac{1}{3} + \frac{7}{9}x \\
\text{I in II} \\
5x + -6(-\frac{1}{3} + \frac{7}{9}x) = -4 \\
2 - 4\frac{2}{3}x - 6x = -4 \quad / -2 \\
-4\frac{2}{3}x - 6x = -4 - 2 \\
\frac{1}{3}x = -6 \quad / : \frac{1}{3} \\
x = \frac{-6}{\frac{1}{3}} \\
x = -18 \\
y = -\frac{1}{3} + \frac{7}{9}x \\
y = -\frac{1}{3} + \frac{7}{9} \cdot (-18) \\
y = -14\frac{1}{3} \\
L = \{-18 / -14\frac{1}{3}\}
\end{array}$$

Aufgabe (23)

$$\begin{array}{l}
I \quad 2x + 2y = 1\frac{7}{10} \\
II \quad 3x + 6y = 3 \\
\text{I nach x auflösen} \\
2x + 2y = 1\frac{7}{10} \\
2x + 2y = 1\frac{7}{10} \quad / -2y \\
2x = 1\frac{7}{10} - 2y \quad / : 2 \\
x = \frac{17}{20} - 1y \\
\text{I in II} \\
3(\frac{17}{20} - 1y) + 6y = 3 \\
2\frac{11}{20} - 3y + 6y = 3 \quad / -2\frac{11}{20} \\
-3y + 6y = 3 - 2\frac{11}{20} \\
3y = \frac{9}{20} \quad / : 3 \\
y = \frac{\frac{9}{20}}{3} \\
y = \frac{3}{20} \\
x = \frac{17}{20} - 1y \\
x = \frac{17}{20} - 1 \cdot \frac{3}{20} \\
x = \frac{14}{20} \\
L = \{\frac{14}{20} / \frac{3}{20}\}
\end{array}$$

$$\begin{array}{l}
I \quad 2x + 2y = 1\frac{7}{10} \\
II \quad 3x + 6y = 3 \\
\text{I nach y auflösen} \\
2x + 2y = 1\frac{7}{10} \\
2x + 2y = 1\frac{7}{10} \quad / -2x \\
2y = 1\frac{7}{10} - 2x \quad / : 2 \\
y = \frac{17}{20} - 1x \\
\text{I in II} \\
3x + 6(\frac{17}{20} - 1x) = 3 \\
5\frac{1}{10} - 6x + 6x = 3 \quad / -5\frac{1}{10} \\
-6x + 6x = 3 - 5\frac{1}{10} \\
-3x = -2\frac{1}{10} \quad / : (-3) \\
x = \frac{-2\frac{1}{10}}{-3} \\
x = \frac{7}{10} \\
y = \frac{17}{20} - 1x \\
y = \frac{17}{20} - 1 \cdot \frac{7}{10} \\
y = \frac{3}{20} \\
L = \{\frac{7}{10} / \frac{3}{20}\}
\end{array}$$

Aufgabe (24)

$$\begin{array}{l}
 I \quad 3x + 5y = 8 \\
 II \quad 9x + 0y = 7 \\
 \text{I nach x auflösen} \\
 3x + 5y = 8 \\
 3x + 5y = 8 \quad / - 5y \\
 3x = 8 - 5y \quad / : 3 \\
 x = 2\frac{2}{3} - 1\frac{2}{3}y \\
 \text{I in II} \\
 9(2\frac{2}{3} - 1\frac{2}{3}y) + 0y = 7 \\
 24 - 15y + 0y = 7 \quad / - 24 \\
 -15y + 0y = 7 - 24 \\
 -15y = -17 \quad / : (-15) \\
 y = \frac{-17}{-15} \\
 y = 1\frac{2}{15} \\
 x = 2\frac{2}{3} - 1\frac{2}{3}y \\
 x = 2\frac{2}{3} - 1\frac{2}{3} \cdot 1\frac{2}{15} \\
 x = \frac{7}{9} \\
 L = \{\frac{7}{9} / 1\frac{2}{15}\}
 \end{array}$$

$$\begin{array}{l}
 I \quad 3x + 5y = 8 \\
 II \quad 9x + 0y = 7 \\
 \text{I nach y auflösen} \\
 3x + 5y = 8 \\
 3x + 5y = 8 \quad / - 3x \\
 5y = 8 - 3x \quad / : 5 \\
 y = 1\frac{3}{5} - \frac{3}{5}x \\
 \text{I in II} \\
 9x + 0(1\frac{3}{5} - \frac{3}{5}x) = 7 \\
 9x - 0x + 0x = 7 \quad / - 0 \\
 -0x + 0x = 7 - 0 \\
 9x = 7 \quad / : 9 \\
 x = \frac{7}{9} \\
 x = \frac{7}{9} \\
 y = 1\frac{3}{5} - \frac{3}{5}x \\
 y = 1\frac{3}{5} - \frac{3}{5} \cdot \frac{7}{9} \\
 y = 1\frac{2}{15} \\
 L = \{\frac{7}{9} / 1\frac{2}{15}\}
 \end{array}$$

Aufgabe (25)

$$\begin{array}{l}
 I \quad 3x + 6y = 8 \\
 II \quad 9x + 0y = 9 \\
 \text{I nach x auflösen} \\
 3x + 6y = 8 \\
 3x + 6y = 8 \quad / - 6y \\
 3x = 8 - 6y \quad / : 3 \\
 x = 2\frac{2}{3} - 2y \\
 \text{I in II} \\
 9(2\frac{2}{3} - 2y) + 0y = 9 \\
 24 - 18y + 0y = 9 \quad / - 24 \\
 -18y + 0y = 9 - 24 \\
 -18y = -15 \quad / : (-18) \\
 y = \frac{-15}{-18} \\
 y = \frac{5}{6} \\
 x = 2\frac{2}{3} - 2y \\
 x = 2\frac{2}{3} - 2 \cdot \frac{5}{6} \\
 x = 1 \\
 L = \{1 / \frac{5}{6}\}
 \end{array}$$

$$\begin{array}{l}
 I \quad 3x + 6y = 8 \\
 II \quad 9x + 0y = 9 \\
 \text{I nach y auflösen} \\
 3x + 6y = 8 \\
 3x + 6y = 8 \quad / - 3x \\
 6y = 8 - 3x \quad / : 6 \\
 y = 1\frac{1}{3} - \frac{1}{2}x \\
 \text{I in II} \\
 9x + 0(1\frac{1}{3} - \frac{1}{2}x) = 9 \\
 9x - 0x + 0x = 9 \quad / - 0 \\
 -0x + 0x = 9 - 0 \\
 9x = 9 \quad / : 9 \\
 x = \frac{9}{9} \\
 x = 1 \\
 y = 1\frac{1}{3} - \frac{1}{2}x \\
 y = 1\frac{1}{3} - \frac{1}{2} \cdot 1 \\
 y = \frac{5}{6} \\
 L = \{1 / \frac{5}{6}\}
 \end{array}$$

Aufgabe (26)

$$I \quad 3x + 6y = 8$$

$$II \quad 9x + 0y = 9$$

I nach x auflösen

$$3x + 6y = 8$$

$$3x + 6y = 8 \quad / - 6y$$

$$3x = 8 - 6y \quad / : 3$$

$$x = 2\frac{2}{3} - 2y$$

I in II

$$9(2\frac{2}{3} - 2y) + 0y = 9$$

$$24 - 18y + 0y = 9 \quad / - 24$$

$$-18y + 0y = 9 - 24$$

$$-18y = -15 \quad / : (-18)$$

$$y = \frac{-15}{-18}$$

$$y = \frac{5}{6}$$

$$x = 2\frac{2}{3} - 2y$$

$$x = 2\frac{2}{3} - 2 \cdot \frac{5}{6}$$

$$x = 1$$

$$L = \{1/\frac{5}{6}\}$$

$$I \quad 3x + 6y = 8$$

$$II \quad 9x + 0y = 9$$

I nach y auflösen

$$3x + 6y = 8$$

$$3x + 6y = 8 \quad / - 3x$$

$$6y = 8 - 3x \quad / : 6$$

$$y = 1\frac{1}{3} - \frac{1}{2}x$$

I in II

$$9x + 0(1\frac{1}{3} - \frac{1}{2}x) = 9$$

$$0 - 0x + 0x = 9 \quad / - 0$$

$$-0x + 0x = 9 - 0$$

$$9x = 9 \quad / : 9$$

$$x = \frac{9}{9}$$

$$x = 1$$

$$y = 1\frac{1}{3} - \frac{1}{2}x$$

$$y = 1\frac{1}{3} - \frac{1}{2} \cdot 1$$

$$y = \frac{5}{6}$$

$$L = \{1/\frac{5}{6}\}$$

2 Gleichsetzungsverfahren (2)

$$I \quad a1 \cdot x + b1 \cdot y = c1$$

$$II \quad a2 \cdot x + b2 \cdot y = c2$$

- beide Gleichungen nach x oder y auflösen
- Terme gleichsetzen
- Gleichung nach der Unbekannten auflösen
- Zweite Unbekannte berechnen

$$I \quad 3x + 5y = 19$$

$$II \quad 7x + 5y = 31$$

I nach y auflösen

$$3x + 5y = 19$$

$$3x + 5y = 19 \quad / - 3x$$

$$5y = 19 - 3x \quad / : 5$$

$$y = 3\frac{4}{5} - \frac{3}{5}x$$

II nach y auflösen

$$7x + 5y = 31$$

$$7x + 5y = 31 \quad / - 7x$$

$$5y = 31 - 7x \quad / : 5$$

$$y = 6\frac{1}{5} - 1\frac{2}{5}x$$

$$I = II$$

$$3\frac{4}{5} - \frac{3}{5}x = 6\frac{1}{5} - 1\frac{2}{5}x \quad / + \frac{3}{5}x$$

$$3\frac{4}{5} = 6\frac{1}{5} - \frac{4}{5}x \quad / - 6\frac{1}{5}$$

$$-2\frac{2}{5} = -\frac{4}{5}x \quad / : (-\frac{4}{5})$$

$$x = 3$$

x in I

$$y = 3\frac{4}{5} - \frac{3}{5} \cdot 3$$

$$y = 2$$

$$L = \{3/2\}$$

$$I \quad 3x + 5y = 19$$

$$II \quad 7x + 5y = 31$$

I nach x auflösen

$$3x + 5y = 19$$

$$3x + 5y = 19 \quad / - 5y$$

$$3x = 19 - 5y \quad / : 3$$

$$x = 6\frac{1}{3} - 1\frac{2}{3}y$$

II nach x auflösen

$$7x + 5y = 31$$

$$7x + 5y = 31 \quad / - 5y$$

$$7x = 31 - 5y \quad / : 7$$

$$x = 4\frac{3}{7} - \frac{5}{7}y$$

$$I = II$$

$$6\frac{1}{3} - 1\frac{2}{3}y = 4\frac{3}{7} - \frac{5}{7}y \quad / + 1\frac{2}{3}y$$

$$6\frac{1}{3} = 4\frac{3}{7} + \frac{20}{21}y \quad / - 4\frac{3}{7}$$

$$1\frac{19}{21} = \frac{20}{21}y \quad / : \frac{20}{21}$$

$$y = 2$$

y in I

$$x = 6\frac{1}{3} - 1\frac{2}{3} \cdot 2$$

$$x = 3$$

$$L = \{3/2\}$$

2.1 Aufgaben

Um eigene Aufgaben zu lösen, klicken Sie hier: [Neue Rechnung](#)

Gegeben:

$$a1 \cdot x + b1 \cdot y = c1$$

$$a2 \cdot x + b2 \cdot y = c2$$

Gesucht:

x und y

$$(1) \quad \begin{cases} 3x + 5y = 19 \\ 7x + 5y = 31 \end{cases}$$

$$(7) \quad \begin{cases} 4x - 5y = 43 \\ -3x - 7y = 0 \end{cases}$$

$$(2) \quad \begin{cases} 1x + 1y = 10 \\ 1x - 1y = 4 \end{cases}$$

$$(8) \quad \begin{cases} 8x - 3y = 10 \\ 12x - 5y = 24 \end{cases}$$

$$(3) \quad \begin{cases} 9x - 2y = 5 \\ 5x - 2y = 1 \end{cases}$$

$$(9) \quad \begin{cases} -\frac{1}{2}x + 1y = 2 \\ \frac{1}{2}x - 3y = -3 \end{cases}$$

$$(4) \quad \begin{cases} 9x - 2y = 1 \\ -3x - 3y = -7 \end{cases}$$

$$(10) \quad \begin{cases} -1x + 1y = 3 \\ \frac{1}{2}x - 4y = 5 \end{cases}$$

$$(5) \quad \begin{cases} 1x + 3y = 9 \\ 3x - 2y = -6 \end{cases}$$

$$(11) \quad \begin{cases} 1\frac{1}{5}x - 1\frac{1}{3}y = 5\frac{1}{3} \\ 2\frac{1}{2}x - \frac{1}{4}y = 12\frac{3}{8} \end{cases}$$

$$(6) \quad \begin{cases} 7x + 1\frac{1}{2}y = 1 \\ 2x - 5y = 22 \end{cases}$$

$$(12) \quad \begin{cases} \frac{2}{3}x - \frac{5}{7}y = \frac{2}{3} \\ 1x + 1y = 10\frac{2}{3} \end{cases}$$

$$(13) \quad \begin{aligned} \frac{1}{2}x - 2y &= 9 \\ \frac{2}{5}x + \frac{1}{3}y &= 5 \end{aligned}$$

$$(21) \quad \begin{aligned} 2x - 7y &= -8 \\ 7x - 1y &= -9 \end{aligned}$$

$$(14) \quad \begin{aligned} 2x + 3y &= 4 \\ \frac{1}{3}x - \frac{1}{5}y &= 12 \end{aligned}$$

$$(22) \quad \begin{aligned} -7x + 9y &= -3 \\ 5x - 6y &= -4 \end{aligned}$$

$$(15) \quad \begin{aligned} 1x + 2y &= -4 \\ -1x + 2y &= 5 \end{aligned}$$

$$(23) \quad \begin{aligned} 2x + 2y &= 1\frac{7}{10} \\ 3x + 6y &= 3 \end{aligned}$$

$$(16) \quad \begin{aligned} 2x + 4y &= 4 \\ -\frac{1}{2}x + 3y &= 3 \end{aligned}$$

$$(24) \quad \begin{aligned} 34x + 5y &= 7 \\ 7x + 9y &= 8 \end{aligned}$$

$$(17) \quad \begin{aligned} -\frac{1}{2}x + 4y &= 6 \\ -2x - 8y &= 2 \end{aligned}$$

$$(25) \quad \begin{aligned} 34x + 5y &= 7 \\ 7x + 9y &= 8 \end{aligned}$$

$$(18) \quad \begin{aligned} 1x + 1y &= 1 \\ 2x + 2y &= 2 \end{aligned}$$

$$(26) \quad \begin{aligned} 34x + 5y &= 7 \\ 7x + 9y &= 8 \end{aligned}$$

$$(19) \quad \begin{aligned} 1x + 1y &= 2 \\ 3x + 3y &= 3 \end{aligned}$$

$$(27) \quad \begin{aligned} 2x + 5y &= 7 \\ -4x + 2y &= -6 \end{aligned}$$

$$(20) \quad \begin{aligned} -1\frac{4}{5}x + 1\frac{1}{3}y &= -1 \\ -\frac{2}{3}x + \frac{1}{9}y &= 9 \end{aligned}$$

$$(28) \quad \begin{aligned} 2x + 5y &= 7 \\ -4x + 2y &= -6 \end{aligned}$$

2.2 Lösungen

Aufgabe (1)

$$\begin{array}{l}
 I \quad 3x + 5y = 19 \\
 II \quad 7x + 5y = 31 \\
 \text{I nach y auflösen} \\
 3x + 5y = 19 \\
 3x + 5y = 19 \quad / - 3x \\
 5y = 19 - 3x \quad / : 5 \\
 y = 3\frac{4}{5} - \frac{3}{5}x \\
 \text{II nach y auflösen} \\
 7x + 5y = 31 \\
 7x + 5y = 31 \quad / - 7x \\
 5y = 31 - 7x \quad / : 5 \\
 y = 6\frac{1}{5} - 1\frac{2}{5}x \\
 \text{I} = \text{II} \\
 3\frac{4}{5} - \frac{3}{5}x = 6\frac{1}{5} - 1\frac{2}{5}x \quad / + \frac{3}{5}x / - 6\frac{1}{5} \\
 3\frac{4}{5} - 6\frac{1}{5} = -1\frac{2}{5}x + \frac{3}{5}x \\
 -2\frac{2}{5} = -\frac{4}{5}x \quad / : (-\frac{4}{5}) \\
 x = 3 \\
 \text{x in I} \\
 y = 3\frac{4}{5} - \frac{3}{5} \cdot 3 \\
 y = 2 \\
 L = \{3/2\}
 \end{array}$$

$$\begin{array}{l}
 I \quad 3x + 5y = 19 \\
 II \quad 7x + 5y = 31 \\
 \text{I nach x auflösen} \\
 3x + 5y = 19 \\
 3x + 5y = 19 \quad / - 5y \\
 3x = 19 - 5y \quad / : 3 \\
 x = 6\frac{1}{3} - 1\frac{2}{3}y \\
 \text{II nach x auflösen} \\
 7x + 5y = 31 \\
 7x + 5y = 31 \quad / - 5y \\
 7x = 31 - 5y \quad / : 7 \\
 x = 4\frac{3}{7} - \frac{5}{7}y \\
 \text{I} = \text{II} \\
 6\frac{1}{3} - 1\frac{2}{3}y = 4\frac{3}{7} - \frac{5}{7}y \quad / + 1\frac{2}{3}y / - 4\frac{3}{7} \\
 6\frac{1}{3} - 4\frac{3}{7} = -\frac{5}{7}y + 1\frac{2}{3}y \\
 1\frac{19}{21} = \frac{20}{21}y \quad / : \frac{20}{21} \\
 y = 2 \\
 \text{y in I} \\
 x = 6\frac{1}{3} - 1\frac{2}{3} \cdot 2 \\
 x = 3 \\
 L = \{3/2\}
 \end{array}$$

Aufgabe (2)

$$\begin{array}{l}
 I \quad 1x + 1y = 10 \\
 II \quad 1x - 1y = 4 \\
 \text{I nach y auflösen} \\
 1x + 1y = 10 \\
 1x + 1y = 10 \quad / - 1x \\
 1y = 10 - 1x \quad / : 1 \\
 y = 10 - 1x \\
 \text{II nach y auflösen} \\
 1x - 1y = 4 \\
 1x - 1y = 4 \quad / - 1x \\
 -1y = 4 - 1x \quad / : (-1) \\
 y = -4 + 1x \\
 \text{I} = \text{II} \\
 10 - 1x = -4 + 1x \quad / + 1x / + 4 \\
 10 + 4 = 1x + 1x \\
 14 = 2x \quad / : 2 \\
 x = 7 \\
 \text{x in I} \\
 y = 10 - 1 \cdot 7 \\
 y = 3 \\
 L = \{7/3\}
 \end{array}$$

$$\begin{array}{l}
 I \quad 1x + 1y = 10 \\
 II \quad 1x - 1y = 4 \\
 \text{I nach x auflösen} \\
 1x + 1y = 10 \\
 1x + 1y = 10 \quad / - 1y \\
 1x = 10 - 1y \quad / : 1 \\
 x = 10 - 1y \\
 \text{II nach x auflösen} \\
 1x - 1y = 4 \\
 1x - 1y = 4 \quad / + 1y \\
 1x = 4 + 1y \quad / : 1 \\
 x = 4 + 1y \\
 \text{I} = \text{II} \\
 10 - 1y = 4 + 1y \quad / + 1y / - 4 \\
 10 - 4 = 1y + 1y \\
 6 = 2y \quad / : 2 \\
 y = 3 \\
 \text{y in I} \\
 x = 10 - 1 \cdot 3 \\
 x = 7 \\
 L = \{7/3\}
 \end{array}$$

Aufgabe (3)

$$\begin{array}{l}
 I \quad 9x - 2y = 5 \\
 II \quad 5x - 2y = 1 \\
 \text{I nach y auflösen} \\
 9x - 2y = 5 \quad / - 9x \\
 -2y = 5 - 9x \quad / : (-2) \\
 y = -2\frac{1}{2} + 4\frac{1}{2}x \\
 \text{II nach y auflösen} \\
 5x - 2y = 1 \\
 5x - 2y = 1 \quad / - 5x \\
 -2y = 1 - 5x \quad / : (-2) \\
 y = -\frac{1}{2} + 2\frac{1}{2}x \\
 \text{I} = \text{II} \\
 -2\frac{1}{2} + 4\frac{1}{2}x = -\frac{1}{2} + 2\frac{1}{2}x \quad / - 4\frac{1}{2}x / + \frac{1}{2} \\
 -2\frac{1}{2} + \frac{1}{2} = 2\frac{1}{2}x - 4\frac{1}{2}x \\
 -2 = -2x \quad / : (-2) \\
 x = 1 \\
 \text{x in I} \\
 y = -2\frac{1}{2} + 4\frac{1}{2} \cdot 1 \\
 y = 2 \\
 L = \{1/2\}
 \end{array}$$

$$\begin{array}{l}
 I \quad 9x - 2y = 5 \\
 II \quad 5x - 2y = 1 \\
 \text{I nach x auflösen} \\
 9x - 2y = 5 \\
 9x - 2y = 5 \quad / + 2y \\
 9x = 5 + 2y \quad / : 9 \\
 x = \frac{5}{9} + \frac{2}{9}y \\
 \text{II nach x auflösen} \\
 5x - 2y = 1 \\
 5x - 2y = 1 \quad / + 2y \\
 5x = 1 + 2y \quad / : 5 \\
 x = \frac{1}{5} + \frac{2}{5}y \\
 \text{I} = \text{II} \\
 \frac{5}{9} + \frac{2}{9}y = \frac{1}{5} + \frac{2}{5}y \quad / - \frac{2}{9}y / - \frac{1}{5} \\
 \frac{5}{9} - \frac{1}{5} = \frac{2}{5}y - \frac{2}{9}y \\
 \frac{16}{45} = \frac{8}{45}y \quad / : \frac{8}{45} \\
 y = 2 \\
 \text{y in I} \\
 x = \frac{5}{9} + \frac{2}{9} \cdot 2 \\
 x = 1 \\
 L = \{1/2\}
 \end{array}$$

Aufgabe (4)

$$\begin{array}{l}
 I \quad 9x - 2y = 1 \\
 II \quad -3x - 3y = -7 \\
 \text{I nach y auflösen} \\
 9x - 2y = 1 \\
 9x - 2y = 1 \quad / - 9x \\
 -2y = 1 - 9x \quad / : (-2) \\
 y = -\frac{1}{2} + 4\frac{1}{2}x \\
 \text{II nach y auflösen} \\
 -3x - 3y = -7 \\
 -3x - 3y = -7 \quad / + 3x \\
 -3y = -7 + 3x \quad / : (-3) \\
 y = 2\frac{1}{3} - 1x \\
 \text{I} = \text{II} \\
 -\frac{1}{2} + 4\frac{1}{2}x = 2\frac{1}{3} - 1x \quad / - 4\frac{1}{2}x / - 2\frac{1}{3} \\
 -\frac{1}{2} - 2\frac{1}{3} = -1x - 4\frac{1}{2}x \\
 -2\frac{5}{6} = -5\frac{1}{2}x \quad / : (-5\frac{1}{2}) \\
 x = \frac{17}{33} \\
 \text{x in I} \\
 y = -\frac{1}{2} + 4\frac{1}{2} \cdot \frac{17}{33} \\
 y = 1\frac{9}{11} \\
 L = \{\frac{17}{33}/1\frac{9}{11}\}
 \end{array}$$

$$\begin{array}{l}
 I \quad 9x - 2y = 1 \\
 II \quad -3x - 3y = -7 \\
 \text{I nach x auflösen} \\
 9x - 2y = 1 \\
 9x - 2y = 1 \quad / + 2y \\
 9x = 1 + 2y \quad / : 9 \\
 x = \frac{1}{9} + \frac{2}{9}y \\
 \text{II nach x auflösen} \\
 -3x - 3y = -7 \\
 -3x - 3y = -7 \quad / + 3y \\
 -3x = -7 + 3y \quad / : (-3) \\
 x = 2\frac{1}{3} - 1y \\
 \text{I} = \text{II} \\
 \frac{1}{9} + \frac{2}{9}y = 2\frac{1}{3} - 1y \quad / - \frac{2}{9}y / - 2\frac{1}{3} \\
 \frac{1}{9} - 2\frac{1}{3} = -1y - \frac{2}{9}y \\
 -2\frac{2}{9} = -1\frac{2}{9}y \quad / : (-1\frac{2}{9}) \\
 y = 1\frac{9}{11} \\
 \text{y in I} \\
 x = \frac{1}{9} + \frac{2}{9} \cdot 1\frac{9}{11} \\
 x = \frac{17}{33} \\
 L = \{\frac{17}{33}/1\frac{9}{11}\}
 \end{array}$$

Aufgabe (5)

$$\begin{array}{l}
I \quad 1x + 3y = 9 \\
II \quad 3x - 2y = -6 \\
\text{I nach y auflösen} \\
1x + 3y = 9 \\
1x + 3y = 9 \quad / - 1x \\
3y = 9 - 1x \quad / : 3 \\
y = 3 - \frac{1}{3}x \\
\text{II nach y auflösen} \\
3x - 2y = -6 \\
3x - 2y = -6 \quad / - 3x \\
-2y = -6 - 3x \quad / : (-2) \\
y = 3 + 1\frac{1}{2}x \\
I = II \\
3 - \frac{1}{3}x = 3 + 1\frac{1}{2}x \quad / + \frac{1}{3}x / - 3 \\
3 - 3 = 1\frac{1}{2}x + \frac{1}{3}x \\
0 = 1\frac{5}{6}x \quad / : 1\frac{5}{6} \\
x = 0 \\
\text{x in I} \\
y = 3 - \frac{1}{3} \cdot 0 \\
y = 3 \\
L = \{0/3\}
\end{array}$$

$$\begin{array}{l}
I \quad 1x + 3y = 9 \\
II \quad 3x - 2y = -6 \\
\text{I nach x auflösen} \\
1x + 3y = 9 \\
1x + 3y = 9 \quad / - 3y \\
1x = 9 - 3y \quad / : 1 \\
x = 9 - 3y \\
\text{II nach x auflösen} \\
3x - 2y = -6 \\
3x - 2y = -6 \quad / + 2y \\
3x = -6 + 2y \quad / : 3 \\
x = -2 + \frac{2}{3}y \\
I = II \\
9 - 3y = -2 + \frac{2}{3}y \quad / + 3y / + 2 \\
9 + 2 = \frac{2}{3}y + 3y \\
11 = 3\frac{2}{3}y \quad / : 3\frac{2}{3} \\
y = 3 \\
\text{y in I} \\
x = 9 - 3 \cdot 3 \\
x = 0 \\
L = \{0/3\}
\end{array}$$

Aufgabe (6)

$$\begin{array}{l}
I \quad 7x + 1\frac{1}{2}y = 1 \\
II \quad 2x - 5y = 22 \\
\text{I nach y auflösen} \\
7x + 1\frac{1}{2}y = 1 \\
7x + 1\frac{1}{2}y = 1 \quad / - 7x \\
1\frac{1}{2}y = 1 - 7x \quad / : 1\frac{1}{2} \\
y = \frac{2}{3} - 4\frac{2}{3}x \\
\text{II nach y auflösen} \\
2x - 5y = 22 \\
2x - 5y = 22 \quad / - 2x \\
-5y = 22 - 2x \quad / : (-5) \\
y = -4\frac{2}{5} + \frac{2}{5}x \\
I = II \\
\frac{2}{3} - 4\frac{2}{3}x = -4\frac{2}{5} + \frac{2}{5}x \quad / + 4\frac{2}{3}x / + 4\frac{2}{5} \\
\frac{2}{3} + 4\frac{2}{5} = \frac{2}{5}x + 4\frac{2}{3}x \\
5\frac{1}{15} = 5\frac{1}{15}x \quad / : 5\frac{1}{15} \\
x = 1 \\
\text{x in I} \\
y = \frac{2}{3} - 4\frac{2}{3} \cdot 1 \\
y = -4 \\
L = \{1 / -4\}
\end{array}$$

$$\begin{array}{l}
I \quad 7x + 1\frac{1}{2}y = 1 \\
II \quad 2x - 5y = 22 \\
\text{I nach x auflösen} \\
7x + 1\frac{1}{2}y = 1 \\
7x + 1\frac{1}{2}y = 1 \quad / - 1\frac{1}{2}y \\
7x = 1 - 1\frac{1}{2}y \quad / : 7 \\
x = \frac{1}{7} - \frac{3}{14}y \\
\text{II nach x auflösen} \\
2x - 5y = 22 \\
2x - 5y = 22 \quad / + 5y \\
2x = 22 + 5y \quad / : 2 \\
x = 11 + 2\frac{1}{2}y \\
I = II \\
\frac{1}{7} - \frac{3}{14}y = 11 + 2\frac{1}{2}y \quad / + \frac{3}{14}y / - 11 \\
\frac{1}{7} - 11 = 2\frac{1}{2}y + \frac{3}{14}y \\
-10\frac{6}{7} = 2\frac{5}{7}y \quad / : 2\frac{5}{7} \\
y = -4 \\
\text{y in I} \\
x = \frac{1}{7} - \frac{3}{14} \cdot -4 \\
x = 1 \\
L = \{1 / -4\}
\end{array}$$

Aufgabe (7)

$$\begin{array}{l}
 I \quad 4x - 5y = 43 \\
 II \quad -3x - 7y = 0 \\
 \text{I nach y auflösen} \\
 4x - 5y = 43 \\
 4x - 5y = 43 \quad / - 4x \\
 -5y = 43 - 4x \quad / : (-5) \\
 y = -8\frac{3}{5} + \frac{4}{5}x \\
 \text{II nach y auflösen} \\
 -3x - 7y = 0 \\
 -3x - 7y = 0 \quad / + 3x \\
 -7y = 0 + 3x \quad / : (-7) \\
 y = 0 - \frac{3}{7}x \\
 \text{I} = \text{II} \\
 -8\frac{3}{5} + \frac{4}{5}x = 0 - \frac{3}{7}x \quad / - \frac{4}{5}x / - 0 \\
 -8\frac{3}{5} - 0 = -\frac{3}{7}x - \frac{4}{5}x \\
 -8\frac{3}{5} = -1\frac{8}{35}x \quad / : (-1\frac{8}{35}) \\
 x = 7 \\
 \text{x in I} \\
 y = -8\frac{3}{5} + \frac{4}{5} \cdot 7 \\
 y = -3 \\
 L = \{7 / -3\}
 \end{array}$$

$$\begin{array}{l}
 I \quad 4x - 5y = 43 \\
 II \quad -3x - 7y = 0 \\
 \text{I nach x auflösen} \\
 4x - 5y = 43 \\
 4x - 5y = 43 \quad / + 5y \\
 4x = 43 + 5y \quad / : 4 \\
 x = 10\frac{3}{4} + 1\frac{1}{4}y \\
 \text{II nach x auflösen} \\
 -3x - 7y = 0 \\
 -3x - 7y = 0 \quad / + 7y \\
 -3x = 0 + 7y \quad / : (-3) \\
 x = 0 - 2\frac{1}{3}y \\
 \text{I} = \text{II} \\
 10\frac{3}{4} + 1\frac{1}{4}y = 0 - 2\frac{1}{3}y \quad / - 1\frac{1}{4}y / - 0 \\
 10\frac{3}{4} - 0 = -2\frac{1}{3}y - 1\frac{1}{4}y \\
 10\frac{3}{4} = -3\frac{7}{12}y \quad / : (-3\frac{7}{12}) \\
 y = -3 \\
 \text{y in I} \\
 x = 10\frac{3}{4} + 1\frac{1}{4} \cdot -3 \\
 x = 7 \\
 L = \{7 / -3\}
 \end{array}$$

Aufgabe (8)

$$\begin{array}{l}
 I \quad 8x - 3y = 10 \\
 II \quad 12x - 5y = 24 \\
 \text{I nach y auflösen} \\
 8x - 3y = 10 \\
 8x - 3y = 10 \quad / - 8x \\
 -3y = 10 - 8x \quad / : (-3) \\
 y = -3\frac{1}{3} + 2\frac{2}{3}x \\
 \text{II nach y auflösen} \\
 12x - 5y = 24 \\
 12x - 5y = 24 \quad / - 12x \\
 -5y = 24 - 12x \quad / : (-5) \\
 y = -4\frac{4}{5} + 2\frac{2}{5}x \\
 \text{I} = \text{II} \\
 -3\frac{1}{3} + 2\frac{2}{3}x = -4\frac{4}{5} + 2\frac{2}{5}x \quad / - 2\frac{2}{3}x / + 4\frac{4}{5} \\
 -3\frac{1}{3} + 4\frac{4}{5} = 2\frac{2}{5}x - 2\frac{2}{3}x \\
 1\frac{7}{15} = -\frac{4}{15}x \quad / : (-\frac{4}{15}) \\
 x = -5\frac{1}{2} \\
 \text{x in I} \\
 y = -3\frac{1}{3} + 2\frac{2}{3} \cdot -5\frac{1}{2} \\
 y = -18 \\
 L = \{-5\frac{1}{2} / -18\}
 \end{array}$$

$$\begin{array}{l}
 I \quad 8x - 3y = 10 \\
 II \quad 12x - 5y = 24 \\
 \text{I nach x auflösen} \\
 8x - 3y = 10 \\
 8x - 3y = 10 \quad / + 3y \\
 8x = 10 + 3y \quad / : 8 \\
 x = 1\frac{1}{4} + \frac{3}{8}y \\
 \text{II nach x auflösen} \\
 12x - 5y = 24 \\
 12x - 5y = 24 \quad / + 5y \\
 12x = 24 + 5y \quad / : 12 \\
 x = 2 + \frac{5}{12}y \\
 \text{I} = \text{II} \\
 1\frac{1}{4} + \frac{3}{8}y = 2 + \frac{5}{12}y \quad / - \frac{3}{8}y / - 2 \\
 1\frac{1}{4} - 2 = \frac{5}{12}y - \frac{3}{8}y \\
 -\frac{3}{4} = \frac{1}{24}y \quad / : \frac{1}{24} \\
 y = -18 \\
 \text{y in I} \\
 x = 1\frac{1}{4} + \frac{3}{8} \cdot -18 \\
 x = -5\frac{1}{2} \\
 L = \{-5\frac{1}{2} / -18\}
 \end{array}$$

Aufgabe (9)

$$\begin{array}{l}
I \quad -\frac{1}{2}x + 1y = 2 \\
II \quad \frac{1}{2}x - 3y = -3 \\
\text{I nach y auflösen} \\
-\frac{1}{2}x + 1y = 2 \\
-\frac{1}{2}x + 1y = 2 \quad / + \frac{1}{2}x \\
1y = 2 + \frac{1}{2}x \quad / : 1 \\
y = 2 + \frac{1}{2}x \\
\text{II nach y auflösen} \\
\frac{1}{2}x - 3y = -3 \\
\frac{1}{2}x - 3y = -3 \quad / - \frac{1}{2}x \\
-3y = -3 - \frac{1}{2}x \quad / : (-3) \\
y = 1 + \frac{1}{6}x \\
I = II \\
2 + \frac{1}{2}x = 1 + \frac{1}{6}x \quad / - \frac{1}{2}x / - 1 \\
2 - 1 = \frac{1}{6}x - \frac{1}{2}x \\
1 = -\frac{1}{3}x \quad / : (-\frac{1}{3}) \\
x = -3 \\
\text{x in I} \\
y = 2 + \frac{1}{2} \cdot -3 \\
y = \frac{1}{2} \\
L = \{-3/\frac{1}{2}\}
\end{array}$$

$$\begin{array}{l}
I \quad -\frac{1}{2}x + 1y = 2 \\
II \quad \frac{1}{2}x - 3y = -3 \\
\text{I nach x auflösen} \\
-\frac{1}{2}x + 1y = 2 \\
-\frac{1}{2}x + 1y = 2 \quad / - 1y \\
-\frac{1}{2}x = 2 - 1y \quad / : (-\frac{1}{2}) \\
x = -4 + 2y \\
\text{II nach x auflösen} \\
\frac{1}{2}x - 3y = -3 \\
\frac{1}{2}x - 3y = -3 \quad / + 3y \\
\frac{1}{2}x = -3 + 3y \quad / : \frac{1}{2} \\
x = -6 + 6y \\
I = II \\
-4 + 2y = -6 + 6y \quad / - 2y / + 6 \\
-4 + 6 = 6y - 2y \\
2 = 4y \quad / : 4 \\
y = \frac{1}{2} \\
\text{y in I} \\
x = -4 + 2 \cdot \frac{1}{2} \\
x = -3 \\
L = \{-3/\frac{1}{2}\}
\end{array}$$

Aufgabe (10)

$$\begin{array}{l}
I \quad -1x + 1y = 3 \\
II \quad \frac{1}{2}x - 4y = 5 \\
\text{I nach y auflösen} \\
-1x + 1y = 3 \\
-1x + 1y = 3 \quad / + 1x \\
1y = 3 + 1x \quad / : 1 \\
y = 3 + 1x \\
\text{II nach y auflösen} \\
\frac{1}{2}x - 4y = 5 \\
\frac{1}{2}x - 4y = 5 \quad / - \frac{1}{2}x \\
-4y = 5 - \frac{1}{2}x \quad / : (-4) \\
y = -1\frac{1}{4} + \frac{1}{8}x \\
I = II \\
3 + 1x = -1\frac{1}{4} + \frac{1}{8}x \quad / - 1x / + 1\frac{1}{4} \\
3 + 1\frac{1}{4} = \frac{1}{8}x - 1x \\
4\frac{1}{4} = -\frac{7}{8}x \quad / : (-\frac{7}{8}) \\
x = -4\frac{6}{7} \\
\text{x in I} \\
y = 3 + 1 \cdot -4\frac{6}{7} \\
y = -1\frac{6}{7} \\
L = \{-4\frac{6}{7}/ -1\frac{6}{7}\}
\end{array}$$

$$\begin{array}{l}
I \quad -1x + 1y = 3 \\
II \quad \frac{1}{2}x - 4y = 5 \\
\text{I nach x auflösen} \\
-1x + 1y = 3 \\
-1x + 1y = 3 \quad / - 1y \\
-1x = 3 - 1y \quad / : (-1) \\
x = -3 + 1y \\
\text{II nach x auflösen} \\
\frac{1}{2}x - 4y = 5 \\
\frac{1}{2}x - 4y = 5 \quad / + 4y \\
\frac{1}{2}x = 5 + 4y \quad / : \frac{1}{2} \\
x = 10 + 8y \\
I = II \\
-3 + 1y = 10 + 8y \quad / - 1y / - 10 \\
-3 - 10 = 8y - 1y \\
-13 = 7y \quad / : 7 \\
y = -1\frac{6}{7} \\
\text{y in I} \\
x = -3 + 1 \cdot -1\frac{6}{7} \\
x = -4\frac{6}{7} \\
L = \{-4\frac{6}{7}/ -1\frac{6}{7}\}
\end{array}$$

Aufgabe (11)

$$\begin{array}{l}
 I \quad 1\frac{1}{5}x - 1\frac{1}{3}y = 5\frac{1}{3} \\
 II \quad 2\frac{1}{2}x - \frac{1}{4}y = 12\frac{3}{8} \\
 \text{I nach y auflösen} \\
 1\frac{1}{5}x - 1\frac{1}{3}y = 5\frac{1}{3} \\
 1\frac{1}{5}x - 1\frac{1}{3}y = 5\frac{1}{3} \quad / - 1\frac{1}{5}x \\
 -1\frac{1}{3}y = 5\frac{1}{3} - 1\frac{1}{5}x \quad / : (-1\frac{1}{3}) \\
 y = -4 + \frac{9}{10}x \\
 \text{II nach y auflösen} \\
 2\frac{1}{2}x - \frac{1}{4}y = 12\frac{3}{8} \\
 2\frac{1}{2}x - \frac{1}{4}y = 12\frac{3}{8} \quad / - 2\frac{1}{2}x \\
 -\frac{1}{4}y = 12\frac{3}{8} - 2\frac{1}{2}x \quad / : (-\frac{1}{4}) \\
 y = -49\frac{1}{2} + 10x \\
 \text{I} = \text{II} \\
 -4 + \frac{9}{10}x = -49\frac{1}{2} + 10x \quad / - \frac{9}{10}x / + 49\frac{1}{2} \\
 -4 + 49\frac{1}{2} = 10x - \frac{9}{10}x \\
 45\frac{1}{2} = 9\frac{1}{10}x \quad / : 9\frac{1}{10} \\
 x = 5 \\
 \text{x in I} \\
 y = -4 + \frac{9}{10} \cdot 5 \\
 y = \frac{1}{2} \\
 L = \{5/\frac{1}{2}\}
 \end{array}$$

$$\begin{array}{l}
 I \quad 1\frac{1}{5}x - 1\frac{1}{3}y = 5\frac{1}{3} \\
 II \quad 2\frac{1}{2}x - \frac{1}{4}y = 12\frac{3}{8} \\
 \text{I nach x auflösen} \\
 1\frac{1}{5}x - 1\frac{1}{3}y = 5\frac{1}{3} \\
 1\frac{1}{5}x - 1\frac{1}{3}y = 5\frac{1}{3} \quad / + 1\frac{1}{3}y \\
 1\frac{1}{5}x = 5\frac{1}{3} + 1\frac{1}{3}y \quad / : 1\frac{1}{5} \\
 x = 4\frac{4}{9} + 1\frac{1}{9}y \\
 \text{II nach x auflösen} \\
 2\frac{1}{2}x - \frac{1}{4}y = 12\frac{3}{8} \\
 2\frac{1}{2}x - \frac{1}{4}y = 12\frac{3}{8} \quad / + \frac{1}{4}y \\
 2\frac{1}{2}x = 12\frac{3}{8} + \frac{1}{4}y \quad / : 2\frac{1}{2} \\
 x = 4\frac{19}{20} + \frac{1}{10}y \\
 \text{I} = \text{II} \\
 4\frac{4}{9} + 1\frac{1}{9}y = 4\frac{19}{20} + \frac{1}{10}y \quad / - 1\frac{1}{9}y / - 4\frac{19}{20} \\
 4\frac{4}{9} - 4\frac{19}{20} = \frac{1}{10}y - 1\frac{1}{9}y \\
 -0,506 = -1\frac{1}{90}y \quad / : (-1\frac{1}{90}) \\
 y = \frac{1}{2} \\
 \text{y in I} \\
 x = 4\frac{4}{9} + 1\frac{1}{9} \cdot \frac{1}{2} \\
 x = 5 \\
 L = \{5/\frac{1}{2}\}
 \end{array}$$

Aufgabe (12)

$$\begin{array}{l}
 I \quad \frac{2}{3}x - \frac{5}{7}y = \frac{2}{3} \\
 II \quad 1x + 1y = 10\frac{2}{3} \\
 \text{I nach y auflösen} \\
 \frac{2}{3}x - \frac{5}{7}y = \frac{2}{3} \\
 \frac{2}{3}x - \frac{5}{7}y = \frac{2}{3} \quad / - \frac{2}{3}x \\
 -\frac{5}{7}y = \frac{2}{3} - \frac{2}{3}x \quad / : (-\frac{5}{7}) \\
 y = -\frac{14}{15} + \frac{14}{15}x \\
 \text{II nach y auflösen} \\
 1x + 1y = 10\frac{2}{3} \\
 1x + 1y = 10\frac{2}{3} \quad / - 1x \\
 1y = 10\frac{2}{3} - 1x \quad / : 1 \\
 y = 10\frac{2}{3} - 1x \\
 \text{I} = \text{II} \\
 -\frac{14}{15} + \frac{14}{15}x = 10\frac{2}{3} - 1x \quad / - \frac{14}{15}x / - 10\frac{2}{3} \\
 -\frac{14}{15} - 10\frac{2}{3} = -1x - \frac{14}{15}x \\
 -11\frac{3}{5} = -1\frac{14}{15}x \quad / : (-1\frac{14}{15}) \\
 x = 6 \\
 \text{x in I} \\
 y = -\frac{14}{15} + \frac{14}{15} \cdot 6 \\
 y = 4\frac{2}{3} \\
 L = \{6/4\frac{2}{3}\}
 \end{array}$$

$$\begin{array}{l}
 I \quad \frac{2}{3}x - \frac{5}{7}y = \frac{2}{3} \\
 II \quad 1x + 1y = 10\frac{2}{3} \\
 \text{I nach x auflösen} \\
 \frac{2}{3}x - \frac{5}{7}y = \frac{2}{3} \\
 \frac{2}{3}x - \frac{5}{7}y = \frac{2}{3} \quad / + \frac{5}{7}y \\
 \frac{2}{3}x = \frac{2}{3} + \frac{5}{7}y \quad / : \frac{2}{3} \\
 x = 1 + 1\frac{1}{14}y \\
 \text{II nach x auflösen} \\
 1x + 1y = 10\frac{2}{3} \\
 1x + 1y = 10\frac{2}{3} \quad / - 1y \\
 1x = 10\frac{2}{3} - 1y \quad / : 1 \\
 x = 10\frac{2}{3} - 1y \\
 \text{I} = \text{II} \\
 1 + 1\frac{1}{14}y = 10\frac{2}{3} - 1y \quad / - 1\frac{1}{14}y / - 10\frac{2}{3} \\
 1 - 10\frac{2}{3} = -1y - 1\frac{1}{14}y \\
 -9\frac{2}{3} = -2\frac{1}{14}y \quad / : (-2\frac{1}{14}) \\
 y = 4\frac{2}{3} \\
 \text{y in I} \\
 x = 1 + 1\frac{1}{14} \cdot 4\frac{2}{3} \\
 x = 6 \\
 L = \{6/4\frac{2}{3}\}
 \end{array}$$

Aufgabe (13)

$$\begin{array}{l}
 I \quad 1\frac{1}{2}x - 2y = 9 \\
 II \quad \frac{2}{5}x + \frac{1}{3}y = 5 \\
 \text{I nach y auflösen} \\
 1\frac{1}{2}x - 2y = 9 \\
 1\frac{1}{2}x - 2y = 9 \quad / - 1\frac{1}{2}x \\
 -2y = 9 - 1\frac{1}{2}x \quad / : (-2) \\
 y = -4\frac{1}{2} + \frac{3}{4}x \\
 \text{II nach y auflösen} \\
 \frac{2}{5}x + \frac{1}{3}y = 5 \\
 \frac{2}{5}x + \frac{1}{3}y = 5 \quad / - \frac{2}{5}x \\
 \frac{1}{3}y = 5 - \frac{2}{5}x \quad / : \frac{1}{3} \\
 y = 15 - 1\frac{1}{5}x \\
 \text{I} = \text{II} \\
 -4\frac{1}{2} + \frac{3}{4}x = 15 - 1\frac{1}{5}x \quad / - \frac{3}{4}x / - 15 \\
 -4\frac{1}{2} - 15 = -1\frac{1}{5}x - \frac{3}{4}x \\
 -19\frac{1}{2} = -1\frac{19}{20}x \quad / : (-1\frac{19}{20}) \\
 x = 10 \\
 \text{x in I} \\
 y = -4\frac{1}{2} + \frac{3}{4} \cdot 10 \\
 y = 3 \\
 L = \{10/3\}
 \end{array}$$

$$\begin{array}{l}
 I \quad 1\frac{1}{2}x - 2y = 9 \\
 II \quad \frac{2}{5}x + \frac{1}{3}y = 5 \\
 \text{I nach x auflösen} \\
 1\frac{1}{2}x - 2y = 9 \\
 1\frac{1}{2}x - 2y = 9 \quad / + 2y \\
 1\frac{1}{2}x = 9 + 2y \quad / : 1\frac{1}{2} \\
 x = 6 + 1\frac{1}{3}y \\
 \text{II nach x auflösen} \\
 \frac{2}{5}x + \frac{1}{3}y = 5 \\
 \frac{2}{5}x + \frac{1}{3}y = 5 \quad / - \frac{1}{3}y \\
 \frac{2}{5}x = 5 - \frac{1}{3}y \quad / : \frac{2}{5} \\
 x = 12\frac{1}{2} - \frac{5}{6}y \\
 \text{I} = \text{II} \\
 6 + 1\frac{1}{3}y = 12\frac{1}{2} - \frac{5}{6}y \quad / - 1\frac{1}{3}y / - 12\frac{1}{2} \\
 6 - 12\frac{1}{2} = -\frac{5}{6}y - 1\frac{1}{3}y \\
 -6\frac{1}{2} = -2\frac{1}{6}y \quad / : (-2\frac{1}{6}) \\
 y = 3 \\
 \text{y in I} \\
 x = 6 + 1\frac{1}{3} \cdot 3 \\
 x = 10 \\
 L = \{10/3\}
 \end{array}$$

Aufgabe (14)

$$\begin{array}{l}
 I \quad 2x + 3y = 4 \\
 II \quad \frac{1}{3}x - \frac{1}{5}y = 12 \\
 \text{I nach y auflösen} \\
 2x + 3y = 4 \\
 2x + 3y = 4 \quad / - 2x \\
 3y = 4 - 2x \quad / : 3 \\
 y = 1\frac{1}{3} - \frac{2}{3}x \\
 \text{II nach y auflösen} \\
 \frac{1}{3}x - \frac{1}{5}y = 12 \\
 \frac{1}{3}x - \frac{1}{5}y = 12 \quad / - \frac{1}{3}x \\
 -\frac{1}{5}y = 12 - \frac{1}{3}x \quad / : (-\frac{1}{5}) \\
 y = -60 + 1\frac{2}{3}x \\
 \text{I} = \text{II} \\
 1\frac{1}{3} - \frac{2}{3}x = -60 + 1\frac{2}{3}x \quad / + \frac{2}{3}x / + 60 \\
 1\frac{1}{3} + 60 = 1\frac{2}{3}x + \frac{2}{3}x \\
 61\frac{1}{3} = 2\frac{1}{3}x \quad / : 2\frac{1}{3} \\
 x = 26\frac{2}{7} \\
 \text{x in I} \\
 y = 1\frac{1}{3} - \frac{2}{3} \cdot 26\frac{2}{7} \\
 y = -16\frac{4}{21} \\
 L = \{26\frac{2}{7} / -16\frac{4}{21}\}
 \end{array}$$

$$\begin{array}{l}
 I \quad 2x + 3y = 4 \\
 II \quad \frac{1}{3}x - \frac{1}{5}y = 12 \\
 \text{I nach x auflösen} \\
 2x + 3y = 4 \\
 2x + 3y = 4 \quad / - 3y \\
 2x = 4 - 3y \quad / : 2 \\
 x = 2 - 1\frac{1}{2}y \\
 \text{II nach x auflösen} \\
 \frac{1}{3}x - \frac{1}{5}y = 12 \\
 \frac{1}{3}x - \frac{1}{5}y = 12 \quad / + \frac{1}{5}y \\
 \frac{1}{3}x = 12 + \frac{1}{5}y \quad / : \frac{1}{3} \\
 x = 36 + \frac{3}{5}y \\
 \text{I} = \text{II} \\
 2 - 1\frac{1}{2}y = 36 + \frac{3}{5}y \quad / + 1\frac{1}{2}y / - 36 \\
 2 - 36 = \frac{3}{5}y + 1\frac{1}{2}y \\
 -34 = 2\frac{1}{10}y \quad / : 2\frac{1}{10} \\
 y = -16\frac{4}{21} \\
 \text{y in I} \\
 x = 2 - 1\frac{1}{2} \cdot -16\frac{4}{21} \\
 x = 26\frac{2}{7} \\
 L = \{26\frac{2}{7} / -16\frac{4}{21}\}
 \end{array}$$

Aufgabe (15)

$ \begin{array}{l} I \quad 1x + 2y = -4 \\ II \quad -1x + 2y = 5 \\ \text{I nach y auflösen} \\ 1x + 2y = -4 \\ 1x + 2y = -4 \quad / - 1x \\ 2y = -4 - 1x \quad / : 2 \\ y = -2 - \frac{1}{2}x \\ \text{II nach y auflösen} \\ -1x + 2y = 5 \\ -1x + 2y = 5 \quad / + 1x \\ 2y = 5 + 1x \quad / : 2 \\ y = 2\frac{1}{2} + \frac{1}{2}x \\ I = II \\ -2 - \frac{1}{2}x = 2\frac{1}{2} + \frac{1}{2}x \quad / + \frac{1}{2}x / - 2\frac{1}{2} \\ -2 - 2\frac{1}{2} = \frac{1}{2}x + \frac{1}{2}x \\ -4\frac{1}{2} = 1x \quad / : 1 \\ x = -4\frac{1}{2} \\ \text{x in I} \\ y = -2 - \frac{1}{2} \cdot -4\frac{1}{2} \\ y = \frac{1}{4} \\ L = \{-4\frac{1}{2} / \frac{1}{4}\} \end{array} $	$ \begin{array}{l} I \quad 1x + 2y = -4 \\ II \quad -1x + 2y = 5 \\ \text{I nach x auflösen} \\ 1x + 2y = -4 \\ 1x + 2y = -4 \quad / - 2y \\ 1x = -4 - 2y \quad / : 1 \\ x = -4 - 2y \\ \text{II nach x auflösen} \\ -1x + 2y = 5 \\ -1x + 2y = 5 \quad / - 2y \\ -1x = 5 - 2y \quad / : (-1) \\ x = -5 + 2y \\ I = II \\ -4 - 2y = -5 + 2y \quad / + 2y / + 5 \\ -4 + 5 = 2y + 2y \\ 1 = 4y \quad / : 4 \\ y = \frac{1}{4} \\ \text{y in I} \\ x = -4 - 2 \cdot \frac{1}{4} \\ x = -4\frac{1}{2} \\ L = \{-4\frac{1}{2} / \frac{1}{4}\} \end{array} $
--	--

Aufgabe (16)

$ \begin{array}{l} I \quad 2x + 4y = 4 \\ II \quad -\frac{1}{2}x + 3y = 3 \\ \text{I nach y auflösen} \\ 2x + 4y = 4 \\ 2x + 4y = 4 \quad / - 2x \\ 4y = 4 - 2x \quad / : 4 \\ y = 1 - \frac{1}{2}x \\ \text{II nach y auflösen} \\ -\frac{1}{2}x + 3y = 3 \\ -\frac{1}{2}x + 3y = 3 \quad / + \frac{1}{2}x \\ 3y = 3 + \frac{1}{2}x \quad / : 3 \\ y = 1 + \frac{1}{6}x \\ I = II \\ 1 - \frac{1}{2}x = 1 + \frac{1}{6}x \quad / + \frac{1}{2}x / - 1 \\ 1 - 1 = \frac{1}{6}x + \frac{1}{2}x \\ 0 = \frac{2}{3}x \quad / : \frac{2}{3} \\ x = 0 \\ \text{x in I} \\ y = 1 - \frac{1}{2} \cdot 0 \\ y = 1 \\ L = \{0/1\} \end{array} $	$ \begin{array}{l} I \quad 2x + 4y = 4 \\ II \quad -\frac{1}{2}x + 3y = 3 \\ \text{I nach x auflösen} \\ 2x + 4y = 4 \\ 2x + 4y = 4 \quad / - 4y \\ 2x = 4 - 4y \quad / : 2 \\ x = 2 - 2y \\ \text{II nach x auflösen} \\ -\frac{1}{2}x + 3y = 3 \\ -\frac{1}{2}x + 3y = 3 \quad / - 3y \\ -\frac{1}{2}x = 3 - 3y \quad / : (-\frac{1}{2}) \\ x = -6 + 6y \\ I = II \\ 2 - 2y = -6 + 6y \quad / + 2y / + 6 \\ 2 + 6 = 6y + 2y \\ 8 = 8y \quad / : 8 \\ y = 1 \\ \text{y in I} \\ x = 2 - 2 \cdot 1 \\ x = 0 \\ L = \{0/1\} \end{array} $
--	--

Aufgabe (17)

$I \quad -\frac{1}{2}x + 4y = 6$ $II \quad -2x - 8y = 2$ <p>I nach y auflösen</p> $-\frac{1}{2}x + 4y = 6$ $-\frac{1}{2}x + 4y = 6 \quad / + \frac{1}{2}x$ $4y = 6 + \frac{1}{2}x \quad / : 4$ $y = 1\frac{1}{2} + \frac{1}{8}x$ <p>II nach y auflösen</p> $-2x - 8y = 2$ $-2x - 8y = 2 \quad / + 2x$ $-8y = 2 + 2x \quad / : (-8)$ $y = -\frac{1}{4} - \frac{1}{4}x$ <p>I = II</p> $1\frac{1}{2} + \frac{1}{8}x = -\frac{1}{4} - \frac{1}{4}x \quad / - \frac{1}{8}x / + \frac{1}{4}$ $1\frac{1}{2} + \frac{1}{4} = -\frac{1}{4}x - \frac{1}{8}x$ $1\frac{3}{4} = -\frac{3}{8}x \quad / : (-\frac{3}{8})$ $x = -4\frac{2}{3}$ <p>x in I</p> $y = 1\frac{1}{2} + \frac{1}{8} \cdot -4\frac{2}{3}$ $y = \frac{11}{12}$ $L = \{-4\frac{2}{3} / \frac{11}{12}\}$	$I \quad -\frac{1}{2}x + 4y = 6$ $II \quad -2x - 8y = 2$ <p>I nach x auflösen</p> $-\frac{1}{2}x + 4y = 6$ $-\frac{1}{2}x + 4y = 6 \quad / - 4y$ $-\frac{1}{2}x = 6 - 4y \quad / : (-\frac{1}{2})$ $x = -12 + 8y$ <p>II nach x auflösen</p> $-2x - 8y = 2$ $-2x - 8y = 2 \quad / + 8y$ $-2x = 2 + 8y \quad / : (-2)$ $x = -1 - 4y$ <p>I = II</p> $-12 + 8y = -1 - 4y \quad / - 8y / + 1$ $-12 + 1 = -4y - 8y$ $-11 = -12y \quad / : (-12)$ $y = \frac{11}{12}$ <p>y in I</p> $x = -12 + 8 \cdot \frac{11}{12}$ $x = -4\frac{2}{3}$ $L = \{-4\frac{2}{3} / \frac{11}{12}\}$
---	--

Aufgabe (18)

$I \quad 1x + 1y = 1$ $II \quad 2x + 2y = 2$ <p>I nach y auflösen</p> $1x + 1y = 1$ $1x + 1y = 1 \quad / - 1x$ $1y = 1 - 1x \quad / : 1$ $y = 1 - 1x$ <p>II nach y auflösen</p> $2x + 2y = 2$ $2x + 2y = 2 \quad / - 2x$ $2y = 2 - 2x \quad / : 2$ $y = 1 - 1x$ <p>I = II</p> $1 - 1x = 1 - 1x \quad / + 1x / - 1$ $1 - 1 = -1x + 1x$ $L = \text{unendlich}$	$I \quad 1x + 1y = 1$ $II \quad 2x + 2y = 2$ <p>I nach x auflösen</p> $1x + 1y = 1$ $1x + 1y = 1 \quad / - 1y$ $1x = 1 - 1y \quad / : 1$ $x = 1 - 1y$ <p>II nach x auflösen</p> $2x + 2y = 2$ $2x + 2y = 2 \quad / - 2y$ $2x = 2 - 2y \quad / : 2$ $x = 1 - 1y$ <p>I = II</p> $1 - 1y = 1 - 1y \quad / + 1y / - 1$ $1 - 1 = -1y + 1y$ $L = \text{unendlich}$
---	---

Aufgabe (19)

$$\begin{array}{l}
 I \quad 1x + 1y = 2 \\
 II \quad 3x + 3y = 3 \\
 \text{I nach y auflösen} \\
 1x + 1y = 2 \\
 1x + 1y = 2 \quad / - 1x \\
 1y = 2 - 1x \quad / : 1 \\
 y = 2 - 1x \\
 \text{II nach y auflösen} \\
 3x + 3y = 3 \\
 3x + 3y = 3 \quad / - 3x \\
 3y = 3 - 3x \quad / : 3 \\
 y = 1 - 1x \\
 \text{I} = \text{II} \\
 2 - 1x = 1 - 1x \quad / + 1x / - 1 \\
 2 - 1 = -1x + 1x \\
 \\
 L = \{ \}
 \end{array}$$

$$\begin{array}{l}
 I \quad 1x + 1y = 2 \\
 II \quad 3x + 3y = 3 \\
 \text{I nach x auflösen} \\
 1x + 1y = 2 \\
 1x + 1y = 2 \quad / - 1y \\
 1x = 2 - 1y \quad / : 1 \\
 x = 2 - 1y \\
 \text{II nach x auflösen} \\
 3x + 3y = 3 \\
 3x + 3y = 3 \quad / - 3y \\
 3x = 3 - 3y \quad / : 3 \\
 x = 1 - 1y \\
 \text{I} = \text{II} \\
 2 - 1y = 1 - 1y \quad / + 1y / - 1 \\
 2 - 1 = -1y + 1y \\
 \\
 L = \{ \}
 \end{array}$$

Aufgabe (20)

$$\begin{array}{l}
 I \quad -1\frac{4}{5}x + 1\frac{1}{3}y = -1 \\
 II \quad -\frac{2}{3}x + \frac{1}{9}y = 9 \\
 \text{I nach y auflösen} \\
 -1\frac{4}{5}x + 1\frac{1}{3}y = -1 \\
 -1\frac{4}{5}x + 1\frac{1}{3}y = -1 \quad / + 1\frac{4}{5}x \\
 1\frac{1}{3}y = -1 + 1\frac{4}{5}x \quad / : 1\frac{1}{3} \\
 y = -\frac{3}{4} + 1\frac{7}{20}x \\
 \text{II nach y auflösen} \\
 -\frac{2}{3}x + \frac{1}{9}y = 9 \\
 -\frac{2}{3}x + \frac{1}{9}y = 9 \quad / + \frac{2}{3}x \\
 \frac{1}{9}y = 9 + \frac{2}{3}x \quad / : \frac{1}{9} \\
 y = 81 + 6x \\
 \text{I} = \text{II} \\
 -\frac{3}{4} + 1\frac{7}{20}x = 81 + 6x \quad / - 1\frac{7}{20}x / - 81 \\
 -\frac{3}{4} - 81 = 6x - 1\frac{7}{20}x \\
 -81\frac{3}{4} = 4\frac{13}{20}x \quad / : 4\frac{13}{20} \\
 x = -17\frac{18}{31} \\
 \text{x in I} \\
 y = -\frac{3}{4} + 1\frac{7}{20} \cdot -17\frac{18}{31} \\
 y = -24\frac{15}{31} \\
 L = \{-17\frac{18}{31} / -24\frac{15}{31}\}
 \end{array}$$

$$\begin{array}{l}
 I \quad -1\frac{4}{5}x + 1\frac{1}{3}y = -1 \\
 II \quad -\frac{2}{3}x + \frac{1}{9}y = 9 \\
 \text{I nach x auflösen} \\
 -1\frac{4}{5}x + 1\frac{1}{3}y = -1 \\
 -1\frac{4}{5}x + 1\frac{1}{3}y = -1 \quad / - 1\frac{1}{3}y \\
 -1\frac{4}{5}x = -1 - 1\frac{1}{3}y \quad / : (-1\frac{4}{5}) \\
 x = \frac{5}{9} + \frac{20}{27}y \\
 \text{II nach x auflösen} \\
 -\frac{2}{3}x + \frac{1}{9}y = 9 \\
 -\frac{2}{3}x + \frac{1}{9}y = 9 \quad / - \frac{1}{9}y \\
 -\frac{2}{3}x = 9 - \frac{1}{9}y \quad / : (-\frac{2}{3}) \\
 x = -13\frac{1}{2} + \frac{1}{6}y \\
 \text{I} = \text{II} \\
 \frac{5}{9} + \frac{20}{27}y = -13\frac{1}{2} + \frac{1}{6}y \quad / - \frac{20}{27}y / + 13\frac{1}{2} \\
 \frac{5}{9} + 13\frac{1}{2} = \frac{1}{6}y - \frac{20}{27}y \\
 14\frac{1}{18} = -\frac{31}{54}y \quad / : (-\frac{31}{54}) \\
 y = -24\frac{15}{31} \\
 \text{y in I} \\
 x = \frac{5}{9} + \frac{20}{27} \cdot -24\frac{15}{31} \\
 x = -17\frac{18}{31} \\
 L = \{-17\frac{18}{31} / -24\frac{15}{31}\}
 \end{array}$$

Aufgabe (21)

$$\begin{array}{l}
 I \quad 2x - 7y = -8 \\
 II \quad 7x - 1y = -9 \\
 \text{I nach y auflösen} \\
 2x - 7y = -8 \\
 2x - 7y = -8 \quad / - 2x \\
 -7y = -8 - 2x \quad / : (-7) \\
 y = 1\frac{1}{7} + \frac{2}{7}x \\
 \text{II nach y auflösen} \\
 7x - 1y = -9 \\
 7x - 1y = -9 \quad / - 7x \\
 -1y = -9 - 7x \quad / : (-1) \\
 y = 9 + 7x \\
 \text{I} = \text{II} \\
 1\frac{1}{7} + \frac{2}{7}x = 9 + 7x \quad / - \frac{2}{7}x / - 9 \\
 1\frac{1}{7} - 9 = 7x - \frac{2}{7}x \\
 -7\frac{6}{7} = 6\frac{5}{7}x \quad / : 6\frac{5}{7} \\
 x = -1\frac{8}{47} \\
 \text{x in I} \\
 y = 1\frac{1}{7} + \frac{2}{7} \cdot -1\frac{8}{47} \\
 y = \frac{38}{47} \\
 L = \{-1\frac{8}{47} / \frac{38}{47}\}
 \end{array}$$

$$\begin{array}{l}
 I \quad 2x - 7y = -8 \\
 II \quad 7x - 1y = -9 \\
 \text{I nach x auflösen} \\
 2x - 7y = -8 \\
 2x - 7y = -8 \quad / + 7y \\
 2x = -8 + 7y \quad / : 2 \\
 x = -4 + 3\frac{1}{2}y \\
 \text{II nach x auflösen} \\
 7x - 1y = -9 \\
 7x - 1y = -9 \quad / + 1y \\
 7x = -9 + 1y \quad / : 7 \\
 x = -1\frac{2}{7} + \frac{1}{7}y \\
 \text{I} = \text{II} \\
 -4 + 3\frac{1}{2}y = -1\frac{2}{7} + \frac{1}{7}y \quad / - 3\frac{1}{2}y / + 1\frac{2}{7} \\
 -4 + 1\frac{2}{7} = \frac{1}{7}y - 3\frac{1}{2}y \\
 -2\frac{5}{7} = -3\frac{5}{14}y \quad / : (-3\frac{5}{14}) \\
 y = \frac{38}{47} \\
 \text{y in I} \\
 x = -4 + 3\frac{1}{2} \cdot \frac{38}{47} \\
 x = -1\frac{8}{47} \\
 L = \{-1\frac{8}{47} / \frac{38}{47}\}
 \end{array}$$

Aufgabe (22)

$$\begin{array}{l}
 I \quad -7x + 9y = -3 \\
 II \quad 5x - 6y = -4 \\
 \text{I nach y auflösen} \\
 -7x + 9y = -3 \\
 -7x + 9y = -3 \quad / + 7x \\
 9y = -3 + 7x \quad / : 9 \\
 y = -\frac{1}{3} + \frac{7}{9}x \\
 \text{II nach y auflösen} \\
 5x - 6y = -4 \\
 5x - 6y = -4 \quad / - 5x \\
 -6y = -4 - 5x \quad / : (-6) \\
 y = \frac{2}{3} + \frac{5}{6}x \\
 \text{I} = \text{II} \\
 -\frac{1}{3} + \frac{7}{9}x = \frac{2}{3} + \frac{5}{6}x \quad / - \frac{7}{9}x / - \frac{2}{3} \\
 -\frac{1}{3} - \frac{2}{3} = \frac{5}{6}x - \frac{7}{9}x \\
 -1 = \frac{1}{18}x \quad / : \frac{1}{18} \\
 x = -18 \\
 \text{x in I} \\
 y = -\frac{1}{3} + \frac{7}{9} \cdot -18 \\
 y = -14\frac{1}{3} \\
 L = \{-18 / -14\frac{1}{3}\}
 \end{array}$$

$$\begin{array}{l}
 I \quad -7x + 9y = -3 \\
 II \quad 5x - 6y = -4 \\
 \text{I nach x auflösen} \\
 -7x + 9y = -3 \\
 -7x + 9y = -3 \quad / - 9y \\
 -7x = -3 - 9y \quad / : (-7) \\
 x = \frac{3}{7} + 1\frac{2}{7}y \\
 \text{II nach x auflösen} \\
 5x - 6y = -4 \\
 5x - 6y = -4 \quad / + 6y \\
 5x = -4 + 6y \quad / : 5 \\
 x = -\frac{4}{5} + 1\frac{1}{5}y \\
 \text{I} = \text{II} \\
 \frac{3}{7} + 1\frac{2}{7}y = -\frac{4}{5} + 1\frac{1}{5}y \quad / - 1\frac{2}{7}y / + \frac{4}{5} \\
 \frac{3}{7} + \frac{4}{5} = 1\frac{1}{5}y - 1\frac{2}{7}y \\
 1\frac{8}{35} = -\frac{3}{35}y \quad / : (-\frac{3}{35}) \\
 y = -14\frac{1}{3} \\
 \text{y in I} \\
 x = \frac{3}{7} + 1\frac{2}{7} \cdot -14\frac{1}{3} \\
 x = -18 \\
 L = \{-18 / -14\frac{1}{3}\}
 \end{array}$$

Aufgabe (23)

$$\begin{array}{l}
 I \quad 2x + 2y = 1\frac{7}{10} \\
 II \quad 3x + 6y = 3 \\
 \text{I nach y auflösen} \\
 2x + 2y = 1\frac{7}{10} \\
 2x + 2y = 1\frac{7}{10} \quad / - 2x \\
 2y = 1\frac{7}{10} - 2x \quad / : 2 \\
 y = \frac{17}{20} - 1x \\
 \text{II nach y auflösen} \\
 3x + 6y = 3 \\
 3x + 6y = 3 \quad / - 3x \\
 6y = 3 - 3x \quad / : 6 \\
 y = \frac{1}{2} - \frac{1}{2}x \\
 \text{I} = \text{II} \\
 \frac{17}{20} - 1x = \frac{1}{2} - \frac{1}{2}x \quad / + 1x / - \frac{1}{2} \\
 \frac{17}{20} - \frac{1}{2} = -\frac{1}{2}x + 1x \\
 \frac{7}{20} = \frac{1}{2}x \quad / : \frac{1}{2} \\
 x = \frac{7}{10} \\
 \text{x in I} \\
 y = \frac{17}{20} - 1 \cdot \frac{7}{10} \\
 y = \frac{3}{20} \\
 L = \left\{ \frac{7}{10} / \frac{3}{20} \right\}
 \end{array}$$

$$\begin{array}{l}
 I \quad 2x + 2y = 1\frac{7}{10} \\
 II \quad 3x + 6y = 3 \\
 \text{I nach x auflösen} \\
 2x + 2y = 1\frac{7}{10} \\
 2x + 2y = 1\frac{7}{10} \quad / - 2y \\
 2x = 1\frac{7}{10} - 2y \quad / : 2 \\
 x = \frac{17}{20} - 1y \\
 \text{II nach x auflösen} \\
 3x + 6y = 3 \\
 3x + 6y = 3 \quad / - 6y \\
 3x = 3 - 6y \quad / : 3 \\
 x = 1 - 2y \\
 \text{I} = \text{II} \\
 \frac{17}{20} - 1y = 1 - 2y \quad / + 1y / - 1 \\
 \frac{17}{20} - 1 = -2y + 1y \\
 -\frac{3}{20} = -1y \quad / : (-1) \\
 y = \frac{3}{20} \\
 \text{y in I} \\
 x = \frac{17}{20} - 1 \cdot \frac{3}{20} \\
 x = \frac{7}{10} \\
 L = \left\{ \frac{7}{10} / \frac{3}{20} \right\}
 \end{array}$$

Aufgabe (24)

$$\begin{array}{l}
 I \quad 34x + 5y = 7 \\
 II \quad 7x + 9y = 8 \\
 \text{I nach y auflösen} \\
 34x + 5y = 7 \\
 34x + 5y = 7 \quad / - 34x \\
 5y = 7 - 34x \quad / : 5 \\
 y = 1\frac{2}{5} - 6\frac{4}{5}x \\
 \text{II nach y auflösen} \\
 7x + 9y = 8 \\
 7x + 9y = 8 \quad / - 7x \\
 9y = 8 - 7x \quad / : 9 \\
 y = \frac{8}{9} - \frac{7}{9}x \\
 \text{I} = \text{II} \\
 1\frac{2}{5} - 6\frac{4}{5}x = \frac{8}{9} - \frac{7}{9}x \quad / + 6\frac{4}{5}x / - \frac{8}{9} \\
 1\frac{2}{5} - \frac{8}{9} = -\frac{7}{9}x + 6\frac{4}{5}x \\
 \frac{23}{45} = 6\frac{1}{45}x \quad / : 6\frac{1}{45} \\
 x = 0,0849 \\
 \text{x in I} \\
 y = 1\frac{2}{5} - 6\frac{4}{5} \cdot 0,0849 \\
 y = 0,823 \\
 L = \{0,0849/0,823\}
 \end{array}$$

$$\begin{array}{l}
 I \quad 34x + 5y = 7 \\
 II \quad 7x + 9y = 8 \\
 \text{I nach x auflösen} \\
 34x + 5y = 7 \\
 34x + 5y = 7 \quad / - 5y \\
 34x = 7 - 5y \quad / : 34 \\
 x = \frac{7}{34} - \frac{5}{34}y \\
 \text{II nach x auflösen} \\
 7x + 9y = 8 \\
 7x + 9y = 8 \quad / - 9y \\
 7x = 8 - 9y \quad / : 7 \\
 x = 1\frac{1}{7} - 1\frac{2}{7}y \\
 \text{I} = \text{II} \\
 \frac{7}{34} - \frac{5}{34}y = 1\frac{1}{7} - 1\frac{2}{7}y \quad / + \frac{5}{34}y / - 1\frac{1}{7} \\
 \frac{7}{34} - 1\frac{1}{7} = -1\frac{2}{7}y + \frac{5}{34}y \\
 -0,937 = -1,14y \quad / : (-1,14) \\
 y = 0,823 \\
 \text{y in I} \\
 x = \frac{7}{34} - \frac{5}{34} \cdot 0,823 \\
 x = 0,0849 \\
 L = \{0,0849/0,823\}
 \end{array}$$

Aufgabe (25)

$$\begin{array}{l}
 I \quad 34x + 5y = 7 \\
 II \quad 7x + 9y = 8 \\
 \text{I nach y auflösen} \\
 34x + 5y = 7 \\
 34x + 5y = 7 \quad / - 34x \\
 5y = 7 - 34x \quad / : 5 \\
 y = 1\frac{2}{5} - 6\frac{4}{5}x \\
 \text{II nach y auflösen} \\
 7x + 9y = 8 \\
 7x + 9y = 8 \quad / - 7x \\
 9y = 8 - 7x \quad / : 9 \\
 y = \frac{8}{9} - \frac{7}{9}x \\
 \text{I} = \text{II} \\
 1\frac{2}{5} - 6\frac{4}{5}x = \frac{8}{9} - \frac{7}{9}x \quad / + 6\frac{4}{5}x / - \frac{8}{9} \\
 1\frac{2}{5} - \frac{8}{9} = -\frac{7}{9}x + 6\frac{4}{5}x \\
 \frac{23}{45} = 6\frac{1}{45}x \quad / : 6\frac{1}{45} \\
 x = 0,0849 \\
 \text{x in I} \\
 y = 1\frac{2}{5} - 6\frac{4}{5} \cdot 0,0849 \\
 y = 0,823 \\
 L = \{0,0849/0,823\}
 \end{array}$$

$$\begin{array}{l}
 I \quad 34x + 5y = 7 \\
 II \quad 7x + 9y = 8 \\
 \text{I nach x auflösen} \\
 34x + 5y = 7 \\
 34x + 5y = 7 \quad / - 5y \\
 34x = 7 - 5y \quad / : 34 \\
 x = \frac{7}{34} - \frac{5}{34}y \\
 \text{II nach x auflösen} \\
 7x + 9y = 8 \\
 7x + 9y = 8 \quad / - 9y \\
 7x = 8 - 9y \quad / : 7 \\
 x = 1\frac{1}{7} - 1\frac{2}{7}y \\
 \text{I} = \text{II} \\
 \frac{7}{34} - \frac{5}{34}y = 1\frac{1}{7} - 1\frac{2}{7}y \quad / + \frac{5}{34}y / - 1\frac{1}{7} \\
 \frac{7}{34} - 1\frac{1}{7} = -1\frac{2}{7}y + \frac{5}{34}y \\
 -0,937 = -1,14y \quad / : (-1,14) \\
 y = 0,823 \\
 \text{y in I} \\
 x = \frac{7}{34} - \frac{5}{34} \cdot 0,823 \\
 x = 0,0849 \\
 L = \{0,0849/0,823\}
 \end{array}$$

Aufgabe (26)

$$\begin{array}{l}
 I \quad 34x + 5y = 7 \\
 II \quad 7x + 9y = 8 \\
 \text{I nach y auflösen} \\
 34x + 5y = 7 \\
 34x + 5y = 7 \quad / - 34x \\
 5y = 7 - 34x \quad / : 5 \\
 y = 1\frac{2}{5} - 6\frac{4}{5}x \\
 \text{II nach y auflösen} \\
 7x + 9y = 8 \\
 7x + 9y = 8 \quad / - 7x \\
 9y = 8 - 7x \quad / : 9 \\
 y = \frac{8}{9} - \frac{7}{9}x \\
 \text{I} = \text{II} \\
 1\frac{2}{5} - 6\frac{4}{5}x = \frac{8}{9} - \frac{7}{9}x \quad / + 6\frac{4}{5}x / - \frac{8}{9} \\
 1\frac{2}{5} - \frac{8}{9} = -\frac{7}{9}x + 6\frac{4}{5}x \\
 \frac{23}{45} = 6\frac{1}{45}x \quad / : 6\frac{1}{45} \\
 x = 0,0849 \\
 \text{x in I} \\
 y = 1\frac{2}{5} - 6\frac{4}{5} \cdot 0,0849 \\
 y = 0,823 \\
 L = \{0,0849/0,823\}
 \end{array}$$

$$\begin{array}{l}
 I \quad 34x + 5y = 7 \\
 II \quad 7x + 9y = 8 \\
 \text{I nach x auflösen} \\
 34x + 5y = 7 \\
 34x + 5y = 7 \quad / - 5y \\
 34x = 7 - 5y \quad / : 34 \\
 x = \frac{7}{34} - \frac{5}{34}y \\
 \text{II nach x auflösen} \\
 7x + 9y = 8 \\
 7x + 9y = 8 \quad / - 9y \\
 7x = 8 - 9y \quad / : 7 \\
 x = 1\frac{1}{7} - 1\frac{2}{7}y \\
 \text{I} = \text{II} \\
 \frac{7}{34} - \frac{5}{34}y = 1\frac{1}{7} - 1\frac{2}{7}y \quad / + \frac{5}{34}y / - 1\frac{1}{7} \\
 \frac{7}{34} - 1\frac{1}{7} = -1\frac{2}{7}y + \frac{5}{34}y \\
 -0,937 = -1,14y \quad / : (-1,14) \\
 y = 0,823 \\
 \text{y in I} \\
 x = \frac{7}{34} - \frac{5}{34} \cdot 0,823 \\
 x = 0,0849 \\
 L = \{0,0849/0,823\}
 \end{array}$$

Aufgabe (27)

$$\begin{array}{l}
I \quad 2x + 5y = 7 \\
II \quad -4x + 2y = -6 \\
\text{I nach y auflösen} \\
2x + 5y = 7 \\
2x + 5y = 7 \quad / - 2x \\
5y = 7 - 2x \quad / : 5 \\
y = 1\frac{2}{5} - \frac{2}{5}x \\
\text{II nach y auflösen} \\
-4x + 2y = -6 \\
-4x + 2y = -6 \quad / + 4x \\
2y = -6 + 4x \quad / : 2 \\
y = -3 + 2x \\
\text{I} = \text{II} \\
1\frac{2}{5} - \frac{2}{5}x = -3 + 2x \quad / + \frac{2}{5}x / + 3 \\
1\frac{2}{5} + 3 = 2x + \frac{2}{5}x \\
4\frac{2}{5} = 2\frac{2}{5}x \quad / : 2\frac{2}{5} \\
x = 1\frac{5}{6} \\
\text{x in I} \\
y = 1\frac{2}{5} - \frac{2}{5} \cdot 1\frac{5}{6} \\
y = \frac{2}{3} \\
L = \{1\frac{5}{6} / \frac{2}{3}\}
\end{array}$$

$$\begin{array}{l}
I \quad 2x + 5y = 7 \\
II \quad -4x + 2y = -6 \\
\text{I nach x auflösen} \\
2x + 5y = 7 \\
2x + 5y = 7 \quad / - 5y \\
2x = 7 - 5y \quad / : 2 \\
x = 3\frac{1}{2} - 2\frac{1}{2}y \\
\text{II nach x auflösen} \\
-4x + 2y = -6 \\
-4x + 2y = -6 \quad / - 2y \\
-4x = -6 - 2y \quad / : (-4) \\
x = 1\frac{1}{2} + \frac{1}{2}y \\
\text{I} = \text{II} \\
3\frac{1}{2} - 2\frac{1}{2}y = 1\frac{1}{2} + \frac{1}{2}y \quad / + 2\frac{1}{2}y / - 1\frac{1}{2} \\
3\frac{1}{2} - 1\frac{1}{2} = \frac{1}{2}y + 2\frac{1}{2}y \\
2 = 3y \quad / : 3 \\
y = \frac{2}{3} \\
\text{y in I} \\
x = 3\frac{1}{2} - 2\frac{1}{2} \cdot \frac{2}{3} \\
x = 1\frac{5}{6} \\
L = \{1\frac{5}{6} / \frac{2}{3}\}
\end{array}$$

Aufgabe (28)

$$\begin{array}{l}
I \quad 2x + 5y = 7 \\
II \quad -4x + 2y = -6 \\
\text{I nach y auflösen} \\
2x + 5y = 7 \\
2x + 5y = 7 \quad / - 2x \\
5y = 7 - 2x \quad / : 5 \\
y = 1\frac{2}{5} - \frac{2}{5}x \\
\text{II nach y auflösen} \\
-4x + 2y = -6 \\
-4x + 2y = -6 \quad / + 4x \\
2y = -6 + 4x \quad / : 2 \\
y = -3 + 2x \\
\text{I} = \text{II} \\
1\frac{2}{5} - \frac{2}{5}x = -3 + 2x \quad / + \frac{2}{5}x / + 3 \\
1\frac{2}{5} + 3 = 2x + \frac{2}{5}x \\
4\frac{2}{5} = 2\frac{2}{5}x \quad / : 2\frac{2}{5} \\
x = 1\frac{5}{6} \\
\text{x in I} \\
y = 1\frac{2}{5} - \frac{2}{5} \cdot 1\frac{5}{6} \\
y = \frac{2}{3} \\
L = \{1\frac{5}{6} / \frac{2}{3}\}
\end{array}$$

$$\begin{array}{l}
I \quad 2x + 5y = 7 \\
II \quad -4x + 2y = -6 \\
\text{I nach x auflösen} \\
2x + 5y = 7 \\
2x + 5y = 7 \quad / - 5y \\
2x = 7 - 5y \quad / : 2 \\
x = 3\frac{1}{2} - 2\frac{1}{2}y \\
\text{II nach x auflösen} \\
-4x + 2y = -6 \\
-4x + 2y = -6 \quad / - 2y \\
-4x = -6 - 2y \quad / : (-4) \\
x = 1\frac{1}{2} + \frac{1}{2}y \\
\text{I} = \text{II} \\
3\frac{1}{2} - 2\frac{1}{2}y = 1\frac{1}{2} + \frac{1}{2}y \quad / + 2\frac{1}{2}y / - 1\frac{1}{2} \\
3\frac{1}{2} - 1\frac{1}{2} = \frac{1}{2}y + 2\frac{1}{2}y \\
2 = 3y \quad / : 3 \\
y = \frac{2}{3} \\
\text{y in I} \\
x = 3\frac{1}{2} - 2\frac{1}{2} \cdot \frac{2}{3} \\
x = 1\frac{5}{6} \\
L = \{1\frac{5}{6} / \frac{2}{3}\}
\end{array}$$

3 Additionsverfahren (2)

$$I \quad a1 \cdot x + b1 \cdot y = c1$$

$$II \quad a2 \cdot x + b2 \cdot y = c2$$

- Terme mit x und y müssen untereinander stehen
- Gleichungen multiplizieren, so dass die Variablen beim spaltenweisen addieren herausfallen
- Gleichung nach der Unbekannten auflösen
- Zweite Unbekannte berechnen

$$I \quad 3x + 5y = 19$$

$$II \quad 7x + 5y = 31$$

$$I \quad 3x + 5y = 19 \quad / \cdot 7$$

$$II \quad 7x + 5y = 31 \quad / \cdot (-3)$$

$$I \quad 21x + 35y = 133$$

$$II \quad -21x - 15y = -93$$

$$I + II$$

$$21x - 21x + 35y - 15y = 133 - 93$$

$$20y = 40 \quad / : 20$$

$$y = \frac{40}{20}$$

$$y = 2$$

$$y \text{ in I}$$

$$I \quad 3x + 5 \cdot 2 = 19$$

$$3x + 10 = 19 \quad / - 10$$

$$3x = 19 - 10$$

$$3x = 9 \quad / : 3$$

$$x = \frac{9}{3}$$

$$x = 3$$

$$L = \{3/2\}$$

$$I \quad 3x + 5y = 19$$

$$II \quad 7x + 5y = 31$$

$$I \quad 3x + 5y = 19 \quad / \cdot 1$$

$$II \quad 7x + 5y = 31 \quad / \cdot (-1)$$

$$I \quad 3x + 5y = 19$$

$$II \quad -7x - 5y = -31$$

$$I + II$$

$$3x - 7x + 5y - 5y = 19 - 31$$

$$-4x = -12 \quad / : (-4)$$

$$x = \frac{-12}{-4}$$

$$x = 3$$

$$x \text{ in I}$$

$$I \quad 3 \cdot 3 + 5y = 19$$

$$5y + 9 = 19 \quad / - 9$$

$$5y = 19 - 9$$

$$5y = 10 \quad / : 5$$

$$y = \frac{10}{5}$$

$$y = 2$$

$$L = \{3/2\}$$

3.1 Aufgaben

Um eigene Aufgaben zu lösen, klicken Sie hier: [Neue Rechnung](#)

Gegeben:

$$a1 \cdot x + b1 \cdot y = c1$$

$$a2 \cdot x + b2 \cdot y = c2$$

Gesucht:

x und y

$$(1) \quad \begin{aligned} 3x + 5y &= 19 \\ 7x + 5y &= 31 \end{aligned}$$

$$(7) \quad \begin{aligned} 4x - 5y &= 43 \\ -3x - 7y &= 0 \end{aligned}$$

$$(2) \quad \begin{aligned} 1x + 1y &= 10 \\ 1x - 1y &= 4 \end{aligned}$$

$$(8) \quad \begin{aligned} 8x - 3y &= 10 \\ 12x - 5y &= 24 \end{aligned}$$

$$(3) \quad \begin{aligned} 9x - 2y &= 5 \\ 5x - 2y &= 1 \end{aligned}$$

$$(9) \quad \begin{aligned} -\frac{1}{2}x + 1y &= 2 \\ \frac{1}{2}x - 3y &= -3 \end{aligned}$$

$$(4) \quad \begin{aligned} 9x - 2y &= 1 \\ -3x - 3y &= -7 \end{aligned}$$

$$(10) \quad \begin{aligned} -1x + 1y &= 3 \\ \frac{1}{2}x - 4y &= 5 \end{aligned}$$

$$(5) \quad \begin{aligned} 1x + 3y &= 9 \\ 3x - 2y &= -6 \end{aligned}$$

$$(11) \quad \begin{aligned} 1\frac{1}{5}x - 1\frac{1}{3}y &= 5\frac{1}{3} \\ 2\frac{1}{2}x - \frac{1}{4}y &= 12\frac{3}{8} \end{aligned}$$

$$(6) \quad \begin{aligned} 7x + 1\frac{1}{2}y &= 1 \\ 2x - 5y &= 22 \end{aligned}$$

$$(12) \quad \begin{aligned} \frac{2}{3}x - \frac{5}{7}y &= \frac{2}{3} \\ 1x + 1y &= 10\frac{2}{3} \end{aligned}$$

$$(13) \quad \begin{aligned} \frac{1}{2}x - 2y &= 9 \\ \frac{2}{5}x + \frac{1}{3}y &= 5 \end{aligned}$$

$$(20) \quad \begin{aligned} -1\frac{4}{5}x + 1\frac{1}{3}y &= -1 \\ -\frac{2}{3}x + \frac{1}{9}y &= 9 \end{aligned}$$

$$(14) \quad \begin{aligned} 2x + 3y &= 4 \\ \frac{1}{3}x - \frac{1}{5}y &= 12 \end{aligned}$$

$$(21) \quad \begin{aligned} 2x - 7y &= -8 \\ 7x - 1y &= -9 \end{aligned}$$

$$(15) \quad \begin{aligned} 1x + 2y &= -4 \\ -1x + 2y &= 5 \end{aligned}$$

$$(22) \quad \begin{aligned} -7x + 9y &= -3 \\ 5x - 6y &= -4 \end{aligned}$$

$$(16) \quad \begin{aligned} 2x + 4y &= 4 \\ -\frac{1}{2}x + 3y &= 3 \end{aligned}$$

$$(23) \quad \begin{aligned} 2x + 2y &= 1\frac{7}{10} \\ 3x + 6y &= 3 \end{aligned}$$

$$(17) \quad \begin{aligned} -\frac{1}{2}x + 4y &= 6 \\ -2x - 8y &= 2 \end{aligned}$$

$$(24) \quad \begin{aligned} 5x + 6y &= 7 \\ 4x + 6y &= 4 \end{aligned}$$

$$(18) \quad \begin{aligned} 1x + 1y &= 1 \\ 2x + 2y &= 2 \end{aligned}$$

$$(25) \quad \begin{aligned} 12x + 6y &= 7 \\ 16x + 6y &= 4 \end{aligned}$$

$$(19) \quad \begin{aligned} 1x + 1y &= 2 \\ 3x + 3y &= 3 \end{aligned}$$

3.2 Lösungen

Aufgabe (1)

$$\begin{array}{l}
 I \quad 3x + 5y = 19 \\
 II \quad 7x + 5y = 31 \\
 I \quad 3x + 5y = 19 \quad / \cdot 7 \\
 II \quad 7x + 5y = 31 \quad / \cdot (-3) \\
 I \quad 21x + 35y = 133 \\
 II \quad -21x - 15y = -93 \\
 I + II \\
 I \quad 21x - 21x + 35y - 15y = 133 - 93 \\
 20y = 40 \quad / : 20 \\
 y = \frac{40}{20} \\
 y = 2 \\
 y \text{ in I} \\
 I \quad 3x + 5 \cdot 2 = 19 \\
 3x + 10 = 19 \quad / - 10 \\
 3x = 19 - 10 \\
 3x = 9 \quad / : 3 \\
 x = \frac{9}{3} \\
 x = 3 \\
 L = \{3/2\}
 \end{array}$$

$$\begin{array}{l}
 I \quad 3x + 5y = 19 \\
 II \quad 7x + 5y = 31 \\
 I \quad 3x + 5y = 19 \quad / \cdot 1 \\
 II \quad 7x + 5y = 31 \quad / \cdot (-1) \\
 I \quad 3x + 5y = 19 \\
 II \quad -7x - 5y = -31 \\
 I + II \\
 I \quad 3x - 7x + 5y - 5y = 19 - 31 \\
 -4x = -12 \quad / : (-4) \\
 x = \frac{-12}{-4} \\
 x = 3 \\
 x \text{ in I} \\
 I \quad 3 \cdot 3 + 5y = 19 \\
 5y + 9 = 19 \quad / - 9 \\
 5y = 19 - 9 \\
 5y = 10 \quad / : 5 \\
 y = \frac{10}{5} \\
 y = 2 \\
 L = \{3/2\}
 \end{array}$$

Aufgabe (2)

$$\begin{array}{l}
 I \quad 1x + 1y = 10 \\
 II \quad 1x - 1y = 4 \\
 I \quad 1x + 1y = 10 \quad / \cdot 1 \\
 II \quad 1x - 1y = 4 \quad / \cdot (-1) \\
 I \quad 1x + 1y = 10 \\
 II \quad -1x + 1y = -4 \\
 I + II \\
 I \quad 1x - 1x + 1y + 1y = 10 - 4 \\
 2y = 6 \quad / : 2 \\
 y = \frac{6}{2} \\
 y = 3 \\
 y \text{ in I} \\
 I \quad 1x + 1 \cdot 3 = 10 \\
 1x + 3 = 10 \quad / - 3 \\
 1x = 10 - 3 \\
 1x = 7 \quad / : 1 \\
 x = \frac{7}{1} \\
 x = 7 \\
 L = \{7/3\}
 \end{array}$$

$$\begin{array}{l}
 I \quad 1x + 1y = 10 \\
 II \quad 1x - 1y = 4 \\
 I \quad 1x + 1y = 10 \quad / \cdot (-1) \\
 II \quad 1x - 1y = 4 \quad / \cdot (-1) \\
 I \quad -1x - 1y = -10 \\
 II \quad -1x + 1y = -4 \\
 I + II \\
 I \quad -1x - 1x - 1y + 1y = -10 - 4 \\
 -2x = -14 \quad / : (-2) \\
 x = \frac{-14}{-2} \\
 x = 7 \\
 x \text{ in I} \\
 I \quad 1 \cdot 7 + 1y = 10 \\
 1y + 7 = 10 \quad / - 7 \\
 1y = 10 - 7 \\
 1y = 3 \quad / : 1 \\
 y = \frac{3}{1} \\
 y = 3 \\
 L = \{7/3\}
 \end{array}$$

Aufgabe (3)

$$\begin{array}{l}
 I \quad 9x - 2y = 5 \\
 II \quad 5x - 2y = 1 \\
 I \quad 9x - 2y = 5 \quad / \cdot 5 \\
 II \quad 5x - 2y = 1 \quad / \cdot (-9) \\
 I \quad 45x - 10y = 25 \\
 II \quad -45x + 18y = -9 \\
 I + II \\
 I \quad 45x - 45x - 10y + 18y = 25 - 9 \\
 8y = 16 \quad / : 8 \\
 y = \frac{16}{8} \\
 y = 2 \\
 y \text{ in I} \\
 I \quad 9x - 2 \cdot 2 = 5 \\
 9x - 4 = 5 \quad / + 4 \\
 9x = 5 + 4 \\
 9x = 9 \quad / : 9 \\
 x = \frac{9}{9} \\
 x = 1 \\
 L = \{1/2\}
 \end{array}$$

$$\begin{array}{l}
 I \quad 9x - 2y = 5 \\
 II \quad 5x - 2y = 1 \\
 I \quad 9x - 2y = 5 \quad / \cdot (-1) \\
 II \quad 5x - 2y = 1 \quad / \cdot 1 \\
 I \quad -9x + 2y = -5 \\
 II \quad 5x - 2y = 1 \\
 I + II \\
 I \quad -9x + 5x + 2y - 2y = -5 + 1 \\
 -4x = -4 \quad / : (-4) \\
 x = \frac{-4}{-4} \\
 x = 1 \\
 x \text{ in I} \\
 I \quad 9 \cdot 1 - 2y = 5 \\
 -2y + 9 = 5 \quad / - 9 \\
 -2y = 5 - 9 \\
 -2y = -4 \quad / : (-2) \\
 y = \frac{-4}{-2} \\
 y = 2 \\
 L = \{1/2\}
 \end{array}$$

Aufgabe (4)

$$\begin{array}{l}
 I \quad 9x - 2y = 1 \\
 II \quad -3x - 3y = -7 \\
 I \quad 9x - 2y = 1 \quad / \cdot (-1) \\
 II \quad -3x - 3y = -7 \quad / \cdot (-3) \\
 I \quad -9x + 2y = -1 \\
 II \quad 9x + 9y = 21 \\
 I + II \\
 I \quad -9x + 9x + 2y + 9y = -1 + 21 \\
 11y = 20 \quad / : 11 \\
 y = \frac{20}{11} \\
 y = 1 \frac{9}{11} \\
 y \text{ in I} \\
 I \quad 9x - 2 \cdot 1 \frac{9}{11} = 1 \\
 9x - 3 \frac{7}{11} = 1 \quad / + 3 \frac{7}{11} \\
 9x = 1 + 3 \frac{7}{11} \\
 9x = 4 \frac{7}{11} \quad / : 9 \\
 x = \frac{4 \frac{7}{11}}{9} \\
 x = \frac{17}{33} \\
 L = \left\{ \frac{17}{33} / 1 \frac{9}{11} \right\}
 \end{array}$$

$$\begin{array}{l}
 I \quad 9x - 2y = 1 \\
 II \quad -3x - 3y = -7 \\
 I \quad 9x - 2y = 1 \quad / \cdot (-3) \\
 II \quad -3x - 3y = -7 \quad / \cdot 2 \\
 I \quad -27x + 6y = -3 \\
 II \quad -6x - 6y = -14 \\
 I + II \\
 I \quad -27x - 6x + 6y - 6y = -3 - 14 \\
 -33x = -17 \quad / : (-33) \\
 x = \frac{-17}{-33} \\
 x = \frac{17}{33} \\
 x \text{ in I} \\
 I \quad 9 \cdot \frac{17}{33} - 2y = 1 \\
 -2y + 4 \frac{7}{11} = 1 \quad / - 4 \frac{7}{11} \\
 -2y = 1 - 4 \frac{7}{11} \\
 -2y = -3 \frac{7}{11} \quad / : (-2) \\
 y = \frac{-3 \frac{7}{11}}{-2} \\
 y = 1 \frac{9}{11} \\
 L = \left\{ \frac{17}{33} / 1 \frac{9}{11} \right\}
 \end{array}$$

Aufgabe (5)

$$\begin{array}{l}
I \quad 1x + 3y = 9 \\
II \quad 3x - 2y = -6 \\
I \quad 1x + 3y = 9 \quad / \cdot 3 \\
II \quad 3x - 2y = -6 \quad / \cdot (-1) \\
I \quad 3x + 9y = 27 \\
II \quad -3x + 2y = 6 \\
I + II \\
I \quad 3x - 3x + 9y + 2y = 27 + 6 \\
11y = 33 \quad / : 11 \\
y = \frac{33}{11} \\
y = 3 \\
y \text{ in I} \\
I \quad 1x + 3 \cdot 3 = 9 \\
1x + 9 = 9 \quad / - 9 \\
1x = 9 - 9 \\
1x = 0 \quad / : 1 \\
x = \frac{0}{1} \\
x = 0 \\
L = \{0/3\}
\end{array}$$

$$\begin{array}{l}
I \quad 1x + 3y = 9 \\
II \quad 3x - 2y = -6 \\
I \quad 1x + 3y = 9 \quad / \cdot (-2) \\
II \quad 3x - 2y = -6 \quad / \cdot (-3) \\
I \quad -2x - 6y = -18 \\
II \quad -9x + 6y = 18 \\
I + II \\
I \quad -2x - 9x - 6y + 6y = -18 + 18 \\
-11x = 0 \quad / : (-11) \\
x = \frac{0}{-11} \\
x = 0 \\
x \text{ in I} \\
I \quad 1 \cdot 0 + 3y = 9 \\
3y + 0 = 9 \quad / - 0 \\
3y = 9 - 0 \\
3y = 9 \quad / : 3 \\
y = \frac{9}{3} \\
y = 3 \\
L = \{0/3\}
\end{array}$$

Aufgabe (6)

$$\begin{array}{l}
I \quad 7x + 1\frac{1}{2}y = 1 \\
II \quad 2x - 5y = 22 \\
I \quad 7x + 1\frac{1}{2}y = 1 \quad / \cdot 2 \\
II \quad 2x - 5y = 22 \quad / \cdot (-7) \\
I \quad 14x + 3y = 2 \\
II \quad -14x + 35y = -154 \\
I + II \\
I \quad 14x - 14x + 3y + 35y = 2 - 154 \\
38y = -152 \quad / : 38 \\
y = \frac{-152}{38} \\
y = -4 \\
y \text{ in I} \\
I \quad 7x + 1\frac{1}{2} \cdot (-4) = 1 \\
7x - 6 = 1 \quad / + 6 \\
7x = 1 + 6 \\
7x = 7 \quad / : 7 \\
x = \frac{7}{7} \\
x = 1 \\
L = \{1/-4\}
\end{array}$$

$$\begin{array}{l}
I \quad 7x + 1\frac{1}{2}y = 1 \\
II \quad 2x - 5y = 22 \\
I \quad 7x + 1\frac{1}{2}y = 1 \quad / \cdot 5 \\
II \quad 2x - 5y = 22 \quad / \cdot 1\frac{1}{2} \\
I \quad 35x + 7\frac{1}{2}y = 5 \\
II \quad 3x - 7\frac{1}{2}y = 33 \\
I + II \\
I \quad 35x + 3x + 7\frac{1}{2}y - 7\frac{1}{2}y = 5 + 33 \\
38x = 38 \quad / : 38 \\
x = \frac{38}{38} \\
x = 1 \\
x \text{ in I} \\
I \quad 7 \cdot 1 + 1\frac{1}{2}y = 1 \\
1\frac{1}{2}y + 7 = 1 \quad / - 7 \\
1\frac{1}{2}y = 1 - 7 \\
1\frac{1}{2}y = -6 \quad / : 1\frac{1}{2} \\
y = \frac{-6}{1\frac{1}{2}} \\
y = -4 \\
L = \{1/-4\}
\end{array}$$

Aufgabe (7)

$$\begin{array}{l}
I \quad 4x - 5y = 43 \\
II \quad -3x - 7y = 0 \\
I \quad 4x - 5y = 43 \quad / \cdot (-3) \\
II \quad -3x - 7y = 0 \quad / \cdot (-4) \\
I \quad -12x + 15y = -129 \\
II \quad 12x + 28y = 0 \\
I + II \\
I \quad -12x + 12x + 15y + 28y = -129 + 0 \\
43y = -129 \quad / : 43 \\
y = \frac{-129}{43} \\
y = -3 \\
y \text{ in I} \\
I \quad 4x - 5 \cdot (-3) = 43 \\
4x + 15 = 43 \quad / - 15 \\
4x = 43 - 15 \\
4x = 28 \quad / : 4 \\
x = \frac{28}{4} \\
x = 7 \\
L = \{7 / -3\}
\end{array}$$

$$\begin{array}{l}
I \quad 4x - 5y = 43 \\
II \quad -3x - 7y = 0 \\
I \quad 4x - 5y = 43 \quad / \cdot (-7) \\
II \quad -3x - 7y = 0 \quad / \cdot 5 \\
I \quad -28x + 35y = -301 \\
II \quad -15x - 35y = 0 \\
I + II \\
I \quad -28x - 15x + 35y - 35y = -301 + 0 \\
-43x = -301 \quad / : (-43) \\
x = \frac{-301}{-43} \\
x = 7 \\
x \text{ in I} \\
I \quad 4 \cdot 7 - 5y = 43 \\
-5y + 28 = 43 \quad / - 28 \\
-5y = 43 - 28 \\
-5y = 15 \quad / : (-5) \\
y = \frac{15}{-5} \\
y = -3 \\
L = \{7 / -3\}
\end{array}$$

Aufgabe (8)

$$\begin{array}{l}
I \quad 8x - 3y = 10 \\
II \quad 12x - 5y = 24 \\
I \quad 8x - 3y = 10 \quad / \cdot 3 \\
II \quad 12x - 5y = 24 \quad / \cdot (-2) \\
I \quad 24x - 9y = 30 \\
II \quad -24x + 10y = -48 \\
I + II \\
I \quad 24x - 24x - 9y + 10y = 30 - 48 \\
1y = -18 \quad / : 1 \\
y = \frac{-18}{1} \\
y = -18 \\
y \text{ in I} \\
I \quad 8x - 3 \cdot (-18) = 10 \\
8x + 54 = 10 \quad / - 54 \\
8x = 10 - 54 \\
8x = -44 \quad / : 8 \\
x = \frac{-44}{8} \\
x = -5\frac{1}{2} \\
L = \{-5\frac{1}{2} / -18\}
\end{array}$$

$$\begin{array}{l}
I \quad 8x - 3y = 10 \\
II \quad 12x - 5y = 24 \\
I \quad 8x - 3y = 10 \quad / \cdot (-5) \\
II \quad 12x - 5y = 24 \quad / \cdot 3 \\
I \quad -40x + 15y = -50 \\
II \quad 36x - 15y = 72 \\
I + II \\
I \quad -40x + 36x + 15y - 15y = -50 + 72 \\
-4x = 22 \quad / : (-4) \\
x = \frac{22}{-4} \\
x = -5\frac{1}{2} \\
x \text{ in I} \\
I \quad 8 \cdot (-5\frac{1}{2}) - 3y = 10 \\
-3y - 44 = 10 \quad / + 44 \\
-3y = 10 + 44 \\
-3y = 54 \quad / : (-3) \\
y = \frac{54}{-3} \\
y = -18 \\
L = \{-5\frac{1}{2} / -18\}
\end{array}$$

Aufgabe (9)

$$\begin{array}{l}
I \quad -\frac{1}{2}x + 1y = 2 \\
II \quad \frac{1}{2}x - 3y = -3 \\
I \quad -\frac{1}{2}x + 1y = 2 \quad / \cdot \left(-\frac{1}{2}\right) \\
II \quad \frac{1}{2}x - 3y = -3 \quad / \cdot \left(-\frac{1}{2}\right) \\
I \quad \frac{1}{4}x - \frac{1}{2}y = -1 \\
II \quad -\frac{1}{4}x + 1\frac{1}{2}y = 1\frac{1}{2} \\
I + II \\
I \quad \frac{1}{4}x - \frac{1}{4}x - \frac{1}{2}y + 1\frac{1}{2}y = -1 + 1\frac{1}{2} \\
1y = \frac{1}{2} \quad / : 1 \\
y = \frac{1}{2} \\
y = \frac{1}{2} \\
y \text{ in I} \\
I \quad -\frac{1}{2}x + 1 \cdot \frac{1}{2} = 2 \\
-\frac{1}{2}x + \frac{1}{2} = 2 \quad / - \frac{1}{2} \\
-\frac{1}{2}x = 2 - \frac{1}{2} \\
-\frac{1}{2}x = 1\frac{1}{2} \quad / : \left(-\frac{1}{2}\right) \\
x = \frac{1\frac{1}{2}}{-\frac{1}{2}} \\
x = -3 \\
L = \{-3/\frac{1}{2}\}
\end{array}$$

$$\begin{array}{l}
I \quad -\frac{1}{2}x + 1y = 2 \\
II \quad \frac{1}{2}x - 3y = -3 \\
I \quad -\frac{1}{2}x + 1y = 2 \quad / \cdot (-3) \\
II \quad \frac{1}{2}x - 3y = -3 \quad / \cdot (-1) \\
I \quad 1\frac{1}{2}x - 3y = -6 \\
II \quad -\frac{1}{2}x + 3y = 3 \\
I + II \\
I \quad 1\frac{1}{2}x - \frac{1}{2}x - 3y + 3y = -6 + 3 \\
1x = -3 \quad / : 1 \\
x = \frac{-3}{1} \\
x = -3 \\
x \text{ in I} \\
I \quad -\frac{1}{2} \cdot (-3) + 1y = 2 \\
1y + 1\frac{1}{2} = 2 \quad / - 1\frac{1}{2} \\
1y = 2 - 1\frac{1}{2} \\
1y = \frac{1}{2} \quad / : 1 \\
y = \frac{1}{2} \\
y = \frac{1}{2} \\
L = \{-3/\frac{1}{2}\}
\end{array}$$

Aufgabe (10)

$$\begin{array}{l}
I \quad -1x + 1y = 3 \\
II \quad \frac{1}{2}x - 4y = 5 \\
I \quad -1x + 1y = 3 \quad / \cdot \left(-\frac{1}{2}\right) \\
II \quad \frac{1}{2}x - 4y = 5 \quad / \cdot (-1) \\
I \quad \frac{1}{2}x - \frac{1}{2}y = -1\frac{1}{2} \\
II \quad -\frac{1}{2}x + 4y = -5 \\
I + II \\
I \quad \frac{1}{2}x - \frac{1}{2}x - \frac{1}{2}y + 4y = -1\frac{1}{2} - 5 \\
3\frac{1}{2}y = -6\frac{1}{2} \quad / : 3\frac{1}{2} \\
y = \frac{-6\frac{1}{2}}{3\frac{1}{2}} \\
y = -1\frac{6}{7} \\
y \text{ in I} \\
I \quad -1x + 1 \cdot \left(-1\frac{6}{7}\right) = 3 \\
-1x - 1\frac{6}{7} = 3 \quad / + 1\frac{6}{7} \\
-1x = 3 + 1\frac{6}{7} \\
-1x = 4\frac{6}{7} \quad / : (-1) \\
x = \frac{4\frac{6}{7}}{-1} \\
x = -4\frac{6}{7} \\
L = \{-4\frac{6}{7}/ - 1\frac{6}{7}\}
\end{array}$$

$$\begin{array}{l}
I \quad -1x + 1y = 3 \\
II \quad \frac{1}{2}x - 4y = 5 \\
I \quad -1x + 1y = 3 \quad / \cdot (-4) \\
II \quad \frac{1}{2}x - 4y = 5 \quad / \cdot (-1) \\
I \quad 4x - 4y = -12 \\
II \quad -\frac{1}{2}x + 4y = -5 \\
I + II \\
I \quad 4x - \frac{1}{2}x - 4y + 4y = -12 - 5 \\
3\frac{1}{2}x = -17 \quad / : 3\frac{1}{2} \\
x = \frac{-17}{3\frac{1}{2}} \\
x = -4\frac{6}{7} \\
x \text{ in I} \\
I \quad -1 \cdot \left(-4\frac{6}{7}\right) + 1y = 3 \\
1y + 4\frac{6}{7} = 3 \quad / - 4\frac{6}{7} \\
1y = 3 - 4\frac{6}{7} \\
1y = -1\frac{6}{7} \quad / : 1 \\
y = \frac{-1\frac{6}{7}}{1} \\
y = -1\frac{6}{7} \\
L = \{-4\frac{6}{7}/ - 1\frac{6}{7}\}
\end{array}$$

Aufgabe (11)

$$\begin{array}{l}
I \quad 1\frac{1}{5}x - 1\frac{1}{3}y = 5\frac{1}{3} \\
II \quad 2\frac{1}{2}x - \frac{1}{4}y = 12\frac{3}{8} \\
I \quad 1\frac{1}{5}x - 1\frac{1}{3}y = 5\frac{1}{3} \quad / \cdot 2\frac{1}{2} \\
II \quad 2\frac{1}{2}x - \frac{1}{4}y = 12\frac{3}{8} \quad / \cdot (-1\frac{1}{5}) \\
I \quad 3x - 3\frac{1}{3}y = 13\frac{1}{3} \\
II \quad -3x + \frac{3}{10}y = -14\frac{17}{20} \\
I + II \\
I \quad 3x - 3x - 3\frac{1}{3}y + \frac{3}{10}y = 13\frac{1}{3} - 14\frac{17}{20} \\
-3\frac{1}{30}y = -1\frac{31}{60} \quad / : (-3\frac{1}{30}) \\
y = \frac{-1\frac{31}{60}}{-3\frac{1}{30}} \\
y = \frac{1}{2} \\
y \text{ in I} \\
I \quad 1\frac{1}{5}x - 1\frac{1}{3} \cdot \frac{1}{2} = 5\frac{1}{3} \\
1\frac{1}{5}x - \frac{5}{6} = 5\frac{1}{3} \quad / + \frac{5}{6} \\
1\frac{1}{5}x = 5\frac{1}{3} + \frac{5}{6} \\
1\frac{1}{5}x = 6 \quad / : 1\frac{1}{5} \\
x = \frac{6}{1\frac{1}{5}} \\
x = 5 \\
L = \{5/\frac{1}{2}\}
\end{array}$$

$$\begin{array}{l}
I \quad 1\frac{1}{5}x - 1\frac{1}{3}y = 5\frac{1}{3} \\
II \quad 2\frac{1}{2}x - \frac{1}{4}y = 12\frac{3}{8} \\
I \quad 1\frac{1}{5}x - 1\frac{1}{3}y = 5\frac{1}{3} \quad / \cdot (-\frac{1}{4}) \\
II \quad 2\frac{1}{2}x - \frac{1}{4}y = 12\frac{3}{8} \quad / \cdot 1\frac{1}{3} \\
I \quad -\frac{3}{10}x + \frac{1}{3}y = -1\frac{1}{3} \\
II \quad 3\frac{1}{3}x - \frac{1}{3}y = 16\frac{1}{2} \\
I + II \\
I \quad -\frac{3}{10}x + 3\frac{1}{3}x + \frac{1}{3}y - \frac{1}{3}y = -1\frac{1}{3} + 16\frac{1}{2} \\
3\frac{1}{30}x = 15\frac{1}{6} \quad / : 3\frac{1}{30} \\
x = \frac{15\frac{1}{6}}{3\frac{1}{30}} \\
x = 5 \\
x \text{ in I} \\
I \quad 1\frac{1}{5} \cdot 5 - 1\frac{1}{3}y = 5\frac{1}{3} \\
-1\frac{1}{3}y + 6 = 5\frac{1}{3} \quad / - 6 \\
-1\frac{1}{3}y = 5\frac{1}{3} - 6 \\
-1\frac{1}{3}y = -\frac{2}{3} \quad / : (-1\frac{1}{3}) \\
y = \frac{-\frac{2}{3}}{-1\frac{1}{3}} \\
y = \frac{1}{2} \\
L = \{5/\frac{1}{2}\}
\end{array}$$

Aufgabe (12)

$$\begin{array}{l}
I \quad \frac{2}{3}x - \frac{5}{7}y = \frac{2}{3} \\
II \quad 1x + 1y = 10\frac{2}{3} \\
I \quad \frac{2}{3}x - \frac{5}{7}y = \frac{2}{3} \quad / \cdot 1 \\
II \quad 1x + 1y = 10\frac{2}{3} \quad / \cdot (-\frac{2}{3}) \\
I \quad \frac{2}{3}x - \frac{5}{7}y = \frac{2}{3} \\
II \quad -\frac{2}{3}x - \frac{2}{3}y = -7\frac{1}{9} \\
I + II \\
I \quad \frac{2}{3}x - \frac{2}{3}x - \frac{5}{7}y - \frac{2}{3}y = \frac{2}{3} - 7\frac{1}{9} \\
-1\frac{8}{21}y = -6\frac{4}{9} \quad / : (-1\frac{8}{21}) \\
y = \frac{-6\frac{4}{9}}{-1\frac{8}{21}} \\
y = 4\frac{2}{3} \\
y \text{ in I} \\
I \quad \frac{2}{3}x - \frac{5}{7} \cdot 4\frac{2}{3} = \frac{2}{3} \\
\frac{2}{3}x - 3\frac{1}{3} = \frac{2}{3} \quad / + 3\frac{1}{3} \\
\frac{2}{3}x = \frac{2}{3} + 3\frac{1}{3} \\
\frac{2}{3}x = 4 \quad / : \frac{2}{3} \\
x = \frac{4}{\frac{2}{3}} \\
x = 6 \\
L = \{6/4\frac{2}{3}\}
\end{array}$$

$$\begin{array}{l}
I \quad \frac{2}{3}x - \frac{5}{7}y = \frac{2}{3} \\
II \quad 1x + 1y = 10\frac{2}{3} \\
I \quad \frac{2}{3}x - \frac{5}{7}y = \frac{2}{3} \quad / \cdot (-1) \\
II \quad 1x + 1y = 10\frac{2}{3} \quad / \cdot (-\frac{5}{7}) \\
I \quad -\frac{2}{3}x + \frac{5}{7}y = -\frac{2}{3} \\
II \quad -\frac{5}{7}x - \frac{5}{7}y = -7\frac{13}{21} \\
I + II \\
I \quad -\frac{2}{3}x - \frac{5}{7}x + \frac{5}{7}y - \frac{5}{7}y = -\frac{2}{3} - 7\frac{13}{21} \\
-1\frac{8}{21}x = -8\frac{2}{7} \quad / : (-1\frac{8}{21}) \\
x = \frac{-8\frac{2}{7}}{-1\frac{8}{21}} \\
x = 6 \\
x \text{ in I} \\
I \quad \frac{2}{3} \cdot 6 - \frac{5}{7}y = \frac{2}{3} \\
-\frac{5}{7}y + 4 = \frac{2}{3} \quad / - 4 \\
-\frac{5}{7}y = \frac{2}{3} - 4 \\
-\frac{5}{7}y = -3\frac{1}{3} \quad / : (-\frac{5}{7}) \\
y = \frac{-3\frac{1}{3}}{-\frac{5}{7}} \\
y = 4\frac{2}{3} \\
L = \{6/4\frac{2}{3}\}
\end{array}$$

Aufgabe (13)

$$\begin{array}{l}
I \quad 1\frac{1}{2}x - 2y = 9 \\
II \quad \frac{2}{5}x + \frac{1}{3}y = 5 \\
I \quad 1\frac{1}{2}x - 2y = 9 \quad / \cdot \frac{2}{5} \\
II \quad \frac{2}{5}x + \frac{1}{3}y = 5 \quad / \cdot (-1\frac{1}{2}) \\
I \quad \frac{3}{5}x - \frac{4}{5}y = 3\frac{3}{5} \\
II \quad -\frac{3}{5}x - \frac{1}{2}y = -7\frac{1}{2} \\
I + II \\
I \quad \frac{3}{5}x - \frac{3}{5}x - \frac{4}{5}y - \frac{1}{2}y = 3\frac{3}{5} - 7\frac{1}{2} \\
-1\frac{3}{10}y = -3\frac{9}{10} \quad / : (-1\frac{3}{10}) \\
y = \frac{-3\frac{9}{10}}{-1\frac{3}{10}} \\
y = 3 \\
y \text{ in I} \\
I \quad 1\frac{1}{2}x - 2 \cdot 3 = 9 \\
1\frac{1}{2}x - 6 = 9 \quad / + 6 \\
1\frac{1}{2}x = 9 + 6 \\
1\frac{1}{2}x = 15 \quad / : 1\frac{1}{2} \\
x = \frac{15}{1\frac{1}{2}} \\
x = 10 \\
L = \{10/3\}
\end{array}$$

$$\begin{array}{l}
I \quad 1\frac{1}{2}x - 2y = 9 \\
II \quad \frac{2}{5}x + \frac{1}{3}y = 5 \\
I \quad 1\frac{1}{2}x - 2y = 9 \quad / \cdot (-\frac{1}{3}) \\
II \quad \frac{2}{5}x + \frac{1}{3}y = 5 \quad / \cdot (-2) \\
I \quad -\frac{1}{2}x + \frac{2}{3}y = -3 \\
II \quad -\frac{4}{5}x - \frac{2}{3}y = -10 \\
I + II \\
I \quad -\frac{1}{2}x - \frac{4}{5}x + \frac{2}{3}y - \frac{2}{3}y = -3 - 10 \\
-1\frac{3}{10}x = -13 \quad / : (-1\frac{3}{10}) \\
x = \frac{-13}{-1\frac{3}{10}} \\
x = 10 \\
x \text{ in I} \\
I \quad 1\frac{1}{2} \cdot 10 - 2y = 9 \\
-2y + 15 = 9 \quad / - 15 \\
-2y = 9 - 15 \\
-2y = -6 \quad / : (-2) \\
y = \frac{-6}{-2} \\
y = 3 \\
L = \{10/3\}
\end{array}$$

Aufgabe (14)

$$\begin{array}{l}
I \quad 2x + 3y = 4 \\
II \quad \frac{1}{3}x - \frac{1}{5}y = 12 \\
I \quad 2x + 3y = 4 \quad / \cdot \frac{1}{3} \\
II \quad \frac{1}{3}x - \frac{1}{5}y = 12 \quad / \cdot (-2) \\
I \quad \frac{2}{3}x + 1y = 1\frac{1}{3} \\
II \quad -\frac{2}{3}x + \frac{2}{5}y = -24 \\
I + II \\
I \quad \frac{2}{3}x - \frac{2}{3}x + 1y + \frac{2}{5}y = 1\frac{1}{3} - 24 \\
1\frac{2}{5}y = -22\frac{2}{3} \quad / : 1\frac{2}{5} \\
y = \frac{-22\frac{2}{3}}{1\frac{2}{5}} \\
y = -16\frac{4}{21} \\
y \text{ in I} \\
I \quad 2x + 3 \cdot (-16\frac{4}{21}) = 4 \\
2x - 48\frac{4}{7} = 4 \quad / + 48\frac{4}{7} \\
2x = 4 + 48\frac{4}{7} \\
2x = 52\frac{4}{7} \quad / : 2 \\
x = \frac{52\frac{4}{7}}{2} \\
x = 26\frac{2}{7} \\
L = \{26\frac{2}{7} / -16\frac{4}{21}\}
\end{array}$$

$$\begin{array}{l}
I \quad 2x + 3y = 4 \\
II \quad \frac{1}{3}x - \frac{1}{5}y = 12 \\
I \quad 2x + 3y = 4 \quad / \cdot \frac{1}{5} \\
II \quad \frac{1}{3}x - \frac{1}{5}y = 12 \quad / \cdot 3 \\
I \quad \frac{2}{5}x + \frac{3}{5}y = \frac{4}{5} \\
II \quad 1x - \frac{3}{5}y = 36 \\
I + II \\
I \quad \frac{2}{5}x + 1x + \frac{3}{5}y - \frac{3}{5}y = \frac{4}{5} + 36 \\
1\frac{2}{5}x = 36\frac{4}{5} \quad / : 1\frac{2}{5} \\
x = \frac{36\frac{4}{5}}{1\frac{2}{5}} \\
x = 26\frac{2}{7} \\
x \text{ in I} \\
I \quad 2 \cdot 26\frac{2}{7} + 3y = 4 \\
3y + 52\frac{4}{7} = 4 \quad / - 52\frac{4}{7} \\
3y = 4 - 52\frac{4}{7} \\
3y = -48\frac{4}{7} \quad / : 3 \\
y = \frac{-48\frac{4}{7}}{3} \\
y = -16\frac{4}{21} \\
L = \{26\frac{2}{7} / -16\frac{4}{21}\}
\end{array}$$

Aufgabe (15)

$ \begin{array}{l} I \quad 1x + 2y = -4 \\ II \quad -1x + 2y = 5 \\ I \quad 1x + 2y = -4 \quad / \cdot (-1) \\ II \quad -1x + 2y = 5 \quad / \cdot (-1) \\ I \quad -1x - 2y = 4 \\ II \quad 1x - 2y = -5 \\ I + II \\ I \quad -1x + 1x - 2y - 2y = 4 - 5 \\ -4y = -1 \quad / : (-4) \\ y = \frac{-1}{-4} \\ y = \frac{1}{4} \\ y \text{ in I} \\ I \quad 1x + 2 \cdot \frac{1}{4} = -4 \\ 1x + \frac{1}{2} = -4 \quad / - \frac{1}{2} \\ 1x = -4 - \frac{1}{2} \\ 1x = -4\frac{1}{2} \quad / : 1 \\ x = \frac{-4\frac{1}{2}}{1} \\ x = -4\frac{1}{2} \\ L = \{-4\frac{1}{2} / \frac{1}{4}\} \end{array} $	$ \begin{array}{l} I \quad 1x + 2y = -4 \\ II \quad -1x + 2y = 5 \\ I \quad 1x + 2y = -4 \quad / \cdot 1 \\ II \quad -1x + 2y = 5 \quad / \cdot (-1) \\ I \quad 1x + 2y = -4 \\ II \quad 1x - 2y = -5 \\ I + II \\ I \quad 1x + 1x + 2y - 2y = -4 - 5 \\ 2x = -9 \quad / : 2 \\ x = \frac{-9}{2} \\ x = -4\frac{1}{2} \\ x \text{ in I} \\ I \quad 1 \cdot (-4\frac{1}{2}) + 2y = -4 \\ 2y - 4\frac{1}{2} = -4 \quad / + 4\frac{1}{2} \\ 2y = -4 + 4\frac{1}{2} \\ 2y = \frac{1}{2} \quad / : 2 \\ y = \frac{\frac{1}{2}}{2} \\ y = \frac{1}{4} \\ L = \{-4\frac{1}{2} / \frac{1}{4}\} \end{array} $
---	--

Aufgabe (16)

$ \begin{array}{l} I \quad 2x + 4y = 4 \\ II \quad -\frac{1}{2}x + 3y = 3 \\ I \quad 2x + 4y = 4 \quad / \cdot \frac{1}{2} \\ II \quad -\frac{1}{2}x + 3y = 3 \quad / \cdot 2 \\ I \quad 1x + 2y = 2 \\ II \quad -1x + 6y = 6 \\ I + II \\ I \quad 1x - 1x + 2y + 6y = 2 + 6 \\ 8y = 8 \quad / : 8 \\ y = \frac{8}{8} \\ y = 1 \\ y \text{ in I} \\ I \quad 2x + 4 \cdot 1 = 4 \\ 2x + 4 = 4 \quad / - 4 \\ 2x = 4 - 4 \\ 2x = 0 \quad / : 2 \\ x = \frac{0}{2} \\ x = 0 \\ L = \{0/1\} \end{array} $	$ \begin{array}{l} I \quad 2x + 4y = 4 \\ II \quad -\frac{1}{2}x + 3y = 3 \\ I \quad 2x + 4y = 4 \quad / \cdot 3 \\ II \quad -\frac{1}{2}x + 3y = 3 \quad / \cdot (-4) \\ I \quad 6x + 12y = 12 \\ II \quad 2x - 12y = -12 \\ I + II \\ I \quad 6x + 2x + 12y - 12y = 12 - 12 \\ 8x = 0 \quad / : 8 \\ x = \frac{0}{8} \\ x = 0 \\ x \text{ in I} \\ I \quad 2 \cdot 0 + 4y = 4 \\ 4y + 0 = 4 \quad / - 0 \\ 4y = 4 - 0 \\ 4y = 4 \quad / : 4 \\ y = \frac{4}{4} \\ y = 1 \\ L = \{0/1\} \end{array} $
---	--

Aufgabe (17)

$$\begin{array}{l}
I \quad -\frac{1}{2}x + 4y = 6 \\
II \quad -2x - 8y = 2 \\
I \quad -\frac{1}{2}x + 4y = 6 \quad / \cdot (-2) \\
II \quad -2x - 8y = 2 \quad / \cdot \frac{1}{2} \\
I \quad 1x - 8y = -12 \\
II \quad -1x - 4y = 1 \\
I + II \\
I \quad 1x - 1x - 8y - 4y = -12 + 1 \\
-12y = -11 \quad / : (-12) \\
y = \frac{-11}{-12} \\
y = \frac{11}{12} \\
y \text{ in I} \\
I \quad -\frac{1}{2}x + 4 \cdot \frac{11}{12} = 6 \\
-\frac{1}{2}x + 3\frac{2}{3} = 6 \quad / - 3\frac{2}{3} \\
-\frac{1}{2}x = 6 - 3\frac{2}{3} \\
-\frac{1}{2}x = 2\frac{1}{3} \quad / : (-\frac{1}{2}) \\
x = \frac{2\frac{1}{3}}{-\frac{1}{2}} \\
x = -4\frac{2}{3} \\
L = \{-4\frac{2}{3} / \frac{11}{12}\}
\end{array}$$

$$\begin{array}{l}
I \quad -\frac{1}{2}x + 4y = 6 \\
II \quad -2x - 8y = 2 \\
I \quad -\frac{1}{2}x + 4y = 6 \quad / \cdot (-2) \\
II \quad -2x - 8y = 2 \quad / \cdot (-1) \\
I \quad 1x - 8y = -12 \\
II \quad 2x + 8y = -2 \\
I + II \\
I \quad 1x + 2x - 8y + 8y = -12 - 2 \\
3x = -14 \quad / : 3 \\
x = \frac{-14}{3} \\
x = -4\frac{2}{3} \\
x \text{ in I} \\
I \quad -\frac{1}{2} \cdot (-4\frac{2}{3}) + 4y = 6 \\
4y + 2\frac{1}{3} = 6 \quad / - 2\frac{1}{3} \\
4y = 6 - 2\frac{1}{3} \\
4y = 3\frac{2}{3} \quad / : 4 \\
y = \frac{3\frac{2}{3}}{4} \\
y = \frac{11}{12} \\
L = \{-4\frac{2}{3} / \frac{11}{12}\}
\end{array}$$

Aufgabe (18)

$$\begin{array}{l}
I \quad 1x + 1y = 1 \\
II \quad 2x + 2y = 2 \\
I \quad 1x + 1y = 1 \quad / \cdot 2 \\
II \quad 2x + 2y = 2 \quad / \cdot (-1) \\
I \quad 2x + 2y = 2 \\
II \quad -2x - 2y = -2 \\
I + II \\
I \quad 2x - 2x + 2y - 2y = 2 - 2 \\
L = \text{unendlich}
\end{array}$$

$$\begin{array}{l}
I \quad 1x + 1y = 1 \\
II \quad 2x + 2y = 2 \\
I \quad 1x + 1y = 1 \quad / \cdot 2 \\
II \quad 2x + 2y = 2 \quad / \cdot (-1) \\
I \quad 2x + 2y = 2 \\
II \quad -2x - 2y = -2 \\
I + II \\
I \quad 2x - 2x + 2y - 2y = 2 - 2 \\
L = \text{unendlich}
\end{array}$$

Aufgabe (19)

$$\begin{array}{l}
I \quad 1x + 1y = 2 \\
II \quad 3x + 3y = 3 \\
I \quad 1x + 1y = 2 \quad / \cdot 3 \\
II \quad 3x + 3y = 3 \quad / \cdot (-1) \\
I \quad 3x + 3y = 6 \\
II \quad -3x - 3y = -3 \\
I + II \\
I \quad 3x - 3x + 3y - 3y = 6 - 3 \\
L = \{\}
\end{array}$$

$$\begin{array}{l}
I \quad 1x + 1y = 2 \\
II \quad 3x + 3y = 3 \\
I \quad 1x + 1y = 2 \quad / \cdot 3 \\
II \quad 3x + 3y = 3 \quad / \cdot (-1) \\
I \quad 3x + 3y = 6 \\
II \quad -3x - 3y = -3 \\
I + II \\
I \quad 3x - 3x + 3y - 3y = 6 - 3 \\
L = \{\}
\end{array}$$

Aufgabe (20)

$$\begin{array}{l}
I \quad -1\frac{4}{5}x + 1\frac{1}{3}y = -1 \\
II \quad -\frac{4}{5}x + \frac{1}{9}y = 9 \\
I \quad -1\frac{4}{5}x + 1\frac{1}{3}y = -1 \quad / \cdot \left(-\frac{2}{3}\right) \\
II \quad -\frac{4}{5}x + \frac{1}{9}y = 9 \quad / \cdot 1\frac{4}{5} \\
I \quad 1\frac{1}{5}x - \frac{8}{9}y = \frac{2}{3} \\
II \quad -1\frac{1}{5}x + \frac{1}{5}y = 16\frac{1}{5} \\
I + II \\
I \quad 1\frac{1}{5}x - 1\frac{1}{5}x - \frac{8}{9}y + \frac{1}{5}y = \frac{2}{3} + 16\frac{1}{5} \\
-\frac{31}{45}y = 16\frac{13}{15} \quad / : \left(-\frac{31}{45}\right) \\
y = \frac{16\frac{13}{15}}{-\frac{31}{45}} \\
y = -24\frac{15}{31} \\
y \text{ in I} \\
I \quad -1\frac{4}{5}x + 1\frac{1}{3} \cdot \left(-24\frac{15}{31}\right) = -1 \\
-1\frac{4}{5}x - 32\frac{20}{31} = -1 \quad / + 32\frac{20}{31} \\
-1\frac{4}{5}x = -1 + 32\frac{20}{31} \\
-1\frac{4}{5}x = 31\frac{20}{31} \quad / : \left(-1\frac{4}{5}\right) \\
x = \frac{31\frac{20}{31}}{-1\frac{4}{5}} \\
x = -17\frac{18}{31} \\
L = \left\{-17\frac{18}{31} / -24\frac{15}{31}\right\}
\end{array}$$

$$\begin{array}{l}
I \quad -1\frac{4}{5}x + 1\frac{1}{3}y = -1 \\
II \quad -\frac{4}{5}x + \frac{1}{9}y = 9 \\
I \quad -1\frac{4}{5}x + 1\frac{1}{3}y = -1 \quad / \cdot \frac{1}{9} \\
II \quad -\frac{4}{5}x + \frac{1}{9}y = 9 \quad / \cdot \left(-1\frac{1}{3}\right) \\
I \quad -\frac{1}{5}x + \frac{4}{27}y = -\frac{1}{9} \\
II \quad \frac{8}{9}x - \frac{4}{27}y = -12 \\
I + II \\
I \quad -\frac{1}{5}x + \frac{8}{9}x + \frac{4}{27}y - \frac{4}{27}y = -\frac{1}{9} - 12 \\
\frac{31}{45}x = -12\frac{1}{9} \quad / : \frac{31}{45} \\
x = \frac{-12\frac{1}{9}}{\frac{31}{45}} \\
x = -17\frac{18}{31} \\
x \text{ in I} \\
I \quad -1\frac{4}{5} \cdot \left(-17\frac{18}{31}\right) + 1\frac{1}{3}y = -1 \\
1\frac{1}{3}y + 31\frac{20}{31} = -1 \quad / - 31\frac{20}{31} \\
1\frac{1}{3}y = -1 - 31\frac{20}{31} \\
1\frac{1}{3}y = -32\frac{20}{31} \quad / : 1\frac{1}{3} \\
y = \frac{-32\frac{20}{31}}{1\frac{1}{3}} \\
y = -24\frac{15}{31} \\
L = \left\{-17\frac{18}{31} / -24\frac{15}{31}\right\}
\end{array}$$

Aufgabe (21)

$$\begin{array}{l}
I \quad 2x - 7y = -8 \\
II \quad 7x - 1y = -9 \\
I \quad 2x - 7y = -8 \quad / \cdot 7 \\
II \quad 7x - 1y = -9 \quad / \cdot (-2) \\
I \quad 14x - 49y = -56 \\
II \quad -14x + 2y = 18 \\
I + II \\
I \quad 14x - 14x - 49y + 2y = -56 + 18 \\
-47y = -38 \quad / : (-47) \\
y = \frac{-38}{-47} \\
y = \frac{38}{47} \\
y \text{ in I} \\
I \quad 2x - 7 \cdot \frac{38}{47} = -8 \\
2x - 5\frac{31}{47} = -8 \quad / + 5\frac{31}{47} \\
2x = -8 + 5\frac{31}{47} \\
2x = -2\frac{16}{47} \quad / : 2 \\
x = \frac{-2\frac{16}{47}}{2} \\
x = -1\frac{8}{47} \\
L = \left\{-1\frac{8}{47} / \frac{38}{47}\right\}
\end{array}$$

$$\begin{array}{l}
I \quad 2x - 7y = -8 \\
II \quad 7x - 1y = -9 \\
I \quad 2x - 7y = -8 \quad / \cdot (-1) \\
II \quad 7x - 1y = -9 \quad / \cdot 7 \\
I \quad -2x + 7y = 8 \\
II \quad 49x - 7y = -63 \\
I + II \\
I \quad -2x + 49x + 7y - 7y = 8 - 63 \\
47x = -55 \quad / : 47 \\
x = \frac{-55}{47} \\
x = -1\frac{8}{47} \\
x \text{ in I} \\
I \quad 2 \cdot \left(-1\frac{8}{47}\right) - 7y = -8 \\
-7y - 2\frac{16}{47} = -8 \quad / + 2\frac{16}{47} \\
-7y = -8 + 2\frac{16}{47} \\
-7y = -5\frac{31}{47} \quad / : (-7) \\
y = \frac{-5\frac{31}{47}}{-7} \\
y = \frac{38}{47} \\
L = \left\{-1\frac{8}{47} / \frac{38}{47}\right\}
\end{array}$$

Aufgabe (22)

$$\begin{array}{l}
I \quad -7x + 9y = -3 \\
II \quad 5x - 6y = -4 \\
I \quad -7x + 9y = -3 \quad / \cdot 5 \\
II \quad 5x - 6y = -4 \quad / \cdot 7 \\
I \quad -35x + 45y = -15 \\
II \quad 35x - 42y = -28 \\
I + II \\
I \quad -35x + 35x + 45y - 42y = -15 - 28 \\
3y = -43 \quad / : 3 \\
y = \frac{-43}{3} \\
y = -14\frac{1}{3} \\
y \text{ in I} \\
I \quad -7x + 9 \cdot (-14\frac{1}{3}) = -3 \\
-7x - 129 = -3 \quad / + 129 \\
-7x = -3 + 129 \\
-7x = 126 \quad / : (-7) \\
x = \frac{126}{-7} \\
x = -18 \\
L = \{-18 / -14\frac{1}{3}\}
\end{array}$$

$$\begin{array}{l}
I \quad -7x + 9y = -3 \\
II \quad 5x - 6y = -4 \\
I \quad -7x + 9y = -3 \quad / \cdot (-2) \\
II \quad 5x - 6y = -4 \quad / \cdot (-3) \\
I \quad 14x - 18y = 6 \\
II \quad -15x + 18y = 12 \\
I + II \\
I \quad 14x - 15x - 18y + 18y = 6 + 12 \\
-1x = 18 \quad / : (-1) \\
x = \frac{18}{-1} \\
x = -18 \\
x \text{ in I} \\
I \quad -7 \cdot (-18) + 9y = -3 \\
9y + 126 = -3 \quad / - 126 \\
9y = -3 - 126 \\
9y = -129 \quad / : 9 \\
y = \frac{-129}{9} \\
y = -14\frac{1}{3} \\
L = \{-18 / -14\frac{1}{3}\}
\end{array}$$

Aufgabe (23)

$$\begin{array}{l}
I \quad 2x + 2y = 1\frac{7}{10} \\
II \quad 3x + 6y = 3 \\
I \quad 2x + 2y = 1\frac{7}{10} \quad / \cdot 3 \\
II \quad 3x + 6y = 3 \quad / \cdot (-2) \\
I \quad 6x + 6y = 5\frac{1}{10} \\
II \quad -6x - 12y = -6 \\
I + II \\
I \quad 6x - 6x + 6y - 12y = 5\frac{1}{10} - 6 \\
-6y = -\frac{9}{10} \quad / : (-6) \\
y = \frac{-\frac{9}{10}}{-6} \\
y = \frac{3}{20} \\
y \text{ in I} \\
I \quad 2x + 2 \cdot \frac{3}{20} = 1\frac{7}{10} \\
2x + \frac{3}{10} = 1\frac{7}{10} \quad / - \frac{3}{10} \\
2x = 1\frac{7}{10} - \frac{3}{10} \\
2x = 1\frac{2}{5} \quad / : 2 \\
x = \frac{1\frac{2}{5}}{2} \\
x = \frac{7}{10} \\
L = \{\frac{7}{10} / \frac{3}{20}\}
\end{array}$$

$$\begin{array}{l}
I \quad 2x + 2y = 1\frac{7}{10} \\
II \quad 3x + 6y = 3 \\
I \quad 2x + 2y = 1\frac{7}{10} \quad / \cdot 3 \\
II \quad 3x + 6y = 3 \quad / \cdot (-1) \\
I \quad 6x + 6y = 5\frac{1}{10} \\
II \quad -3x - 6y = -3 \\
I + II \\
I \quad 6x - 3x + 6y - 6y = 5\frac{1}{10} - 3 \\
3x = 2\frac{1}{10} \quad / : 3 \\
x = \frac{2\frac{1}{10}}{3} \\
x = \frac{7}{10} \\
x \text{ in I} \\
I \quad 2 \cdot \frac{7}{10} + 2y = 1\frac{7}{10} \\
2y + 1\frac{2}{5} = 1\frac{7}{10} \quad / - 1\frac{2}{5} \\
2y = 1\frac{7}{10} - 1\frac{2}{5} \\
2y = \frac{3}{10} \quad / : 2 \\
y = \frac{\frac{3}{10}}{2} \\
y = \frac{3}{20} \\
L = \{\frac{7}{10} / \frac{3}{20}\}
\end{array}$$

Aufgabe (24)

$$\begin{array}{l}
I \quad 5x + 6y = 7 \\
II \quad 4x + 6y = 4 \\
I \quad 5x + 6y = 7 \quad / \cdot 4 \\
II \quad 4x + 6y = 4 \quad / \cdot (-5) \\
I \quad 20x + 24y = 28 \\
II \quad -20x - 30y = -20 \\
I + II \\
I \quad 20x - 20x + 24y - 30y = 28 - 20 \\
-6y = 8 \quad / : (-6) \\
y = \frac{8}{-6} \\
y = -1\frac{1}{3} \\
y \text{ in I} \\
I \quad 5x + 6 \cdot (-1\frac{1}{3}) = 7 \\
5x - 8 = 7 \quad / + 8 \\
5x = 7 + 8 \\
5x = 15 \quad / : 5 \\
x = \frac{15}{5} \\
x = 3 \\
L = \{3 / -1\frac{1}{3}\}
\end{array}$$

$$\begin{array}{l}
I \quad 5x + 6y = 7 \\
II \quad 4x + 6y = 4 \\
I \quad 5x + 6y = 7 \quad / \cdot 1 \\
II \quad 4x + 6y = 4 \quad / \cdot (-1) \\
I \quad 5x + 6y = 7 \\
II \quad -4x - 6y = -4 \\
I + II \\
I \quad 5x - 4x + 6y - 6y = 7 - 4 \\
1x = 3 \quad / : 1 \\
x = \frac{3}{1} \\
x = 3 \\
x \text{ in I} \\
I \quad 5 \cdot 3 + 6y = 7 \\
6y + 15 = 7 \quad / - 15 \\
6y = 7 - 15 \\
6y = -8 \quad / : 6 \\
y = \frac{-8}{6} \\
y = -1\frac{1}{3} \\
L = \{3 / -1\frac{1}{3}\}
\end{array}$$

Aufgabe (25)

$$\begin{array}{l}
I \quad 12x + 6y = 7 \\
II \quad 16x + 6y = 4 \\
I \quad 12x + 6y = 7 \quad / \cdot 4 \\
II \quad 16x + 6y = 4 \quad / \cdot (-3) \\
I \quad 48x + 24y = 28 \\
II \quad -48x - 18y = -12 \\
I + II \\
I \quad 48x - 48x + 24y - 18y = 28 - 12 \\
6y = 16 \quad / : 6 \\
y = \frac{16}{6} \\
y = 2\frac{2}{3} \\
y \text{ in I} \\
I \quad 12x + 6 \cdot 2\frac{2}{3} = 7 \\
12x + 16 = 7 \quad / - 16 \\
12x = 7 - 16 \\
12x = -9 \quad / : 12 \\
x = \frac{-9}{12} \\
x = -\frac{3}{4} \\
L = \{-\frac{3}{4} / 2\frac{2}{3}\}
\end{array}$$

$$\begin{array}{l}
I \quad 12x + 6y = 7 \\
II \quad 16x + 6y = 4 \\
I \quad 12x + 6y = 7 \quad / \cdot 1 \\
II \quad 16x + 6y = 4 \quad / \cdot (-1) \\
I \quad 12x + 6y = 7 \\
II \quad -16x - 6y = -4 \\
I + II \\
I \quad 12x - 16x + 6y - 6y = 7 - 4 \\
-4x = 3 \quad / : (-4) \\
x = \frac{3}{-4} \\
x = -\frac{3}{4} \\
x \text{ in I} \\
I \quad 12 \cdot (-\frac{3}{4}) + 6y = 7 \\
6y - 9 = 7 \quad / + 9 \\
6y = 7 + 9 \\
6y = 16 \quad / : 6 \\
y = \frac{16}{6} \\
y = 2\frac{2}{3} \\
L = \{-\frac{3}{4} / 2\frac{2}{3}\}
\end{array}$$

4 Determinantenverfahren (2)

$$I \quad a1 \cdot x + b1 \cdot y = c1$$

$$II \quad a2 \cdot x + b2 \cdot y = c2$$

$$D_h = \begin{vmatrix} a1 & b1 \\ a2 & b2 \end{vmatrix} = a1 \cdot b2 - b1 \cdot a2$$

$$D_x = \begin{vmatrix} c1 & b1 \\ c2 & b2 \end{vmatrix} = c1 \cdot b2 - b1 \cdot c2$$

$$D_y = \begin{vmatrix} a1 & c1 \\ a2 & c2 \end{vmatrix} = a1 \cdot c2 - c1 \cdot a2$$

- Eindeutige Lösung $D_h \neq 0$

$$x = \frac{D_x}{D_h}$$

$$y = \frac{D_y}{D_h}$$

- Keine Lösung $D_h = 0$

$$D_x \neq 0 \text{ oder } D_y \neq 0$$

- Unendlich viele Lösungen

$$D_h = D_x = D_y = 0$$

$$I \quad 3x + 5y = 19$$

$$II \quad 7x + 5y = 31$$

$$D_h = \begin{vmatrix} 3 & 5 \\ 7 & 5 \end{vmatrix} = 3 \cdot 5 - 5 \cdot 7 = -20$$

$$D_x = \begin{vmatrix} 19 & 5 \\ 31 & 5 \end{vmatrix} = 19 \cdot 5 - 5 \cdot 31 = -60$$

$$D_y = \begin{vmatrix} 3 & 19 \\ 7 & 31 \end{vmatrix} = 3 \cdot 31 - 19 \cdot 7 = -40$$

$$x = \frac{-60}{-20}$$

$$x = 3$$

$$y = \frac{-40}{-20}$$

$$y = 2$$

$$L = \{3/2\}$$

4.1 Aufgaben

Um eigene Aufgaben zu lösen, klicken Sie hier: [Neue Rechnung](#)

$$D_h = \begin{vmatrix} a1 & b1 \\ a2 & b2 \end{vmatrix} = a1 \cdot b2 - b1 \cdot a2$$

$$D_x = \begin{vmatrix} c1 & b1 \\ c2 & b2 \end{vmatrix} = c1 \cdot b2 - b1 \cdot c2$$

$$D_y = \begin{vmatrix} a1 & c1 \\ a2 & c2 \end{vmatrix} = a1 \cdot c2 - c1 \cdot a2$$

$$x = \frac{D_x}{D_h}$$

$$y = \frac{D_y}{D_h}$$

$$(1) \quad \begin{aligned} 3x + 5y &= 19 \\ 7x + 5y &= 31 \end{aligned}$$

$$(5) \quad \begin{aligned} 1x + 3y &= 9 \\ 3x - 2y &= -6 \end{aligned}$$

$$(2) \quad \begin{aligned} 1x + 1y &= 10 \\ 1x - 1y &= 4 \end{aligned}$$

$$(6) \quad \begin{aligned} 7x + 1\frac{1}{2}y &= 1 \\ 2x - 5y &= 22 \end{aligned}$$

$$(3) \quad \begin{aligned} 9x - 2y &= 5 \\ 5x - 2y &= 1 \end{aligned}$$

$$(7) \quad \begin{aligned} 4x - 5y &= 43 \\ -3x - 7y &= 0 \end{aligned}$$

$$(4) \quad \begin{aligned} 9x - 2y &= 1 \\ -3x - 3y &= -7 \end{aligned}$$

$$(8) \quad \begin{aligned} 8x - 3y &= 10 \\ 12x - 5y &= 24 \end{aligned}$$

$$(9) \quad \begin{aligned} -\frac{1}{2}x + 1y &= 2 \\ \frac{1}{2}x - 3y &= -3 \end{aligned}$$

$$(17) \quad \begin{aligned} -\frac{1}{2}x + 4y &= 6 \\ -2x - 8y &= 2 \end{aligned}$$

$$(10) \quad \begin{aligned} -1x + 1y &= 3 \\ \frac{1}{2}x - 4y &= 5 \end{aligned}$$

$$(18) \quad \begin{aligned} 1x + 1y &= 1 \\ 2x + 2y &= 2 \end{aligned}$$

$$(11) \quad \begin{aligned} 1\frac{1}{5}x - 1\frac{1}{3}y &= 5\frac{1}{3} \\ 2\frac{1}{2}x - \frac{1}{4}y &= 12\frac{3}{8} \end{aligned}$$

$$(19) \quad \begin{aligned} 1x + 1y &= 2 \\ 3x + 3y &= 3 \end{aligned}$$

$$(12) \quad \begin{aligned} \frac{2}{3}x - \frac{5}{7}y &= \frac{2}{3} \\ 1x + 1y &= 10\frac{2}{3} \end{aligned}$$

$$(20) \quad \begin{aligned} -1\frac{4}{5}x + 1\frac{1}{3}y &= -1 \\ -\frac{2}{3}x + \frac{1}{9}y &= 9 \end{aligned}$$

$$(13) \quad \begin{aligned} 1\frac{1}{2}x - 2y &= 9 \\ \frac{2}{5}x + \frac{1}{3}y &= 5 \end{aligned}$$

$$(21) \quad \begin{aligned} 2x - 7y &= -8 \\ 7x - 1y &= -9 \end{aligned}$$

$$(14) \quad \begin{aligned} 2x + 3y &= 4 \\ \frac{1}{3}x - \frac{1}{5}y &= 12 \end{aligned}$$

$$(22) \quad \begin{aligned} -7x + 9y &= -3 \\ 5x - 6y &= -4 \end{aligned}$$

$$(15) \quad \begin{aligned} 1x + 2y &= -4 \\ -1x + 2y &= 5 \end{aligned}$$

$$(23) \quad \begin{aligned} 2x + 2y &= 1\frac{7}{10} \\ 3x + 6y &= 3 \end{aligned}$$

$$(16) \quad \begin{aligned} 2x + 4y &= 4 \\ -\frac{1}{2}x + 3y &= 3 \end{aligned}$$

$$(24) \quad \begin{aligned} 4x + 6y &= 7 \\ 5x + 6y &= 5 \end{aligned}$$

4.2 Lösungen

Aufgabe (1)

$$D_h = \begin{vmatrix} 3 & 5 \\ 7 & 5 \end{vmatrix} = 3 \cdot 5 - 5 \cdot 7 = -20$$

$$D_x = \begin{vmatrix} 19 & 5 \\ 31 & 5 \end{vmatrix} = 19 \cdot 5 - 5 \cdot 31 = -60$$

$$D_y = \begin{vmatrix} 3 & 19 \\ 7 & 31 \end{vmatrix} = 3 \cdot 31 - 19 \cdot 7 = -40$$

$$x = \frac{-60}{-20}$$

$$x = 3$$

$$y = \frac{-40}{-20}$$

$$y = 2$$

$$L = \{3/2\}$$

Aufgabe (2)

$$D_h = \begin{vmatrix} 1 & 1 \\ 1 & -1 \end{vmatrix} = 1 \cdot (-1) - 1 \cdot 1 = -2$$

$$D_x = \begin{vmatrix} 10 & 1 \\ 4 & -1 \end{vmatrix} = 10 \cdot (-1) - 1 \cdot 4 = -14$$

$$D_y = \begin{vmatrix} 1 & 10 \\ 1 & 4 \end{vmatrix} = 1 \cdot 4 - 10 \cdot 1 = -6$$

$$x = \frac{-14}{-2}$$

$$x = 7$$

$$y = \frac{-6}{-2}$$

$$y = 3$$

$$L = \{7/3\}$$

Aufgabe (3)

$$D_h = \begin{vmatrix} 9 & -2 \\ 5 & -2 \end{vmatrix} = 9 \cdot (-2) - (-2) \cdot 5 = -8$$

$$D_x = \begin{vmatrix} 5 & -2 \\ 1 & -2 \end{vmatrix} = 5 \cdot (-2) - (-2) \cdot 1 = -8$$

$$D_y = \begin{vmatrix} 9 & 5 \\ 5 & 1 \end{vmatrix} = 9 \cdot 1 - 5 \cdot 5 = -16$$

$$x = \frac{-8}{-8}$$

$$x = 1$$

$$y = \frac{-16}{-8}$$

$$y = 2$$

$$L = \{1/2\}$$

Aufgabe (4)

$$D_h = \begin{vmatrix} 9 & -2 \\ -3 & -3 \end{vmatrix} = 9 \cdot (-3) - (-2) \cdot (-3) = -33$$

$$D_x = \begin{vmatrix} 1 & -2 \\ -7 & -3 \end{vmatrix} = 1 \cdot (-3) - (-2) \cdot (-7) = -17$$

$$D_y = \begin{vmatrix} 9 & 1 \\ -3 & -7 \end{vmatrix} = 9 \cdot (-7) - 1 \cdot (-3) = -60$$

$$x = \frac{-17}{-33}$$

$$x = \frac{17}{33}$$

$$y = \frac{-60}{-33}$$

$$y = 1 \frac{9}{11}$$

$$L = \left\{ \frac{17}{33} / 1 \frac{9}{11} \right\}$$

Aufgabe (5)

$$D_h = \begin{vmatrix} 1 & 3 \\ 3 & -2 \end{vmatrix} = 1 \cdot (-2) - 3 \cdot 3 = -11$$

$$D_x = \begin{vmatrix} 9 & 3 \\ -6 & -2 \end{vmatrix} = 9 \cdot (-2) - 3 \cdot (-6) = 0$$

$$D_y = \begin{vmatrix} 1 & 9 \\ 3 & -6 \end{vmatrix} = 1 \cdot (-6) - 9 \cdot 3 = -33$$

$$x = \frac{0}{-11}$$

$$x = 0$$

$$y = \frac{-33}{-11}$$

$$y = 3$$

$$L = \{0/3\}$$

Aufgabe (6)

$$D_h = \begin{vmatrix} 7 & 1\frac{1}{2} \\ 2 & -5 \end{vmatrix} = 7 \cdot (-5) - 1\frac{1}{2} \cdot 2 = -38$$

$$D_x = \begin{vmatrix} 1 & 1\frac{1}{2} \\ 22 & -5 \end{vmatrix} = 1 \cdot (-5) - 1\frac{1}{2} \cdot 22 = -38$$

$$D_y = \begin{vmatrix} 7 & 1 \\ 2 & 22 \end{vmatrix} = 7 \cdot 22 - 1 \cdot 2 = 152$$

$$x = \frac{-38}{-38}$$

$$x = 1$$

$$y = \frac{152}{-38}$$

$$y = -4$$

$$L = \{1/ -4\}$$

Aufgabe (7)

$$D_h = \begin{vmatrix} 4 & -5 \\ -3 & -7 \end{vmatrix} = 4 \cdot (-7) - (-5) \cdot (-3) = -43$$

$$D_x = \begin{vmatrix} 43 & -5 \\ 0 & -7 \end{vmatrix} = 43 \cdot (-7) - (-5) \cdot 0 = -301$$

$$D_y = \begin{vmatrix} 4 & 43 \\ -3 & 0 \end{vmatrix} = 4 \cdot 0 - 43 \cdot (-3) = 129$$

$$x = \frac{-301}{-43}$$

$$x = 7$$

$$y = \frac{129}{-43}$$

$$y = -3$$

$$L = \{7/ -3\}$$

Aufgabe (8)

$$D_h = \begin{vmatrix} 8 & -3 \\ 12 & -5 \end{vmatrix} = 8 \cdot (-5) - (-3) \cdot 12 = -4$$

$$D_x = \begin{vmatrix} 10 & -3 \\ 24 & -5 \end{vmatrix} = 10 \cdot (-5) - (-3) \cdot 24 = 22$$

$$D_y = \begin{vmatrix} 8 & 10 \\ 12 & 24 \end{vmatrix} = 8 \cdot 24 - 10 \cdot 12 = 72$$

$$x = \frac{22}{-4}$$

$$x = -5\frac{1}{2}$$

$$y = \frac{72}{-4}$$

$$y = -18$$

$$L = \{-5\frac{1}{2} / -18\}$$

Aufgabe (9)

$$D_h = \begin{vmatrix} -\frac{1}{2} & 1 \\ \frac{1}{2} & -3 \end{vmatrix} = -\frac{1}{2} \cdot (-3) - 1 \cdot \frac{1}{2} = 1$$

$$D_x = \begin{vmatrix} 2 & 1 \\ -3 & -3 \end{vmatrix} = 2 \cdot (-3) - 1 \cdot (-3) = -3$$

$$D_y = \begin{vmatrix} -\frac{1}{2} & 2 \\ \frac{1}{2} & -3 \end{vmatrix} = -\frac{1}{2} \cdot (-3) - 2 \cdot \frac{1}{2} = \frac{1}{2}$$

$$x = \frac{-3}{1}$$

$$x = -3$$

$$y = \frac{\frac{1}{2}}{\frac{1}{2}}$$

$$y = 1$$

$$L = \{-3 / \frac{1}{2}\}$$

Aufgabe (10)

$$D_h = \begin{vmatrix} -1 & 1 \\ \frac{1}{2} & -4 \end{vmatrix} = -1 \cdot (-4) - 1 \cdot \frac{1}{2} = 3\frac{1}{2}$$

$$D_x = \begin{vmatrix} 3 & 1 \\ 5 & -4 \end{vmatrix} = 3 \cdot (-4) - 1 \cdot 5 = -17$$

$$D_y = \begin{vmatrix} -1 & 3 \\ \frac{1}{2} & 5 \end{vmatrix} = -1 \cdot 5 - 3 \cdot \frac{1}{2} = -6\frac{1}{2}$$

$$x = \frac{-17}{3\frac{1}{2}}$$

$$x = -4\frac{6}{7}$$

$$y = \frac{-6\frac{1}{2}}{3\frac{1}{2}}$$

$$y = -1\frac{6}{7}$$

$$L = \{-4\frac{6}{7} / -1\frac{6}{7}\}$$

Aufgabe (11)

$$D_h = \begin{vmatrix} 1\frac{1}{5} & -1\frac{1}{3} \\ 2\frac{1}{2} & -\frac{1}{4} \end{vmatrix} = 1\frac{1}{5} \cdot (-\frac{1}{4}) - (-1\frac{1}{3}) \cdot 2\frac{1}{2} = 3\frac{1}{30}$$

$$D_x = \begin{vmatrix} 5\frac{1}{3} & -1\frac{1}{3} \\ 12\frac{3}{8} & -\frac{1}{4} \end{vmatrix} = 5\frac{1}{3} \cdot (-\frac{1}{4}) - (-1\frac{1}{3}) \cdot 12\frac{3}{8} = 15\frac{1}{6}$$

$$D_y = \begin{vmatrix} 1\frac{1}{5} & 5\frac{1}{3} \\ 2\frac{1}{2} & 12\frac{3}{8} \end{vmatrix} = 1\frac{1}{5} \cdot 12\frac{3}{8} - 5\frac{1}{3} \cdot 2\frac{1}{2} = 1\frac{31}{60}$$

$$x = \frac{15\frac{1}{6}}{3\frac{1}{30}}$$

$$x = 5$$

$$y = \frac{1\frac{31}{60}}{3\frac{1}{30}}$$

$$y = \frac{1}{2}$$

$$L = \{5/\frac{1}{2}\}$$

Aufgabe (12)

$$D_h = \begin{vmatrix} \frac{2}{3} & -\frac{5}{7} \\ 1 & 1 \end{vmatrix} = \frac{2}{3} \cdot 1 - \left(-\frac{5}{7}\right) \cdot 1 = 1\frac{8}{21}$$

$$D_x = \begin{vmatrix} \frac{2}{3} & -\frac{5}{7} \\ 10\frac{2}{3} & 1 \end{vmatrix} = \frac{2}{3} \cdot 1 - \left(-\frac{5}{7}\right) \cdot 10\frac{2}{3} = 8\frac{2}{7}$$

$$D_y = \begin{vmatrix} \frac{2}{3} & 1 \\ 1 & 10\frac{2}{3} \end{vmatrix} = \frac{2}{3} \cdot 10\frac{2}{3} - \frac{2}{3} \cdot 1 = 6\frac{4}{9}$$

$$x = \frac{8\frac{2}{7}}{1\frac{8}{21}}$$

$$x = 6$$

$$y = \frac{6\frac{4}{9}}{1\frac{8}{21}}$$

$$y = 4\frac{2}{3}$$

$$L = \{6/4\frac{2}{3}\}$$

Aufgabe (13)

$$D_h = \begin{vmatrix} 1\frac{1}{2} & -2 \\ \frac{1}{3} & \frac{1}{3} \end{vmatrix} = 1\frac{1}{2} \cdot \frac{1}{3} - (-2) \cdot \frac{2}{5} = 1\frac{3}{10}$$

$$D_x = \begin{vmatrix} 9 & -2 \\ 5 & \frac{1}{3} \end{vmatrix} = 9 \cdot \frac{1}{3} - (-2) \cdot 5 = 13$$

$$D_y = \begin{vmatrix} 1\frac{1}{2} & 9 \\ \frac{1}{3} & 5 \end{vmatrix} = 1\frac{1}{2} \cdot 5 - 9 \cdot \frac{2}{5} = 3\frac{9}{10}$$

$$x = \frac{13}{1\frac{3}{10}}$$

$$x = 10$$

$$y = \frac{3\frac{9}{10}}{1\frac{3}{10}}$$

$$y = 3$$

$$L = \{10/3\}$$

Aufgabe (14)

$$D_h = \begin{vmatrix} 2 & 3 \\ \frac{1}{3} & -\frac{1}{5} \end{vmatrix} = 2 \cdot \left(-\frac{1}{5}\right) - 3 \cdot \frac{1}{3} = -1\frac{2}{5}$$

$$D_x = \begin{vmatrix} 4 & 3 \\ 12 & -\frac{1}{5} \end{vmatrix} = 4 \cdot \left(-\frac{1}{5}\right) - 3 \cdot 12 = -36\frac{4}{5}$$

$$D_y = \begin{vmatrix} 2 & 4 \\ \frac{1}{3} & 12 \end{vmatrix} = 2 \cdot 12 - 4 \cdot \frac{1}{3} = 22\frac{2}{3}$$

$$x = \frac{-36\frac{4}{5}}{-1\frac{2}{5}}$$

$$x = 26\frac{2}{7}$$

$$y = \frac{22\frac{2}{3}}{-1\frac{2}{5}}$$

$$y = -16\frac{4}{21}$$

$$L = \{26\frac{2}{7}/-16\frac{4}{21}\}$$

Aufgabe (15)

$$D_h = \begin{vmatrix} 1 & 2 \\ -1 & 2 \end{vmatrix} = 1 \cdot 2 - 2 \cdot (-1) = 4$$

$$D_x = \begin{vmatrix} -4 & 2 \\ 5 & 2 \end{vmatrix} = -4 \cdot 2 - 2 \cdot 5 = -18$$

$$D_y = \begin{vmatrix} 1 & -4 \\ -1 & 5 \end{vmatrix} = 1 \cdot 5 - (-4) \cdot (-1) = 1$$

$$x = \frac{-18}{4}$$

$$x = -4\frac{1}{2}$$

$$y = \frac{1}{4}$$

$$y = \frac{1}{4}$$

$$L = \{-4\frac{1}{2}/\frac{1}{4}\}$$

Aufgabe (16)

$$D_h = \begin{vmatrix} 2 & 4 \\ -\frac{1}{2} & 3 \end{vmatrix} = 2 \cdot 3 - 4 \cdot (-\frac{1}{2}) = 8$$

$$D_x = \begin{vmatrix} 4 & 4 \\ 3 & 3 \end{vmatrix} = 4 \cdot 3 - 4 \cdot 3 = 0$$

$$D_y = \begin{vmatrix} 2 & 4 \\ -\frac{1}{2} & 3 \end{vmatrix} = 2 \cdot 3 - 4 \cdot (-\frac{1}{2}) = 8$$

$$x = \frac{0}{8}$$

$$x = 0$$

$$y = \frac{8}{8}$$

$$y = 1$$

$$L = \{0/1\}$$

Aufgabe (17)

$$D_h = \begin{vmatrix} -\frac{1}{2} & 4 \\ -2 & -8 \end{vmatrix} = -\frac{1}{2} \cdot (-8) - 4 \cdot (-2) = 12$$

$$D_x = \begin{vmatrix} 6 & 4 \\ 2 & -8 \end{vmatrix} = 6 \cdot (-8) - 4 \cdot 2 = -56$$

$$D_y = \begin{vmatrix} -\frac{1}{2} & 6 \\ -2 & 2 \end{vmatrix} = -\frac{1}{2} \cdot 2 - 6 \cdot (-2) = 11$$

$$x = \frac{-56}{12}$$

$$x = -4\frac{2}{3}$$

$$y = \frac{11}{12}$$

$$y = \frac{11}{12}$$

$$L = \{-4\frac{2}{3}/\frac{11}{12}\}$$

Aufgabe (18)

$$D_h = \begin{vmatrix} 1 & 1 \\ 2 & 2 \end{vmatrix} = 1 \cdot 2 - 1 \cdot 2 = 0$$

$$D_x = \begin{vmatrix} 1 & 1 \\ 2 & 2 \end{vmatrix} = 1 \cdot 2 - 1 \cdot 2 = 0$$

$$D_y = \begin{vmatrix} 1 & 1 \\ 2 & 2 \end{vmatrix} = 1 \cdot 2 - 1 \cdot 2 = 0$$

$$L = \{\text{unendlich}\}$$

Aufgabe (19)

$$D_h = \begin{vmatrix} 1 & 1 \\ 3 & 3 \end{vmatrix} = 1 \cdot 3 - 1 \cdot 3 = 0$$

$$D_x = \begin{vmatrix} 2 & 1 \\ 3 & 3 \end{vmatrix} = 2 \cdot 3 - 1 \cdot 3 = 3$$

$$D_y = \begin{vmatrix} 1 & 2 \\ 3 & 3 \end{vmatrix} = 1 \cdot 3 - 2 \cdot 3 = -3$$

$$L = \{\}$$

Aufgabe (20)

$$D_h = \begin{vmatrix} -1\frac{4}{5} & 1\frac{1}{3} \\ -\frac{2}{3} & \frac{1}{9} \end{vmatrix} = -1\frac{4}{5} \cdot \frac{1}{9} - 1\frac{1}{3} \cdot \left(-\frac{2}{3}\right) = \frac{31}{45}$$

$$D_x = \begin{vmatrix} -1 & 1\frac{1}{3} \\ 9 & \frac{1}{9} \end{vmatrix} = -1 \cdot \frac{1}{9} - 1\frac{1}{3} \cdot 9 = -12\frac{1}{9}$$

$$D_y = \begin{vmatrix} -1\frac{4}{5} & -1 \\ -\frac{2}{3} & 9 \end{vmatrix} = -1\frac{4}{5} \cdot 9 - (-1) \cdot \left(-\frac{2}{3}\right) = -16\frac{13}{15}$$

$$x = \frac{-12\frac{1}{9}}{\frac{31}{45}}$$

$$x = -17\frac{18}{31}$$

$$y = \frac{-16\frac{13}{15}}{\frac{31}{45}}$$

$$y = -24\frac{15}{31}$$

$$L = \{-17\frac{18}{31} / -24\frac{15}{31}\}$$

Aufgabe (21)

$$D_h = \begin{vmatrix} 2 & -7 \\ 7 & -1 \end{vmatrix} = 2 \cdot (-1) - (-7) \cdot 7 = 47$$

$$D_x = \begin{vmatrix} -8 & -7 \\ -9 & -1 \end{vmatrix} = -8 \cdot (-1) - (-7) \cdot (-9) = -55$$

$$D_y = \begin{vmatrix} 2 & -8 \\ 7 & -9 \end{vmatrix} = 2 \cdot (-9) - (-8) \cdot 7 = 38$$

$$x = \frac{-55}{47}$$

$$x = -1\frac{8}{47}$$

$$y = \frac{38}{47}$$

$$y = \frac{38}{47}$$

$$L = \{-1\frac{8}{47} / \frac{38}{47}\}$$

Aufgabe (22)

$$D_h = \begin{vmatrix} -7 & 9 \\ 5 & -6 \end{vmatrix} = -7 \cdot (-6) - 9 \cdot 5 = -3$$

$$D_x = \begin{vmatrix} -3 & 9 \\ -4 & -6 \end{vmatrix} = -3 \cdot (-6) - 9 \cdot (-4) = 54$$

$$D_y = \begin{vmatrix} -7 & -3 \\ 5 & -4 \end{vmatrix} = -7 \cdot (-4) - (-3) \cdot 5 = 43$$

$$x = \frac{54}{-3}$$

$$x = -18$$

$$y = \frac{43}{-3}$$

$$y = -14\frac{1}{3}$$

$$L = \{-18 / -14\frac{1}{3}\}$$

Aufgabe (23)

$$D_h = \begin{vmatrix} 2 & 2 \\ 3 & 6 \end{vmatrix} = 2 \cdot 6 - 2 \cdot 3 = 6$$

$$D_x = \begin{vmatrix} 1\frac{7}{10} & 2 \\ 3 & 6 \end{vmatrix} = 1\frac{7}{10} \cdot 6 - 2 \cdot 3 = 4\frac{1}{5}$$

$$D_y = \begin{vmatrix} 2 & 1\frac{7}{10} \\ 3 & 3 \end{vmatrix} = 2 \cdot 3 - 1\frac{7}{10} \cdot 3 = \frac{9}{10}$$

$$x = \frac{4\frac{1}{5}}{6}$$

$$x = \frac{7}{10}$$

$$y = \frac{\frac{9}{10}}{\frac{6}{3}}$$

$$y = \frac{3}{20}$$

$$L = \{\frac{7}{10} / \frac{3}{20}\}$$

Aufgabe (24)

$$D_h = \begin{vmatrix} 4 & 6 \\ 5 & 6 \end{vmatrix} = 4 \cdot 6 - 6 \cdot 5 = -6$$

$$D_x = \begin{vmatrix} 7 & 6 \\ 5 & 6 \end{vmatrix} = 7 \cdot 6 - 6 \cdot 5 = 12$$

$$D_y = \begin{vmatrix} 4 & 7 \\ 5 & 5 \end{vmatrix} = 4 \cdot 5 - 7 \cdot 5 = -15$$

$$x = \frac{12}{-6}$$

$$x = -2$$

$$y = \frac{-15}{-6}$$

$$y = 2\frac{1}{2}$$

$$L = \{-2 / 2\frac{1}{2}\}$$

5 Determinantenverfahren (3)

$$a_1x + b_1y + c_1z = d_1$$

$$a_2x + b_2y + c_2z = d_2$$

$$a_3x + b_3y + c_3z = d_3$$

$$D_h = \begin{vmatrix} a_1 & b_1 & c_1 \\ a_2 & b_2 & c_2 \\ a_3 & b_3 & c_3 \end{vmatrix} \begin{vmatrix} a_1 & b_1 \\ a_2 & b_2 \\ a_3 & b_3 \end{vmatrix}$$

$$D_h = a_1 \cdot b_2 \cdot c_3 + b_1 \cdot c_2 \cdot a_3 + c_1 \cdot a_2 \cdot b_3 - c_1 \cdot b_2 \cdot a_3 - a_1 \cdot c_2 \cdot b_3 - b_1 \cdot a_2 \cdot c_3$$

$$D_x = \begin{vmatrix} d_1 & b_1 & c_1 \\ d_2 & b_2 & c_2 \\ d_3 & b_3 & c_3 \end{vmatrix} \begin{vmatrix} d_1 & b_1 \\ d_2 & b_2 \\ d_3 & b_3 \end{vmatrix}$$

$$D_x = d_1 \cdot b_2 \cdot c_3 + b_1 \cdot c_2 \cdot d_3 + c_1 \cdot d_2 \cdot b_3 - c_1 \cdot b_2 \cdot d_3 - d_1 \cdot c_2 \cdot b_3 - b_1 \cdot d_2 \cdot c_3$$

$$D_y = \begin{vmatrix} a_1 & d_1 & c_1 \\ a_2 & d_2 & c_2 \\ a_3 & d_3 & c_3 \end{vmatrix} \begin{vmatrix} a_1 & d_1 \\ a_2 & d_2 \\ a_3 & d_3 \end{vmatrix}$$

$$D_y = a_1 \cdot d_2 \cdot c_3 + d_1 \cdot c_2 \cdot a_3 + c_1 \cdot a_2 \cdot d_3 - c_1 \cdot d_2 \cdot a_3 - a_1 \cdot c_2 \cdot d_3 - d_1 \cdot a_2 \cdot c_3$$

$$D_z = \begin{vmatrix} a_1 & b_1 & d_1 \\ a_2 & b_2 & d_2 \\ a_3 & b_3 & d_3 \end{vmatrix} \begin{vmatrix} a_1 & b_1 \\ a_2 & b_2 \\ a_3 & b_3 \end{vmatrix}$$

$$D_z = a_1 \cdot b_2 \cdot d_3 + b_1 \cdot d_2 \cdot a_3 + d_1 \cdot a_2 \cdot b_3 - d_1 \cdot b_2 \cdot a_3 - a_1 \cdot d_2 \cdot b_3 - b_1 \cdot a_2 \cdot d_3 = 0$$

- Eindeutige Lösung $D_h \neq 0$

$$x = \frac{D_x}{D_h}$$

$$y = \frac{D_y}{D_h}$$

$$z = \frac{D_z}{D_h}$$

- Keine Lösung $D_h = 0$

$$D_x \neq 0 \text{ oder } D_y \neq 0 \text{ oder } D_z \neq 0$$

- Unendlich viele Lösungen

$$D_h = D_x = D_y = D_z = 0$$

$$11x + 13y + 4z = 37$$

$$12x + 14y + 5z = 40$$

$$9x + 3y + 3z = 15$$

$$D_h = \begin{vmatrix} 11 & 13 & 4 \\ 12 & 14 & 5 \\ 9 & 3 & 3 \end{vmatrix} \begin{vmatrix} 11 & 13 \\ 12 & 14 \\ 9 & 3 \end{vmatrix}$$

$$D_h = 11 \cdot 14 \cdot 3 + 13 \cdot 5 \cdot 9 + 4 \cdot 12 \cdot 3 - 4 \cdot 14 \cdot 9 - 11 \cdot 5 \cdot 3 - 13 \cdot 12 \cdot 3 = 54$$

$$D_x = \begin{vmatrix} 37 & 13 & 4 \\ 40 & 14 & 5 \\ 15 & 3 & 3 \end{vmatrix} \begin{vmatrix} 37 & 13 \\ 40 & 14 \\ 15 & 3 \end{vmatrix}$$

$$D_x = 37 \cdot 14 \cdot 3 + 13 \cdot 5 \cdot 15 + 4 \cdot 40 \cdot 3 - 4 \cdot 14 \cdot 15 - 37 \cdot 5 \cdot 3 - 13 \cdot 40 \cdot 3 = 54$$

$$D_y = \begin{vmatrix} 11 & 37 & 4 \\ 12 & 40 & 5 \\ 9 & 15 & 3 \end{vmatrix} \begin{vmatrix} 11 & 37 \\ 12 & 40 \\ 9 & 15 \end{vmatrix}$$

$$D_y = 11 \cdot 40 \cdot 3 + 37 \cdot 5 \cdot 9 + 4 \cdot 12 \cdot 15 - 4 \cdot 40 \cdot 9 - 11 \cdot 5 \cdot 15 - 37 \cdot 12 \cdot 3 = 108$$

$$D_z = \begin{vmatrix} 11 & 13 & 37 \\ 12 & 14 & 40 \\ 9 & 3 & 15 \end{vmatrix} \begin{vmatrix} 11 & 13 \\ 12 & 14 \\ 9 & 3 \end{vmatrix}$$

$$D_z = 11 \cdot 14 \cdot 15 + 13 \cdot 40 \cdot 9 + 37 \cdot 12 \cdot 3 - 37 \cdot 14 \cdot 9 - 11 \cdot 40 \cdot 3 - 13 \cdot 12 \cdot 15 = 0$$

$$x = \frac{54}{54}$$

$$x = 1$$

$$y = \frac{108}{54}$$

$$y = 2$$

$$z = \frac{0}{54}$$

$$z = 0$$

$$L = \{1/2/0\}$$

5.1 Aufgaben

Um eigene Aufgaben zu lösen, klicken Sie hier: [Neue Rechnung](#)

Gegeben:

$$a_1 \cdot x + b_1 \cdot y + c_1 \cdot z = d_1$$

$$a_2 \cdot x + b_2 \cdot y + c_2 \cdot z = d_2$$

$$a_3 \cdot x + b_3 \cdot y + c_3 \cdot z = d_3$$

Gesucht:

x,y,z

$$(1) \quad \begin{aligned} 11x + 13y + 4z &= 37 \\ 12x + 14y + 5z &= 40 \\ 9x + 3y + 3z &= 15 \end{aligned}$$

$$(2) \quad \begin{aligned} 9x + 5y + 4z &= 13 \\ 6x + 3y + -5z &= 17 \\ 3x - 10y + 6z &= 23 \end{aligned}$$

- (3) $4x - 3 + 2z = 10$
 $5x + 6y + -7z = 4$
 $10x + 2y + -3z = 7$
 $2x + 3 + -4z = 16$
- (4) $4x + 9y + -1z = 58$
 $1x + 6y + 2z = 34$
 $1x + 2 + 3z = 4$
- (5) $2x + 3y + 2z = 6$
 $0x + 2y + 6z = 0$
 $-2x - 8 + 0z = 1$
- (6) $1x + 4y + 0z = -\frac{1}{2}$
 $8x - 2y + -1z = 8$
 $-2x + 2 + 4z = 0$
- (7) $4x - \frac{1}{2}y + 2z = 5$
 $4x - 2y + -1z = 8$
 $2x + 3 + -4z = 16$
- (8) $4x + 9y + -1z = 58$
 $1x + 6y + 2z = 34$
 $4x - 3 + 2z = 10$
- (9) $5x + 6y + -7z = 4$
 $10x - 2y + -3z = 7$
 $9x + 5 + 4z = 13$
- (10) $6x + 3y + -5z = 17$
 $3x - 10y + 6z = 23$
- (11) $11x + 13 + 4z = 37$
 $12x + 14y + 5z = 40$
 $9x + 3y + 3z = 15$
 $2x + 3 + 4z = 175$
- (12) $4x + 6y + 5z = 287$
 $3x + 2y + 8z = 257$
 $6x + 4 + 9z = 32$
- (13) $5x + 7y + 10z = 17$
 $4x + 8y + 5z = 100$
 $1x + 1 + 0z = 1$
- (14) $1x + 0y + 1z = 6$
 $0x + 1y + -1z = 5$
 $1x - 2 + 3z = 9$
- (15) $3x + 8y + 9z = 5$
 $2x + 3y + 6z = 7$
 $6x + 4 + 5z = 8$
- (16) $4x + 2y + 3z = 7$
 $5x + 3y + 4z = 9$
 $1x + 3 + -2z = 3$
- (17) $3x + 2y + 1z = 2$
 $0x + 1y + 3z = 5$

5.2 Lösungen

Aufgabe (1)

$$11x + 13y + 4z = 37$$

$$12x + 14y + 5z = 40$$

$$9x + 3y + 3z = 15$$

$$D_h = \begin{vmatrix} 11 & 13 & 4 & | & 11 & 13 \\ 12 & 14 & 5 & | & 12 & 14 \\ 9 & 3 & 3 & | & 9 & 3 \end{vmatrix}$$

$$D_h = 11 \cdot 14 \cdot 3 + 13 \cdot 5 \cdot 9 + 4 \cdot 12 \cdot 3 - 4 \cdot 14 \cdot 9 - 11 \cdot 5 \cdot 3 - 13 \cdot 12 \cdot 3 = 54$$

$$D_x = \begin{vmatrix} 37 & 13 & 4 & | & 37 & 13 \\ 40 & 14 & 5 & | & 40 & 14 \\ 15 & 3 & 3 & | & 15 & 3 \end{vmatrix}$$

$$D_x = 37 \cdot 14 \cdot 3 + 13 \cdot 5 \cdot 15 + 4 \cdot 40 \cdot 3 - 4 \cdot 14 \cdot 15 - 37 \cdot 5 \cdot 3 - 13 \cdot 40 \cdot 3 = 54$$

$$D_y = \begin{vmatrix} 11 & 37 & 4 & | & 11 & 37 \\ 12 & 40 & 5 & | & 12 & 40 \\ 9 & 15 & 3 & | & 9 & 15 \end{vmatrix}$$

$$D_y = 11 \cdot 40 \cdot 3 + 37 \cdot 5 \cdot 9 + 4 \cdot 12 \cdot 15 - 4 \cdot 40 \cdot 9 - 11 \cdot 5 \cdot 15 - 37 \cdot 12 \cdot 3 = 108$$

$$D_z = \begin{vmatrix} 11 & 13 & 37 & | & 11 & 13 \\ 12 & 14 & 40 & | & 12 & 14 \\ 9 & 3 & 15 & | & 9 & 3 \end{vmatrix}$$

$$D_z = 11 \cdot 14 \cdot 15 + 13 \cdot 40 \cdot 9 + 37 \cdot 12 \cdot 3 - 37 \cdot 14 \cdot 9 - 11 \cdot 40 \cdot 3 - 13 \cdot 12 \cdot 15 = 0$$

$$x = \frac{54}{54}$$

$$x = 1$$

$$y = \frac{108}{54}$$

$$y = 2$$

$$z = \frac{0}{54}$$

$$z = 0$$

$$L = \{1/2/0\}$$

Aufgabe (2)

$$9x + 5y + 4z = 13$$

$$6x + 3y - 5z = 17$$

$$3x - 10y + 6z = 23$$

$$D_h = \begin{vmatrix} 9 & 5 & 4 & | & 9 & 5 \\ 6 & 3 & -5 & | & 6 & 3 \\ 3 & -10 & 6 & | & 3 & -10 \end{vmatrix}$$

$$D_h = 9 \cdot 3 \cdot 6 + 5 \cdot (-5) \cdot 3 + 4 \cdot 6 \cdot (-10) - 4 \cdot 3 \cdot 3 - 9 \cdot (-5) \cdot (-10) - 5 \cdot 6 \cdot 6 = -819$$

$$D_x = \begin{vmatrix} 13 & 5 & 4 & | & 13 & 5 \\ 17 & 3 & -5 & | & 17 & 3 \\ 23 & -10 & 6 & | & 23 & -10 \end{vmatrix}$$

$$D_x = 13 \cdot 3 \cdot 6 + 5 \cdot (-5) \cdot 23 + 4 \cdot 17 \cdot (-10) - 4 \cdot 3 \cdot 23 - 13 \cdot (-5) \cdot (-10) - 5 \cdot 17 \cdot 6 = -2,46 \cdot 10^3$$

$$D_y = \begin{vmatrix} 9 & 13 & 4 & | & 9 & 13 \\ 6 & 17 & -5 & | & 6 & 17 \\ 3 & 23 & 6 & | & 3 & 23 \end{vmatrix}$$

$$D_y = 9 \cdot 17 \cdot 6 + 13 \cdot (-5) \cdot 3 + 4 \cdot 6 \cdot 23 - 4 \cdot 17 \cdot 3 - 9 \cdot (-5) \cdot 23 - 13 \cdot 6 \cdot 6 = 1,64 \cdot 10^3$$

$$D_z = \begin{vmatrix} 9 & 5 & 13 & | & 9 & 5 \\ 6 & 3 & 17 & | & 6 & 3 \\ 3 & -10 & 23 & | & 3 & -10 \end{vmatrix}$$

$$D_z = 9 \cdot 3 \cdot 23 + 5 \cdot 17 \cdot 3 + 13 \cdot 6 \cdot (-10) - 13 \cdot 3 \cdot 3 - 9 \cdot 17 \cdot (-10) - 5 \cdot 6 \cdot 23 = 819$$

$$x = \frac{-2,46 \cdot 10^3}{-819}$$

$$x = 3$$

$$y = \frac{1,64 \cdot 10^3}{-819}$$

$$y = -2$$

$$z = \frac{819}{-819}$$

$$z = -1$$

$$L = \{3/-2/-1\}$$

Aufgabe (3)

$$4x + -3y + 2z = 10$$

$$5x + 6y - 7z = 4$$

$$10x + 2y - 3z = 7$$

$$D_h = \begin{vmatrix} 4 & -3 & 2 & 4 & -3 \\ 5 & 6 & -7 & 5 & 6 \\ 10 & 2 & -3 & 10 & 2 \end{vmatrix}$$

$$D_h = 4 \cdot 6 \cdot (-3) + (-3) \cdot (-7) \cdot 10 + 2 \cdot 5 \cdot 2 - 2 \cdot 6 \cdot 10 - 4 \cdot (-7) \cdot 2 - (-3) \cdot 5 \cdot (-3) = 49$$

$$D_x = \begin{vmatrix} 10 & -3 & 2 & 10 & -3 \\ 4 & 6 & -7 & 4 & 6 \\ 7 & 2 & -3 & 7 & 2 \end{vmatrix}$$

$$D_x = 10 \cdot 6 \cdot (-3) + (-3) \cdot (-7) \cdot 7 + 2 \cdot 4 \cdot 2 - 2 \cdot 6 \cdot 7 - 10 \cdot (-7) \cdot 2 - (-3) \cdot 4 \cdot (-3) = 3$$

$$D_y = \begin{vmatrix} 4 & 10 & 2 & 4 & 10 \\ 5 & 4 & -7 & 5 & 4 \\ 10 & 7 & -3 & 10 & 7 \end{vmatrix}$$

$$D_y = 4 \cdot 4 \cdot (-3) + 10 \cdot (-7) \cdot 10 + 2 \cdot 5 \cdot 7 - 2 \cdot 4 \cdot 10 - 4 \cdot (-7) \cdot 7 - 10 \cdot 5 \cdot (-3) = -412$$

$$D_z = \begin{vmatrix} 4 & -3 & 10 & 4 & -3 \\ 5 & 6 & 4 & 5 & 6 \\ 10 & 2 & 7 & 10 & 2 \end{vmatrix}$$

$$D_z = 4 \cdot 6 \cdot 7 + (-3) \cdot 4 \cdot 10 + 10 \cdot 5 \cdot 2 - 10 \cdot 6 \cdot 10 - 4 \cdot 4 \cdot 2 - (-3) \cdot 5 \cdot 7 = -379$$

$$x = \frac{3}{49}$$

$$x = \frac{3}{49}$$

$$y = \frac{-412}{49}$$

$$y = -8\frac{20}{49}$$

$$z = \frac{-379}{49}$$

$$z = -7\frac{36}{49}$$

$$L = \left\{ \frac{3}{49} / -8\frac{20}{49} / -7\frac{36}{49} \right\}$$

Aufgabe (4)

$$2x + 3y + -4z = 16$$

$$4x + 9y - 1z = 58$$

$$1x + 6y + 2z = 34$$

$$D_h = \begin{vmatrix} 2 & 3 & -4 & 2 & 3 \\ 4 & 9 & -1 & 4 & 9 \\ 1 & 6 & 2 & 1 & 6 \end{vmatrix}$$

$$D_h = 2 \cdot 9 \cdot 2 + 3 \cdot (-1) \cdot 1 + (-4) \cdot 4 \cdot 6 - (-4) \cdot 9 \cdot 1 - 2 \cdot (-1) \cdot 6 - 3 \cdot 4 \cdot 2 = -39$$

$$D_x = \begin{vmatrix} 16 & 3 & -4 & 16 & 3 \\ 58 & 9 & -1 & 58 & 9 \\ 34 & 6 & 2 & 34 & 6 \end{vmatrix}$$

$$D_x = 16 \cdot 9 \cdot 2 + 3 \cdot (-1) \cdot 34 + (-4) \cdot 58 \cdot 6 - (-4) \cdot 9 \cdot 34 - 16 \cdot (-1) \cdot 6 - 3 \cdot 58 \cdot 2 = -234$$

$$D_y = \begin{vmatrix} 2 & 16 & -4 & 2 & 16 \\ 4 & 58 & -1 & 4 & 58 \\ 1 & 34 & 2 & 1 & 34 \end{vmatrix}$$

$$D_y = 2 \cdot 58 \cdot 2 + 16 \cdot (-1) \cdot 1 + (-4) \cdot 4 \cdot 34 - (-4) \cdot 58 \cdot 1 - 2 \cdot (-1) \cdot 34 - 16 \cdot 4 \cdot 2 = -156$$

$$D_z = \begin{vmatrix} 2 & 3 & 16 & 2 & 3 \\ 4 & 9 & 58 & 4 & 9 \\ 1 & 6 & 34 & 1 & 6 \end{vmatrix}$$

$$D_z = 2 \cdot 9 \cdot 34 + 3 \cdot 58 \cdot 1 + 16 \cdot 4 \cdot 6 - 16 \cdot 9 \cdot 1 - 2 \cdot 58 \cdot 6 - 3 \cdot 4 \cdot 34 = -78$$

$$x = \frac{-234}{-39}$$

$$x = 6$$

$$y = \frac{-156}{-39}$$

$$y = 4$$

$$z = \frac{-78}{-39}$$

$$z = 2$$

$$L = \{6/4/2\}$$

Aufgabe (5)

$$1x + 2y + 3z = 4$$

$$2x + 3y + 2z = 6$$

$$0x + 2y + 6z = 0$$

$$D_h = \begin{vmatrix} 1 & 2 & 3 & 1 & 2 \\ 2 & 3 & 2 & 2 & 3 \\ 0 & 2 & 6 & 0 & 2 \end{vmatrix}$$

$$D_h = 1 \cdot 3 \cdot 6 + 2 \cdot 2 \cdot 0 + 3 \cdot 2 \cdot 2 - 3 \cdot 3 \cdot 0 - 1 \cdot 2 \cdot 2 - 2 \cdot 2 \cdot 6 = 2$$

$$D_x = \begin{vmatrix} 4 & 2 & 3 & 4 & 2 \\ 6 & 3 & 2 & 6 & 3 \\ 0 & 2 & 6 & 0 & 2 \end{vmatrix}$$

$$D_x = 4 \cdot 3 \cdot 6 + 2 \cdot 2 \cdot 0 + 3 \cdot 6 \cdot 2 - 3 \cdot 3 \cdot 0 - 4 \cdot 2 \cdot 2 - 2 \cdot 6 \cdot 6 = 20$$

$$D_y = \begin{vmatrix} 1 & 4 & 3 & 1 & 4 \\ 2 & 6 & 2 & 2 & 6 \\ 0 & 0 & 6 & 0 & 0 \end{vmatrix}$$

$$D_y = 1 \cdot 6 \cdot 6 + 4 \cdot 2 \cdot 0 + 3 \cdot 2 \cdot 0 - 3 \cdot 6 \cdot 0 - 1 \cdot 2 \cdot 0 - 4 \cdot 2 \cdot 6 = -12$$

$$D_z = \begin{vmatrix} 1 & 2 & 4 & 1 & 2 \\ 2 & 3 & 6 & 2 & 3 \\ 0 & 2 & 0 & 0 & 2 \end{vmatrix}$$

$$D_z = 1 \cdot 3 \cdot 0 + 2 \cdot 6 \cdot 0 + 4 \cdot 2 \cdot 2 - 4 \cdot 3 \cdot 0 - 1 \cdot 6 \cdot 2 - 2 \cdot 2 \cdot 0 = 4$$

$$x = \frac{20}{2}$$

$$x = 10$$

$$y = \frac{-12}{2}$$

$$y = -6$$

$$z = \frac{4}{2}$$

$$z = 2$$

$$L = \{10/ -6/2\}$$

Aufgabe (6)

$$-2x + -8y + 0z = 1$$

$$1x + 4y + 0z = -\frac{1}{2}$$

$$8x - 2y - 1z = 8$$

$$D_h = \begin{vmatrix} -2 & -8 & 0 & -2 & -8 \\ 1 & 4 & 0 & 1 & 4 \\ 8 & -2 & -1 & 8 & -2 \end{vmatrix}$$

$$D_h = (-2) \cdot 4 \cdot (-1) + (-8) \cdot 0 \cdot 8 + 0 \cdot 1 \cdot (-2) - 0 \cdot 4 \cdot 8 - (-2) \cdot 0 \cdot (-2) - (-8) \cdot 1 \cdot (-1) = 0$$

$$D_x = \begin{vmatrix} 1 & -8 & 0 & 1 & -8 \\ -\frac{1}{2} & 4 & 0 & -\frac{1}{2} & 4 \\ 8 & -2 & -1 & 8 & -2 \end{vmatrix}$$

$$D_x = 1 \cdot 4 \cdot (-1) + (-8) \cdot 0 \cdot 8 + 0 \cdot (-\frac{1}{2}) \cdot (-2) - 0 \cdot 4 \cdot 8 - 1 \cdot 0 \cdot (-2) - (-8) \cdot (-\frac{1}{2}) \cdot (-1) = 0$$

$$D_y = \begin{vmatrix} -2 & 1 & 0 & -2 & 1 \\ 1 & -\frac{1}{2} & 0 & 1 & -\frac{1}{2} \\ 8 & 8 & -1 & 8 & 8 \end{vmatrix}$$

$$D_y = (-2) \cdot (-\frac{1}{2}) \cdot (-1) + 1 \cdot 0 \cdot 8 + 0 \cdot 1 \cdot 8 - 0 \cdot (-\frac{1}{2}) \cdot 8 - (-2) \cdot 0 \cdot 8 - 1 \cdot 1 \cdot (-1) = 0$$

$$D_z = \begin{vmatrix} -2 & -8 & 1 & -2 & -8 \\ 1 & 4 & -\frac{1}{2} & 1 & 4 \\ 8 & -2 & 8 & 8 & -2 \end{vmatrix}$$

$$D_z = (-2) \cdot 4 \cdot 8 + (-8) \cdot (-\frac{1}{2}) \cdot 8 + 1 \cdot 1 \cdot (-2) - 1 \cdot 4 \cdot 8 - (-2) \cdot (-\frac{1}{2}) \cdot (-2) - (-8) \cdot 1 \cdot 8 = 0$$

$$L = \text{unendlich}$$

Aufgabe (7)

$$-2x + 2y + 4z = 0$$

$$4x - \frac{1}{2}y + 2z = 5$$

$$4x - 2y - 1z = 8$$

$$D_h = \begin{vmatrix} -2 & 2 & 4 & -2 & 2 \\ 4 & -\frac{1}{2} & 2 & 4 & -\frac{1}{2} \\ 4 & -2 & -1 & 4 & -2 \end{vmatrix}$$

$$D_h = (-2) \cdot (-\frac{1}{2}) \cdot (-1) + 2 \cdot 2 \cdot 4 + 4 \cdot 4 \cdot (-2) - 4 \cdot (-\frac{1}{2}) \cdot 4 - (-2) \cdot 2 \cdot (-2) - 2 \cdot 4 \cdot (-1) = -9$$

$$D_x = \begin{vmatrix} 0 & 2 & 4 & 0 & 2 \\ 5 & -\frac{1}{2} & 2 & 5 & -\frac{1}{2} \\ 8 & -2 & -1 & 8 & -2 \end{vmatrix}$$

$$D_x = 0 \cdot (-\frac{1}{2}) \cdot (-1) + 2 \cdot 2 \cdot 8 + 4 \cdot 5 \cdot (-2) - 4 \cdot (-\frac{1}{2}) \cdot 8 - 0 \cdot 2 \cdot (-2) - 2 \cdot 5 \cdot (-1) = 18$$

$$D_y = \begin{vmatrix} -2 & 0 & 4 & -2 & 0 \\ 4 & 5 & 2 & 4 & 5 \\ 4 & 8 & -1 & 4 & 8 \end{vmatrix}$$

$$D_y = (-2) \cdot 5 \cdot (-1) + 0 \cdot 2 \cdot 4 + 4 \cdot 4 \cdot 8 - 4 \cdot 5 \cdot 4 - (-2) \cdot 2 \cdot 8 - 0 \cdot 4 \cdot (-1) = 90$$

$$D_z = \begin{vmatrix} -2 & 2 & 0 & -2 & 2 \\ 4 & -\frac{1}{2} & 5 & 4 & -\frac{1}{2} \\ 4 & -2 & 8 & 4 & -2 \end{vmatrix}$$

$$D_z = (-2) \cdot (-\frac{1}{2}) \cdot 8 + 2 \cdot 5 \cdot 4 + 0 \cdot 4 \cdot (-2) - 0 \cdot (-\frac{1}{2}) \cdot 4 - (-2) \cdot 5 \cdot (-2) - 2 \cdot 4 \cdot 8 = -36$$

$$x = \frac{18}{-9}$$

$$x = -2$$

$$y = \frac{90}{-9}$$

$$y = -10$$

$$z = \frac{-36}{-9}$$

$$z = 4$$

$$L = \{-2/ -10/4\}$$

Aufgabe (8)

$$2x + 3y + -4z = 16$$

$$4x + 9y - 1z = 58$$

$$1x + 6y + 2z = 34$$

$$D_h = \begin{vmatrix} 2 & 3 & -4 & 2 & 3 \\ 4 & 9 & -1 & 4 & 9 \\ 1 & 6 & 2 & 1 & 6 \end{vmatrix}$$

$$D_h = 2 \cdot 9 \cdot 2 + 3 \cdot (-1) \cdot 1 + (-4) \cdot 4 \cdot 6 - (-4) \cdot 9 \cdot 1 - 2 \cdot (-1) \cdot 6 - 3 \cdot 4 \cdot 2 = -39$$

$$D_x = \begin{vmatrix} 16 & 3 & -4 & 16 & 3 \\ 58 & 9 & -1 & 58 & 9 \\ 34 & 6 & 2 & 34 & 6 \end{vmatrix}$$

$$D_x = 16 \cdot 9 \cdot 2 + 3 \cdot (-1) \cdot 34 + (-4) \cdot 58 \cdot 6 - (-4) \cdot 9 \cdot 34 - 16 \cdot (-1) \cdot 6 - 3 \cdot 58 \cdot 2 = -234$$

$$D_y = \begin{vmatrix} 2 & 16 & -4 & 2 & 16 \\ 4 & 58 & -1 & 4 & 58 \\ 1 & 34 & 2 & 1 & 34 \end{vmatrix}$$

$$D_y = 2 \cdot 58 \cdot 2 + 16 \cdot (-1) \cdot 1 + (-4) \cdot 4 \cdot 34 - (-4) \cdot 58 \cdot 1 - 2 \cdot (-1) \cdot 34 - 16 \cdot 4 \cdot 2 = -156$$

$$D_z = \begin{vmatrix} 2 & 3 & 16 & 2 & 3 \\ 4 & 9 & 58 & 4 & 9 \\ 1 & 6 & 34 & 1 & 6 \end{vmatrix}$$

$$D_z = 2 \cdot 9 \cdot 34 + 3 \cdot 58 \cdot 1 + 16 \cdot 4 \cdot 6 - 16 \cdot 9 \cdot 1 - 2 \cdot 58 \cdot 6 - 3 \cdot 4 \cdot 34 = -78$$

$$x = \frac{-234}{-39}$$

$$x = 6$$

$$y = \frac{-156}{-39}$$

$$y = 4$$

$$z = \frac{-78}{-39}$$

$$z = 2$$

$$L = \{6/4/2\}$$

Aufgabe (9)

$$4x + -3y + 2z = 10$$

$$5x + 6y - 7z = 4$$

$$10x - 2y - 3z = 7$$

$$D_h = \begin{vmatrix} 4 & -3 & 2 & | & 4 & -3 \\ 5 & 6 & -7 & | & 5 & 6 \\ 10 & -2 & -3 & | & 10 & -2 \end{vmatrix}$$

$$D_h = 4 \cdot 6 \cdot (-3) + (-3) \cdot (-7) \cdot 10 + 2 \cdot 5 \cdot (-2) - 2 \cdot 6 \cdot 10 - 4 \cdot (-7) \cdot (-2) - (-3) \cdot 5 \cdot (-3) = -103$$

$$D_x = \begin{vmatrix} 10 & -3 & 2 & | & 10 & -3 \\ 4 & 6 & -7 & | & 4 & 6 \\ 7 & -2 & -3 & | & 7 & -2 \end{vmatrix}$$

$$D_x = 10 \cdot 6 \cdot (-3) + (-3) \cdot (-7) \cdot 7 + 2 \cdot 4 \cdot (-2) - 2 \cdot 6 \cdot 7 - 10 \cdot (-7) \cdot (-2) - (-3) \cdot 4 \cdot (-3) = -309$$

$$D_y = \begin{vmatrix} 4 & 10 & 2 & | & 4 & 10 \\ 5 & 4 & -7 & | & 5 & 4 \\ 10 & 7 & -3 & | & 10 & 7 \end{vmatrix}$$

$$D_y = 4 \cdot 4 \cdot (-3) + 10 \cdot (-7) \cdot 10 + 2 \cdot 5 \cdot 7 - 2 \cdot 4 \cdot 10 - 4 \cdot (-7) \cdot 7 - 10 \cdot 5 \cdot (-3) = -412$$

$$D_z = \begin{vmatrix} 4 & -3 & 10 & | & 4 & -3 \\ 5 & 6 & 4 & | & 5 & 6 \\ 10 & -2 & 7 & | & 10 & -2 \end{vmatrix}$$

$$D_z = 4 \cdot 6 \cdot 7 + (-3) \cdot 4 \cdot 10 + 10 \cdot 5 \cdot (-2) - 10 \cdot 6 \cdot 10 - 4 \cdot 4 \cdot (-2) - (-3) \cdot 5 \cdot 7 = -515$$

$$x = \frac{-309}{-103}$$

$$x = 3$$

$$y = \frac{-412}{-103}$$

$$y = 4$$

$$z = \frac{-515}{-103}$$

$$z = 5$$

$$L = \{3/4/5\}$$

Aufgabe (10)

$$9x + 5y + 4z = 13$$

$$6x + 3y - 5z = 17$$

$$3x - 10y + 6z = 23$$

$$D_h = \begin{vmatrix} 9 & 5 & 4 & | & 9 & 5 \\ 6 & 3 & -5 & | & 6 & 3 \\ 3 & -10 & 6 & | & 3 & -10 \end{vmatrix}$$

$$D_h = 9 \cdot 3 \cdot 6 + 5 \cdot (-5) \cdot 3 + 4 \cdot 6 \cdot (-10) - 4 \cdot 3 \cdot 3 - 9 \cdot (-5) \cdot (-10) - 5 \cdot 6 \cdot 6 = -819$$

$$D_x = \begin{vmatrix} 13 & 5 & 4 & | & 13 & 5 \\ 17 & 3 & -5 & | & 17 & 3 \\ 23 & -10 & 6 & | & 23 & -10 \end{vmatrix}$$

$$D_x = 13 \cdot 3 \cdot 6 + 5 \cdot (-5) \cdot 23 + 4 \cdot 17 \cdot (-10) - 4 \cdot 3 \cdot 23 - 13 \cdot (-5) \cdot (-10) - 5 \cdot 17 \cdot 6 = -2,46 \cdot 10^3$$

$$D_y = \begin{vmatrix} 9 & 13 & 4 & | & 9 & 13 \\ 6 & 17 & -5 & | & 6 & 17 \\ 3 & 23 & 6 & | & 3 & 23 \end{vmatrix}$$

$$D_y = 9 \cdot 17 \cdot 6 + 13 \cdot (-5) \cdot 3 + 4 \cdot 6 \cdot 23 - 4 \cdot 17 \cdot 3 - 9 \cdot (-5) \cdot 23 - 13 \cdot 6 \cdot 6 = 1,64 \cdot 10^3$$

$$D_z = \begin{vmatrix} 9 & 5 & 13 & | & 9 & 5 \\ 6 & 3 & 17 & | & 6 & 3 \\ 3 & -10 & 23 & | & 3 & -10 \end{vmatrix}$$

$$D_z = 9 \cdot 3 \cdot 23 + 5 \cdot 17 \cdot 3 + 13 \cdot 6 \cdot (-10) - 13 \cdot 3 \cdot 3 - 9 \cdot 17 \cdot (-10) - 5 \cdot 6 \cdot 23 = 819$$

$$x = \frac{-2,46 \cdot 10^3}{-819}$$

$$x = 3$$

$$y = \frac{1,64 \cdot 10^3}{-819}$$

$$y = -2$$

$$z = \frac{819}{-819}$$

$$z = -1$$

$$L = \{3/-2/-1\}$$

Aufgabe (11)

$$11x + 13y + 4z = 37$$

$$12x + 14y + 5z = 40$$

$$9x + 3y + 3z = 15$$

$$D_h = \begin{vmatrix} 11 & 13 & 4 \\ 12 & 14 & 5 \\ 9 & 3 & 3 \end{vmatrix} \begin{vmatrix} 11 & 13 \\ 12 & 14 \\ 9 & 3 \end{vmatrix}$$

$$D_h = 11 \cdot 14 \cdot 3 + 13 \cdot 5 \cdot 9 + 4 \cdot 12 \cdot 3 - 4 \cdot 14 \cdot 9 - 11 \cdot 5 \cdot 3 - 13 \cdot 12 \cdot 3 = 54$$

$$D_x = \begin{vmatrix} 37 & 13 & 4 \\ 40 & 14 & 5 \\ 15 & 3 & 3 \end{vmatrix} \begin{vmatrix} 37 & 13 \\ 40 & 14 \\ 15 & 3 \end{vmatrix}$$

$$D_x = 37 \cdot 14 \cdot 3 + 13 \cdot 5 \cdot 15 + 4 \cdot 40 \cdot 3 - 4 \cdot 14 \cdot 15 - 37 \cdot 5 \cdot 3 - 13 \cdot 40 \cdot 3 = 54$$

$$D_y = \begin{vmatrix} 11 & 37 & 4 \\ 12 & 40 & 5 \\ 9 & 15 & 3 \end{vmatrix} \begin{vmatrix} 11 & 37 \\ 12 & 40 \\ 9 & 15 \end{vmatrix}$$

$$D_y = 11 \cdot 40 \cdot 3 + 37 \cdot 5 \cdot 9 + 4 \cdot 12 \cdot 15 - 4 \cdot 40 \cdot 9 - 11 \cdot 5 \cdot 15 - 37 \cdot 12 \cdot 3 = 108$$

$$D_z = \begin{vmatrix} 11 & 13 & 37 \\ 12 & 14 & 40 \\ 9 & 3 & 15 \end{vmatrix} \begin{vmatrix} 11 & 13 \\ 12 & 14 \\ 9 & 3 \end{vmatrix}$$

$$D_z = 11 \cdot 14 \cdot 15 + 13 \cdot 40 \cdot 9 + 37 \cdot 12 \cdot 3 - 37 \cdot 14 \cdot 9 - 11 \cdot 40 \cdot 3 - 13 \cdot 12 \cdot 15 = 0$$

$$x = \frac{54}{54}$$

$$x = 1$$

$$y = \frac{108}{54}$$

$$y = 2$$

$$z = \frac{0}{54}$$

$$z = 0$$

$$L = \{1/2/0\}$$

Aufgabe (12)

$$2x + 3y + 4z = 175$$

$$4x + 6y + 5z = 287$$

$$3x + 2y + 8z = 257$$

$$D_h = \begin{vmatrix} 2 & 3 & 4 \\ 4 & 6 & 5 \\ 3 & 2 & 8 \end{vmatrix} \begin{vmatrix} 2 & 3 \\ 4 & 6 \\ 3 & 2 \end{vmatrix}$$

$$D_h = 2 \cdot 6 \cdot 8 + 3 \cdot 5 \cdot 3 + 4 \cdot 4 \cdot 2 - 4 \cdot 6 \cdot 3 - 2 \cdot 5 \cdot 2 - 3 \cdot 4 \cdot 8 = -15$$

$$D_x = \begin{vmatrix} 175 & 3 & 4 \\ 287 & 6 & 5 \\ 257 & 2 & 8 \end{vmatrix} \begin{vmatrix} 175 & 3 \\ 287 & 6 \\ 257 & 2 \end{vmatrix}$$

$$D_x = 175 \cdot 6 \cdot 8 + 3 \cdot 5 \cdot 257 + 4 \cdot 287 \cdot 2 - 4 \cdot 6 \cdot 257 - 175 \cdot 5 \cdot 2 - 3 \cdot 287 \cdot 8 = -255$$

$$D_y = \begin{vmatrix} 2 & 175 & 4 \\ 4 & 287 & 5 \\ 3 & 257 & 8 \end{vmatrix} \begin{vmatrix} 2 & 175 \\ 4 & 287 \\ 3 & 257 \end{vmatrix}$$

$$D_y = 2 \cdot 287 \cdot 8 + 175 \cdot 5 \cdot 3 + 4 \cdot 4 \cdot 257 - 4 \cdot 287 \cdot 3 - 2 \cdot 5 \cdot 257 - 175 \cdot 4 \cdot 8 = -285$$

$$D_z = \begin{vmatrix} 2 & 3 & 175 \\ 4 & 6 & 287 \\ 3 & 2 & 257 \end{vmatrix} \begin{vmatrix} 2 & 3 \\ 4 & 6 \\ 3 & 2 \end{vmatrix}$$

$$D_z = 2 \cdot 6 \cdot 257 + 3 \cdot 287 \cdot 3 + 175 \cdot 4 \cdot 2 - 175 \cdot 6 \cdot 3 - 2 \cdot 287 \cdot 2 - 3 \cdot 4 \cdot 257 = -315$$

$$x = \frac{-255}{-15}$$

$$x = 17$$

$$y = \frac{-285}{-15}$$

$$y = 19$$

$$z = \frac{-315}{-15}$$

$$z = 21$$

$$L = \{17/19/21\}$$

Aufgabe (13)

$$6x + 4y + 9z = 32$$

$$5x + 7y + 10z = 17$$

$$4x + 8y + 5z = 100$$

$$D_h = \begin{vmatrix} 6 & 4 & 9 \\ 5 & 7 & 10 \\ 4 & 8 & 5 \end{vmatrix} \begin{vmatrix} 6 & 4 \\ 5 & 7 \\ 4 & 8 \end{vmatrix}$$

$$D_h = 6 \cdot 7 \cdot 5 + 4 \cdot 10 \cdot 4 + 9 \cdot 5 \cdot 8 - 9 \cdot 7 \cdot 4 - 6 \cdot 10 \cdot 8 - 4 \cdot 5 \cdot 5 = -102$$

$$D_x = \begin{vmatrix} 32 & 4 & 9 \\ 17 & 7 & 10 \\ 100 & 8 & 5 \end{vmatrix} \begin{vmatrix} 32 & 4 \\ 17 & 7 \\ 100 & 8 \end{vmatrix}$$

$$D_x = 32 \cdot 7 \cdot 5 + 4 \cdot 10 \cdot 100 + 9 \cdot 17 \cdot 8 - 9 \cdot 7 \cdot 100 - 32 \cdot 10 \cdot 8 - 4 \cdot 17 \cdot 5 = -2,86 \cdot 10^3$$

$$D_y = \begin{vmatrix} 6 & 32 & 9 \\ 5 & 17 & 10 \\ 4 & 100 & 5 \end{vmatrix} \begin{vmatrix} 6 & 32 \\ 5 & 17 \\ 4 & 100 \end{vmatrix}$$

$$D_y = 6 \cdot 17 \cdot 5 + 32 \cdot 10 \cdot 4 + 9 \cdot 5 \cdot 100 - 9 \cdot 17 \cdot 4 - 6 \cdot 10 \cdot 100 - 32 \cdot 5 \cdot 5 = -1,12 \cdot 10^3$$

$$D_z = \begin{vmatrix} 6 & 4 & 32 \\ 5 & 7 & 17 \\ 4 & 8 & 100 \end{vmatrix} \begin{vmatrix} 6 & 4 \\ 5 & 7 \\ 4 & 8 \end{vmatrix}$$

$$D_z = 6 \cdot 7 \cdot 100 + 4 \cdot 17 \cdot 4 + 32 \cdot 5 \cdot 8 - 32 \cdot 7 \cdot 4 - 6 \cdot 17 \cdot 8 - 4 \cdot 5 \cdot 100 = 2,04 \cdot 10^3$$

$$x = \frac{-2,86 \cdot 10^3}{-102}$$

$$x = 28$$

$$y = \frac{-1,12 \cdot 10^3}{-102}$$

$$y = 11$$

$$z = \frac{2,04 \cdot 10^3}{-102}$$

$$z = -20$$

$$L = \{28/11/ -20\}$$

Aufgabe (14)

$$1x + 1y + 0z = 1$$

$$1x + 0y + 1z = 6$$

$$0x + 1y - 1z = 5$$

$$D_h = \begin{vmatrix} 1 & 1 & 0 \\ 1 & 0 & 1 \\ 0 & 1 & -1 \end{vmatrix} \begin{vmatrix} 1 & 1 \\ 1 & 0 \\ 0 & 1 \end{vmatrix}$$

$$D_h = 1 \cdot 0 \cdot (-1) + 1 \cdot 1 \cdot 0 + 0 \cdot 1 \cdot 1 - 0 \cdot 0 \cdot 0 - 1 \cdot 1 \cdot 1 - 1 \cdot 1 \cdot (-1) = 0$$

$$D_x = \begin{vmatrix} 1 & 1 & 0 \\ 6 & 0 & 1 \\ 5 & 1 & -1 \end{vmatrix} \begin{vmatrix} 1 & 1 \\ 6 & 0 \\ 5 & 1 \end{vmatrix}$$

$$D_x = 1 \cdot 0 \cdot (-1) + 1 \cdot 1 \cdot 5 + 0 \cdot 6 \cdot 1 - 0 \cdot 0 \cdot 5 - 1 \cdot 1 \cdot 1 - 1 \cdot 6 \cdot (-1) = 10$$

$$D_y = \begin{vmatrix} 1 & 1 & 0 \\ 1 & 6 & 1 \\ 0 & 5 & -1 \end{vmatrix} \begin{vmatrix} 1 & 1 \\ 1 & 6 \\ 0 & 5 \end{vmatrix}$$

$$D_y = 1 \cdot 6 \cdot (-1) + 1 \cdot 1 \cdot 0 + 0 \cdot 1 \cdot 5 - 0 \cdot 6 \cdot 0 - 1 \cdot 1 \cdot 5 - 1 \cdot 1 \cdot (-1) = -10$$

$$D_z = \begin{vmatrix} 1 & 1 & 1 \\ 1 & 0 & 6 \\ 0 & 1 & 5 \end{vmatrix} \begin{vmatrix} 1 & 1 \\ 1 & 0 \\ 0 & 1 \end{vmatrix}$$

$$D_z = 1 \cdot 0 \cdot 5 + 1 \cdot 6 \cdot 0 + 1 \cdot 1 \cdot 1 - 1 \cdot 0 \cdot 0 - 1 \cdot 6 \cdot 1 - 1 \cdot 1 \cdot 5 = -10$$

$$L = \{\}$$

Aufgabe (15)

$$1x + -2y + 3z = 9$$

$$3x + 8y + 9z = 5$$

$$2x + 3y + 6z = 7$$

$$D_h = \begin{vmatrix} 1 & -2 & 3 & | & 1 & -2 \\ 3 & 8 & 9 & | & 3 & 8 \\ 2 & 3 & 6 & | & 2 & 3 \end{vmatrix}$$

$$D_h = 1 \cdot 8 \cdot 6 + (-2) \cdot 9 \cdot 2 + 3 \cdot 3 \cdot 3 - 3 \cdot 8 \cdot 2 - 1 \cdot 9 \cdot 3 - (-2) \cdot 3 \cdot 6 = 0$$

$$D_x = \begin{vmatrix} 9 & -2 & 3 & | & 9 & -2 \\ 5 & 8 & 9 & | & 5 & 8 \\ 7 & 3 & 6 & | & 7 & 3 \end{vmatrix}$$

$$D_x = 9 \cdot 8 \cdot 6 + (-2) \cdot 9 \cdot 7 + 3 \cdot 5 \cdot 3 - 3 \cdot 8 \cdot 7 - 9 \cdot 9 \cdot 3 - (-2) \cdot 5 \cdot 6 = 0$$

$$D_y = \begin{vmatrix} 1 & 9 & 3 & | & 1 & 9 \\ 3 & 5 & 9 & | & 3 & 5 \\ 2 & 7 & 6 & | & 2 & 7 \end{vmatrix}$$

$$D_y = 1 \cdot 5 \cdot 6 + 9 \cdot 9 \cdot 2 + 3 \cdot 3 \cdot 7 - 3 \cdot 5 \cdot 2 - 1 \cdot 9 \cdot 7 - 9 \cdot 3 \cdot 6 = 0$$

$$D_z = \begin{vmatrix} 1 & -2 & 9 & | & 1 & -2 \\ 3 & 8 & 5 & | & 3 & 8 \\ 2 & 3 & 7 & | & 2 & 3 \end{vmatrix}$$

$$D_z = 1 \cdot 8 \cdot 7 + (-2) \cdot 5 \cdot 2 + 9 \cdot 3 \cdot 3 - 9 \cdot 8 \cdot 2 - 1 \cdot 5 \cdot 3 - (-2) \cdot 3 \cdot 7 = 0$$

$L = \text{unendlich}$

Aufgabe (16)

$$6x + 4y + 5z = 8$$

$$4x + 2y + 3z = 7$$

$$5x + 3y + 4z = 9$$

$$D_h = \begin{vmatrix} 6 & 4 & 5 & | & 6 & 4 \\ 4 & 2 & 3 & | & 4 & 2 \\ 5 & 3 & 4 & | & 5 & 3 \end{vmatrix}$$

$$D_h = 6 \cdot 2 \cdot 4 + 4 \cdot 3 \cdot 5 + 5 \cdot 4 \cdot 3 - 5 \cdot 2 \cdot 5 - 6 \cdot 3 \cdot 3 - 4 \cdot 4 \cdot 4 = 0$$

$$D_x = \begin{vmatrix} 8 & 4 & 5 & | & 8 & 4 \\ 7 & 2 & 3 & | & 7 & 2 \\ 9 & 3 & 4 & | & 9 & 3 \end{vmatrix}$$

$$D_x = 8 \cdot 2 \cdot 4 + 4 \cdot 3 \cdot 9 + 5 \cdot 7 \cdot 3 - 5 \cdot 2 \cdot 9 - 8 \cdot 3 \cdot 3 - 4 \cdot 7 \cdot 4 = 3$$

$$D_y = \begin{vmatrix} 6 & 8 & 5 & | & 6 & 8 \\ 4 & 7 & 3 & | & 4 & 7 \\ 5 & 9 & 4 & | & 5 & 9 \end{vmatrix}$$

$$D_y = 6 \cdot 7 \cdot 4 + 8 \cdot 3 \cdot 5 + 5 \cdot 4 \cdot 9 - 5 \cdot 7 \cdot 5 - 6 \cdot 3 \cdot 9 - 8 \cdot 4 \cdot 4 = 3$$

$$D_z = \begin{vmatrix} 6 & 4 & 8 & | & 6 & 4 \\ 4 & 2 & 7 & | & 4 & 2 \\ 5 & 3 & 9 & | & 5 & 3 \end{vmatrix}$$

$$D_z = 6 \cdot 2 \cdot 9 + 4 \cdot 7 \cdot 5 + 8 \cdot 4 \cdot 3 - 8 \cdot 2 \cdot 5 - 6 \cdot 7 \cdot 3 - 4 \cdot 4 \cdot 9 = -6$$

$L = \{\}$

Aufgabe (17)

$$1x + 3y + -2z = 3$$

$$3x + 2y + 1z = 2$$

$$0x + 1y + 3z = 5$$

$$D_h = \begin{vmatrix} 1 & 3 & -2 \\ 3 & 2 & 1 \\ 0 & 1 & 3 \end{vmatrix} \begin{vmatrix} 1 & 3 \\ 3 & 2 \\ 0 & 1 \end{vmatrix}$$

$$D_h = 1 \cdot 2 \cdot 3 + 3 \cdot 1 \cdot 0 + (-2) \cdot 3 \cdot 1 - (-2) \cdot 2 \cdot 0 - 1 \cdot 1 \cdot 1 - 3 \cdot 3 \cdot 3 = -28$$

$$D_x = \begin{vmatrix} 3 & 3 & -2 \\ 2 & 2 & 1 \\ 5 & 1 & 3 \end{vmatrix} \begin{vmatrix} 3 & 3 \\ 2 & 2 \\ 5 & 1 \end{vmatrix}$$

$$D_x = 3 \cdot 2 \cdot 3 + 3 \cdot 1 \cdot 5 + (-2) \cdot 2 \cdot 1 - (-2) \cdot 2 \cdot 5 - 3 \cdot 1 \cdot 1 - 3 \cdot 2 \cdot 3 = 28$$

$$D_y = \begin{vmatrix} 1 & 3 & -2 \\ 3 & 2 & 1 \\ 0 & 5 & 3 \end{vmatrix} \begin{vmatrix} 1 & 3 \\ 3 & 2 \\ 0 & 5 \end{vmatrix}$$

$$D_y = 1 \cdot 2 \cdot 3 + 3 \cdot 1 \cdot 0 + (-2) \cdot 3 \cdot 5 - (-2) \cdot 2 \cdot 0 - 1 \cdot 1 \cdot 5 - 3 \cdot 3 \cdot 3 = -56$$

$$D_z = \begin{vmatrix} 1 & 3 & 3 \\ 3 & 2 & 2 \\ 0 & 1 & 5 \end{vmatrix} \begin{vmatrix} 1 & 3 \\ 3 & 2 \\ 0 & 1 \end{vmatrix}$$

$$D_z = 1 \cdot 2 \cdot 5 + 3 \cdot 2 \cdot 0 + 3 \cdot 3 \cdot 1 - 3 \cdot 2 \cdot 0 - 1 \cdot 2 \cdot 1 - 3 \cdot 3 \cdot 5 = -28$$

$$x = \frac{28}{-28}$$

$$x = -1$$

$$y = \frac{-56}{-28}$$

$$y = 2$$

$$z = \frac{-28}{-28}$$

$$z = 1$$

$$L = \{-1/2/1\}$$