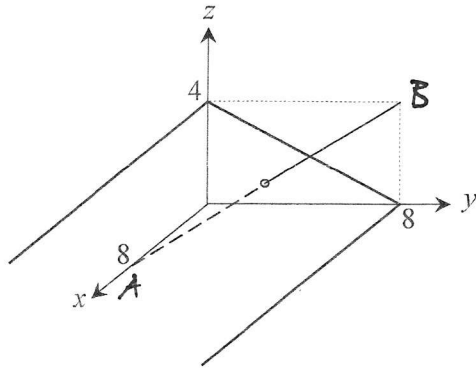


1a



$$\vec{r}_A = \begin{pmatrix} 8 \\ 0 \\ 0 \end{pmatrix} \quad 0,5$$

$$\vec{r}_B = \begin{pmatrix} 8 \\ 0 \\ 4 \end{pmatrix} \quad 0,5$$

$$\vec{r} = \vec{r}_A + \lambda (\vec{r}_B - \vec{r}_A)$$

$$\vec{r} = \begin{pmatrix} 8 \\ 0 \\ 0 \end{pmatrix} + \lambda \begin{pmatrix} 0 \\ 0 \\ 4 \end{pmatrix} = \begin{pmatrix} 8 \\ 0 \\ 0 \end{pmatrix} + \lambda \begin{pmatrix} -2 \\ 2 \\ 1 \end{pmatrix} \quad 0,5$$

$$E: u_2 y + u_3 z = k \quad | :k$$

$$\frac{u_2 y}{k} + \frac{u_3 z}{k} = 1$$

$$\frac{y}{8} + \frac{z}{4} = 1 \quad | \cdot 8$$

$$E: y + 2z = 8 \quad \Rightarrow \vec{n} = \begin{pmatrix} 0 \\ 1 \\ 2 \end{pmatrix} \quad 0,5$$

$$\cos \varphi = \frac{\vec{n} \cdot \vec{r}}{|\vec{n}| \cdot |\vec{r}|} = \frac{\begin{pmatrix} 0 \\ 1 \\ 2 \end{pmatrix} \cdot \begin{pmatrix} -2 \\ 2 \\ 1 \end{pmatrix}}{\sqrt{5} \cdot \sqrt{9}} = \frac{4}{3\sqrt{5}}$$

$$\underline{\underline{\varphi = 36,60^\circ}} \quad 0,5$$

$$\vec{r} = \begin{pmatrix} x \\ y \\ z \end{pmatrix} = \begin{pmatrix} 8 - 2\lambda \\ 2\lambda \\ \lambda \end{pmatrix} \quad \Rightarrow \quad \begin{aligned} 2\lambda + 2\lambda &= 8 \\ \lambda &= 2 \end{aligned} \quad 0,5$$

$$\underline{\underline{\vec{r}_S = \begin{pmatrix} 8 - 4 \\ 4 \\ 2 \end{pmatrix} = \begin{pmatrix} 4 \\ 4 \\ 2 \end{pmatrix}}} \quad 0,5$$

16

$$\vec{r}_1 = \begin{pmatrix} 2 + \lambda + 2\mu \\ 5 + \lambda \\ 9 + \lambda + 3\mu \end{pmatrix}$$

$$\vec{r}_2 = \begin{pmatrix} 4 + \nu + m\omega \\ 1 - 2\nu + 5\omega \\ 10 + \nu - 2\omega \end{pmatrix}$$

$$\vec{n}_1 = \begin{pmatrix} 1 \\ 1 \\ 1 \end{pmatrix} \times \begin{pmatrix} 2 \\ 0 \\ 3 \end{pmatrix} = \begin{pmatrix} |1 & 0| \\ |1 & 3| \\ -|1 & 2| \\ |1 & 3| \\ |1 & 2| \\ |1 & 0| \end{pmatrix} = \begin{pmatrix} 3 \\ -1 \\ -2 \end{pmatrix}$$

$$\vec{n}_2 = \begin{pmatrix} 1 \\ -2 \\ 1 \end{pmatrix} \times \begin{pmatrix} m \\ 5 \\ -2 \end{pmatrix} = \begin{pmatrix} |-2 & 5| \\ |1 & -2| \\ -|1 & m| \\ |1 & -2| \\ |1 & m| \\ |-2 & 5| \end{pmatrix} = \begin{pmatrix} -1 \\ m+2 \\ 5+2m \end{pmatrix}$$

$$\vec{n}_1 \cdot \vec{n}_2 = 0$$

$$\begin{pmatrix} 3 \\ -1 \\ -2 \end{pmatrix} \cdot \begin{pmatrix} -1 \\ m+2 \\ 5+2m \end{pmatrix} = 0$$

$$-3 - m - 2 - 10 - 4m = 0$$

$$5m = -15$$

$$\underline{\underline{m = -3}}$$

1c

$$\left. \begin{array}{l} A(0|3|0) \\ B(7|4|5) \end{array} \right\} g: \vec{r} = \vec{r}_A + \nu (\vec{r}_B - \vec{r}_A)$$

$$\vec{r} = \begin{pmatrix} 0 \\ 3 \\ 0 \end{pmatrix} + \nu \begin{pmatrix} 7 \\ 4-3 \\ 5 \end{pmatrix}$$

$$\vec{r} = \begin{pmatrix} 0 \\ 3 \\ 0 \end{pmatrix} + \nu \begin{pmatrix} 7 \\ 1 \\ 5 \end{pmatrix} \quad \uparrow$$

$$L: \vec{r} = \begin{pmatrix} 1 \\ 1 \\ 0 \end{pmatrix} + \lambda \begin{pmatrix} 7 \\ 1 \\ 5 \end{pmatrix}$$

$$\vec{d} = \begin{pmatrix} 1 \\ 1 \\ 0 \end{pmatrix} - \begin{pmatrix} 0 \\ 3 \\ 0 \end{pmatrix} = \begin{pmatrix} 1 \\ -2 \\ 0 \end{pmatrix}$$

$$\vec{f} = \begin{pmatrix} 7 \\ 1 \\ 5 \end{pmatrix}$$

Zu zeigen:

$$\vec{d} \neq \mu \vec{f} \quad 0,5$$

$$\begin{pmatrix} 1 \\ -2 \\ 0 \end{pmatrix} = \mu \begin{pmatrix} 7 \\ 1 \\ 5 \end{pmatrix} \quad 0,5$$

$\mu \neq$  konst.

$$\Rightarrow \underline{\underline{g \parallel L}} \quad 0,5$$

$$E: \vec{n} (\vec{r} - \vec{r}_A) = 0$$

$$\vec{n} = \vec{d} \times \vec{f} = \begin{pmatrix} 1 \\ -2 \\ 0 \end{pmatrix} \times \begin{pmatrix} 7 \\ 1 \\ 5 \end{pmatrix} = \begin{pmatrix} |-2 \ 1| \\ |1 \ 7| \\ |0 \ 5| \end{pmatrix}$$

$$\vec{n} = \begin{pmatrix} -10 \\ -5 \\ 15 \end{pmatrix} \Rightarrow \underline{\underline{\vec{n}^* = \begin{pmatrix} 2 \\ 1 \\ -3 \end{pmatrix}}}$$

$$\Rightarrow \begin{pmatrix} 2 \\ 1 \\ -3 \end{pmatrix} \cdot \left[ \begin{pmatrix} x \\ y \\ z \end{pmatrix} - \begin{pmatrix} 0 \\ 3 \\ 0 \end{pmatrix} \right] = 0$$

$$2x + y - 3z - 3z = 0 \Rightarrow \underline{\underline{2x + y - 3z = 3}}$$

2a

$$A: x_4 + 140 = 120 + x_1$$

$$\Rightarrow \underline{\underline{x_1 = f(x_4) = 20 + x_4}} \quad \leftarrow$$

$$B: x_1 + 90 = x_2 + 100$$

$$C: x_2 + 70 = x_3 + 50$$

$$D: x_3 + 80 = 110 + x_4$$

$$\Rightarrow \underline{\underline{x_3 = f(x_4) = 30 + x_4}} \quad \leftarrow$$

$$B: 20 + x_4 + 90 = x_2 + 100$$

$$\underline{\underline{x_2 = f(x_4) = 10 + x_4}} \quad \leftarrow$$

b)  $x_4 \leq 70$  autos/h

$$\Rightarrow x_1 \leq 90 \text{ autos/h} \quad 0,5$$

$$x_2 \leq 80 \text{ autos/h} \quad 0,5$$

$$x_3 \leq 100 \text{ autos/h} \quad 0,5$$

34 a)

$$m^7 \cdot (m^{x-1})^{\sqrt{x-1}} = m^x \cdot m^{-8} (m^{x-2})^{\sqrt{x-7}}$$

$$m^7 \cdot m^{(x-1)(\sqrt{x-1})} = m^{x-8} \cdot m^{(x-2)(\sqrt{x-7})}$$

$$m^{7 + \sqrt{x^2 - 6x + 1}} = m^{x-8 + \sqrt{x^2 - 17x + 14}}$$

$$\Rightarrow \cancel{\sqrt{x^2}} - 6x + 8 = \cancel{5\sqrt{x^2}} - 16x + 6$$

$$10x = -2$$

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

PT

346)

$$\frac{\log_k(x+4) + \log_k(x)}{2\log_k(x+1)} = 1$$

$$\underline{D} : x+4 > 0 \Rightarrow x > -4$$

$$x > 0$$

$$x > -1$$

$$\Rightarrow \underline{\underline{D = \mathbb{R}^+}}$$

$$\log_k(x+4) + \log_k(x) = 2\log_k(x+1)$$

$$\log_k[(x+4) \cdot x] = \log_k(x+1)^2 \quad |k^{\cdot}$$

$$\cancel{x} + 4x = \cancel{x} + 2x + 1$$

$$2x = 1$$

$$\underline{\underline{x = \frac{1}{2} \in D}} \quad \text{S17}$$

4

$$N(t) = N_u + (N_0 - N_u) e^{-\lambda t}$$

$$N_u = 20^\circ\text{C} \quad t = 10 \text{ min} \quad N = 35^\circ\text{C}$$

$$N_0 = 95^\circ\text{C}$$

a)

$$35 = 20 + (95 - 20) e^{-10\lambda}$$

$$15 = 75 e^{-10\lambda}$$

$$\frac{1}{5} = e^{-10\lambda} \quad \ln(\quad)$$

$$\ln\left(\frac{1}{5}\right) = -10\lambda$$

$$10\lambda = \ln 5 \quad \rightarrow \quad \lambda = \frac{\ln(5)}{10}$$

$$\lambda = \underline{\underline{0,1609}}$$

b) 1. Art

$$\underline{N_1} = \frac{\frac{2}{3} \cdot 95 + \frac{1}{3} \cdot 4}{1} = \underline{64,67^\circ\text{C}}$$

$$N_{T1} = 20 + (64,67 - 20) e^{-0,1609 \cdot 4}$$

$$\underline{\underline{N_{T1} = 43,5^\circ\text{C}}}$$

2. Art

$$N_2 = 20 + (95 - 20) e^{-0,1609 \cdot 4}$$

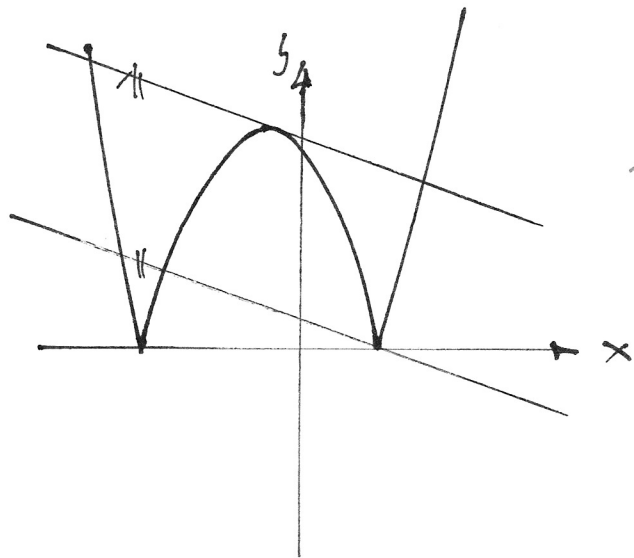
$$\underline{N_2 = 59,40^\circ\text{C}}$$

$$\underline{\underline{N_{T2} = \frac{\frac{2}{3} \cdot 59,4 + \frac{1}{3} \cdot 4}{1} = 40,9^\circ\text{C}}}$$

5  $g = g(x) = -0,5x + 9$

$g = f(x) = |(x+1)^2 - 9|$

Orientierungsfrei



Nullstelle

$(x+1)^2 - 9 = 0$

$(x+1)^2 = 9$

$|x+1| = 3$

$x_1 = -4$

$x_2 = 2$

$\rightarrow$   $g_{\min} : 0 = -0,5 \cdot 2 + g_{\min}$

$g_{\min} = 1$

$g_{\max} :$

$-\sqrt{(x+1)^2 - 9} = -0,5x + 9$

$(x+1)^2 - 9 = 0,5x - 9$

$x^2 + 2x + 1 - 9 = 0,5x - 9$

$x^2 + 2x - 8 - 0,5x + 9 = 0$

$x^2 + 1,5x - 8 + 9 = 0$

Tangente:  $D = 0$

$\Rightarrow b^2 - 4ac = 0$

$\left(\frac{3}{2}\right)^2 - 4 \cdot 1 \cdot (-8 + 9) = 0$

$\frac{9}{4} + 32 - 49 = 0 \Rightarrow \underline{g = \frac{137}{16}}$

$g \in \left[1; \frac{137}{16}\right]$



69

$$g = f(x) = a(x+b)^n + c$$

Aus dem Graphen:

$$b = 2 \quad 0,5$$

$$c = 1 \quad 0,5$$

$$\rightarrow g = f(x) = a(x+2)^n + 1$$

$$P_1 (-3/1,5) \rightarrow 1,5 = a(-3+2)^n + 1$$

$$0,5 = a(-1)^n$$

$\rightarrow$  nicht gerade!

$$\rightarrow \underline{a = 0,5} \quad \pi$$

$$P_2 (-2,5/3) \rightarrow 3 = 0,5(-2,5+2)^n + 1$$

$$2 = 0,5(-0,5)^n$$

$$4 = (-0,5)^n$$

$$4 = \left(\frac{-1}{2}\right)^n \quad \underline{n = -2} \quad \pi$$

$$\rightarrow \underline{\underline{g = f(x) = 0,5(x+2)^{-2} + 1}} \quad 0,5$$

6b

$$b_1) \quad g = f(x) = a^{kx}$$

$$P_1 (0/1)$$

$$P_2 (-2/4) \Rightarrow 4 = a^{-2k}$$

$$P_3 (-3/8) \Rightarrow 8 = a^{-3k}$$

q.v.

$$\frac{4^1}{8^2} = \frac{a^{-2k}}{a^{-3k}}$$

$$\frac{1}{2} = a^k \Rightarrow 2^{-1} = a^k$$

$$\Rightarrow a = 2$$

$$k = -1$$

$$\Rightarrow \underline{\underline{g = f(x) = 2^{-x}}}$$

q.v.

$$b_2) \quad g = f(x) = k \cdot \sqrt[n]{x} + 2$$

$$b = 2$$

$$P_1 (4/0) \Rightarrow k \sqrt[n]{4} + 2 = 0$$

$$P_2 (9/-1) \Rightarrow k \sqrt[n]{9} + 2 = -1$$

$$\therefore k \sqrt[n]{4} = -2$$

$$k \sqrt[n]{9} = -3$$

$$\Rightarrow \underline{k = \frac{-2}{2} = -1}$$

$$\frac{\sqrt[n]{4}}{\sqrt[n]{9}} = \frac{2}{3} \Rightarrow \underline{n=2}$$

$$\Rightarrow \underline{\underline{g = f(x) = -\sqrt{x} + 2}}$$

7a)

$$\cos(\alpha) - \sin(\alpha) = \sqrt{2} \cos\left(\frac{\pi}{4} + \alpha\right)$$

$$\sqrt{2} \cos\left(\frac{\pi}{4} + \alpha\right) = \sqrt{2} \left[ \cos\left(\frac{\pi}{4}\right) \cos(\alpha) - \sin\left(\frac{\pi}{4}\right) \sin(\alpha) \right]$$

$$= \sqrt{2} \cdot \frac{\sqrt{2}}{2} \cos \alpha - \sqrt{2} \cdot \frac{\sqrt{2}}{2} \sin \alpha$$

$$= \underline{\underline{\cos \alpha - \sin \alpha}}$$

27

76

$$\sin(x) + \cos(x) = \frac{1}{\cos(x)} \quad x \in [0; 2\pi]$$

D:  $\cos(x) = 0$

$$x_1 = \frac{\pi}{2}; \quad x_2 = \frac{3\pi}{2}$$

$$\Rightarrow \underline{\underline{D = [0; 2\pi] \setminus \left\{ \frac{\pi}{2}, \frac{3\pi}{2} \right\}}}} \quad 2\pi$$

$$\sin(x) \cdot \cos(x) + \cos^2(x) = 1$$

$$\sin(x) \cos(x) + \underbrace{\cos^2(x) - 1}_{-\sin^2(x)} = 0$$

$$\underbrace{\sin(x)}_{=0} \left( \underbrace{\cos(x) - \sin(x)}_{=0} \right) = 0 \quad 1\pi$$

$$= 0$$

$$x_3 = 0$$

$$x_4 = \pi$$

$$x_5 = 2\pi$$

$$\Rightarrow \cos(x) = \sin(x)$$

$$x_6 = \frac{\pi}{4}$$

$$x_7 = \frac{5\pi}{4}$$

$$\Rightarrow \underline{\underline{L = \left\{ 0; \frac{\pi}{4}; \pi; \frac{5\pi}{4}; 2\pi \right\}}} \quad 9\pi$$

7c

$$\phi = 90 - \beta$$

$$\phi = 90 - 58,0 = \underline{32,0^\circ} \quad \text{qv}$$

$$\frac{10}{s} = \tan(\beta)$$

$$s = \frac{10}{\tan(\beta)}$$

$$s = \frac{10}{\tan(58,0)}$$

$$s = \underline{6,25 \text{ m}} \quad \text{qv}$$

$$\rightarrow a^2 = 10^2 + s^2$$

$$a = \sqrt{10^2 + 6,25^2} = \underline{11,79 \text{ m}} \quad \text{qv}$$

$$\epsilon = 180^\circ - \alpha - \beta - 2\phi$$

$$\underline{\epsilon = 180 - 52,4^\circ - 58,0^\circ - 64,0^\circ = 5,6^\circ} \quad \text{qv}$$

$$\frac{a}{\sin(\epsilon)} = \frac{x}{\sin(\alpha + \beta)}$$

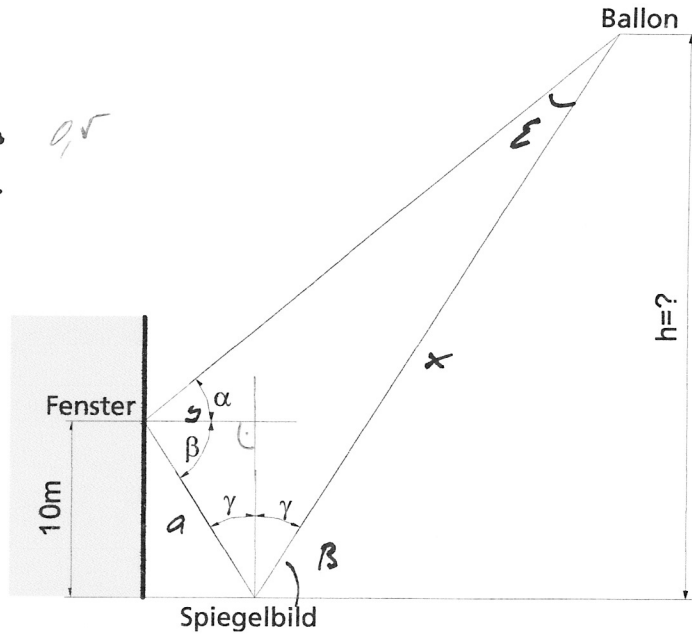
$$\rightarrow x = a \cdot \frac{\sin(\alpha + \beta)}{\sin(\epsilon)}$$

$$x = 11,79 \cdot \frac{\sin(110,4^\circ)}{\sin(5,6^\circ)}$$

$$\underline{x = 113,26 \text{ m}} \quad \text{qv}$$

$$h = x \cdot \sin(\beta)$$

$$\underline{h = 113,26 \cdot \sin(58,0) = 96,05 \text{ m}} \quad \text{qv}$$



$$\left. \begin{array}{l} \text{Anzahl 6er - Zelle: } x \\ \text{Anzahl 10er - Zelle: } y \end{array} \right\} \text{0,5}$$

$$x, y \geq 0$$

$$x \leq 7 \quad \left. \vphantom{x \leq 7} \right\} \text{0,5}$$

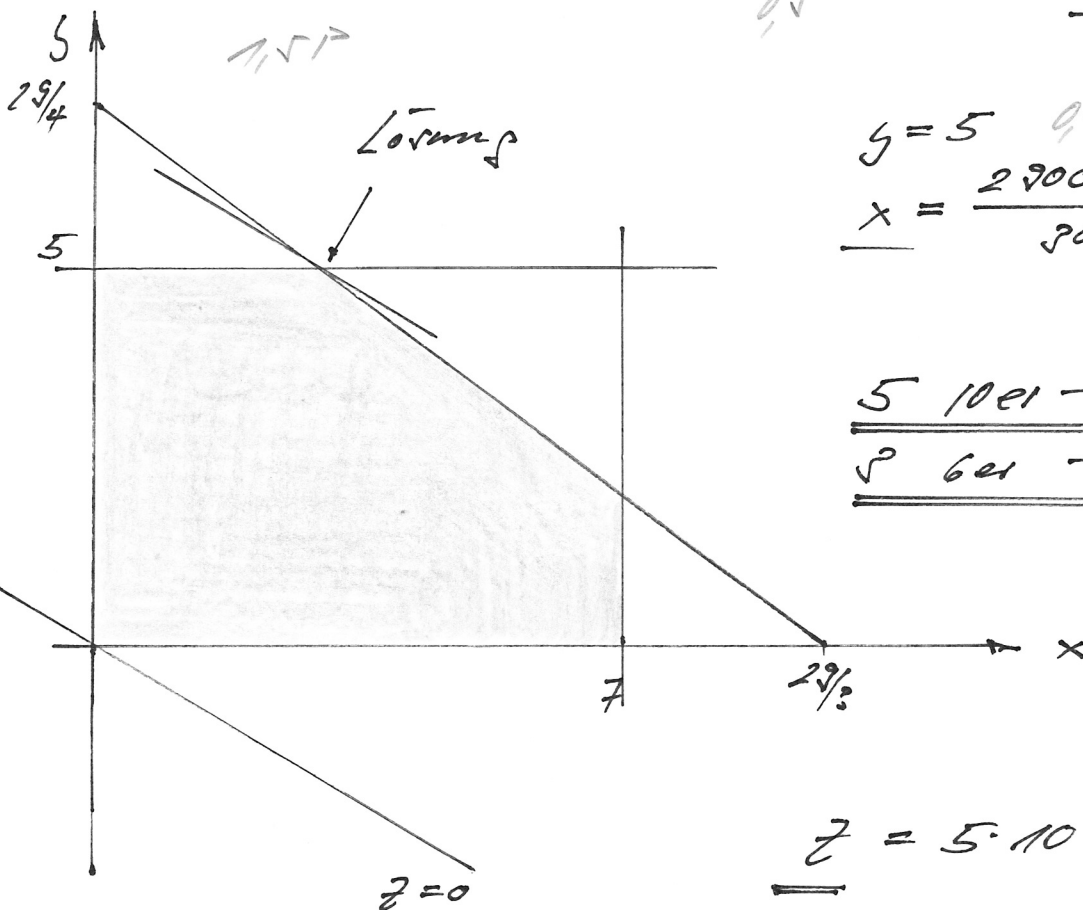
$$y \leq 5$$

$$300x + 400y \leq 2900 \quad \text{0,5}$$

$$y \leq -\frac{3x}{4} + \frac{2900}{400}$$

$$y \leq -\frac{3x}{4} + \frac{29}{4} \quad \text{0,5}$$

$$\text{Zielfunktion } Z = 6x + 10y \Rightarrow y = -\frac{3x}{5} + \frac{Z}{10} \quad \text{0,5}$$



$$y = 5 \quad \text{0,5}$$

$$x = \frac{2900 - 2000}{300} = \frac{3}{1} \quad \text{0,5}$$

5 10er - Zelle

3 6er - Zelle

$$Z = 5 \cdot 10 + 3 \cdot 6 = \underline{\underline{68}} \quad \text{0,5}$$

(68 Inseln/Äckle)