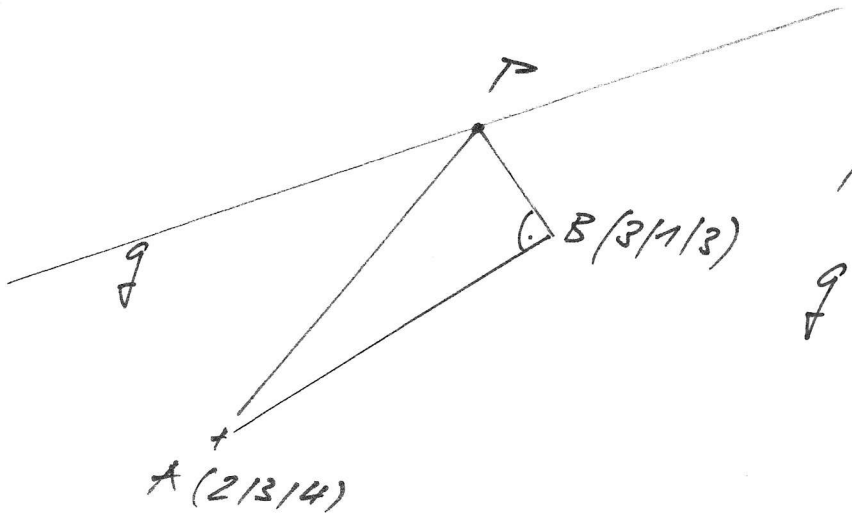
1

a)



$P(x/y/z)$

$g: \vec{r} = \begin{pmatrix} -1 \\ 2\lambda \\ 3\lambda \end{pmatrix}$

$\vec{AB} \cdot \vec{BP} = 0$

$\vec{BP} = \vec{r_P} - \vec{r_B}$

$= \begin{pmatrix} -1 \\ 2\lambda \\ 3\lambda \end{pmatrix} - \begin{pmatrix} 3 \\ 1 \\ 3 \end{pmatrix}$

$\vec{BP} = \begin{pmatrix} -\lambda - 3 \\ 2\lambda - 1 \\ 3\lambda - 3 \end{pmatrix}$

$\vec{AB} = \vec{r_B} - \vec{r_A} = \begin{pmatrix} 3 \\ 1 \\ 3 \end{pmatrix} - \begin{pmatrix} 2 \\ 3 \\ 4 \end{pmatrix}$

$\vec{AB} = \begin{pmatrix} 1 \\ -2 \\ -1 \end{pmatrix}$ q.r

$\vec{r_A} = \begin{pmatrix} -1 \\ 2\lambda \\ 3\lambda \end{pmatrix}$ q.r

$\rightarrow \begin{pmatrix} 1 \\ -2 \\ -1 \end{pmatrix} \begin{pmatrix} -\lambda - 3 \\ 2\lambda - 1 \\ 3\lambda - 3 \end{pmatrix} = 0$ q.r

$-\lambda - 3 - 2(2\lambda - 1) - 1(3\lambda - 3) = 0$

$-\lambda - 3 - 4\lambda + 2 - 3\lambda + 3 = 0$

$-8\lambda = -2$

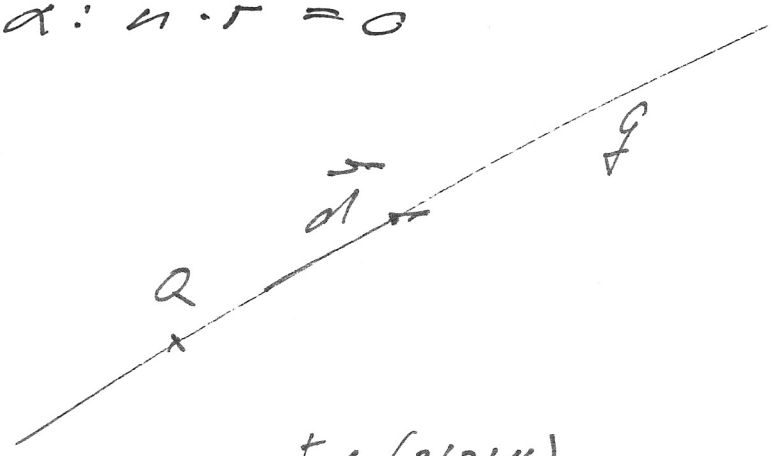
$\lambda = 1/4$ ri

$\vec{r_A} = \begin{pmatrix} -1/4 \\ 1/2 \\ 3/4 \end{pmatrix}$ q.r

1b)

$$\alpha: \vec{n} \cdot (\vec{r} - \vec{r_A}) = 0$$

$$\vec{r_A} \to \vec{0} \Rightarrow \alpha: \vec{n} \cdot \vec{r} = 0$$



$$\vec{n} = \vec{AQ} \times \vec{d}$$

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

$$A(2|3|4)$$

$$\vec{r_Q}(\lambda = 1) = \begin{pmatrix} -1 \\ 2 \\ 3 \end{pmatrix} \to \vec{AQ} = \begin{pmatrix} -1 \\ 2 \\ 3 \end{pmatrix} - \begin{pmatrix} 2 \\ 3 \\ 4 \end{pmatrix}$$

0,5

$$\vec{AQ} = \begin{pmatrix} -3 \\ -1 \\ -1 \end{pmatrix}$$

$$\vec{QA} = \begin{pmatrix} 3 \\ 1 \\ 1 \end{pmatrix}$$ 0,5

$$\vec{n} = \begin{pmatrix} 3 \\ 1 \\ 1 \end{pmatrix} \times \begin{pmatrix} -1 \\ 2 \\ 3 \end{pmatrix}$$

$$= \begin{pmatrix} \begin{vmatrix} 1 & 2 \\ 1 & 3 \end{vmatrix} \\ -\begin{vmatrix} 3 & -1 \\ 1 & 3 \end{vmatrix} \\ \begin{vmatrix} 3 & -1 \\ 1 & 2 \end{vmatrix} \end{pmatrix} = \begin{pmatrix} 1 \\ -10 \\ 7 \end{pmatrix}$$ 0,5

$$\Rightarrow \alpha: \vec{n} \cdot \vec{r} = 0$$

$$\begin{pmatrix} 1 \\ -10 \\ 7 \end{pmatrix} \begin{pmatrix} x \\ 5 \\ z \end{pmatrix} = 0$$

$$\alpha: \underline{x - 10y + 7z = 0}$$ 0,5

2 a)

$$x_7 = x_6 + 100 \quad \Rightarrow \quad x_6 = x_7 - 100 \quad 0{,}5$$

$$x_5 + 110 = x_1$$

$$x_1 = 100 + x_2$$

$$x_2 + 80 = x_3$$

$$x_3 = x_4 + 60$$

$$x_4 + 70 = x_7$$

$$x_1 = x_7 - 100 + 110$$

$$x_1 = x_7 + 10 \quad 0{,}5$$

$$x_2 = x_1 - 100 = x_7 + 10 - 100$$

$$x_2 = x_7 - 90 \quad 0{,}5$$

$$x_3 = x_7 - 90 + 80$$

$$x_3 = x_7 - 10 \quad 0{,}5$$

$$x_4 = x_7 - 70 \quad 0{,}5$$

b) Verkehrsfluss

max: $x_i = 180$ Autos/h

$0{,}5$

$\rightarrow \quad x_1 = 180$ Autos/h $\rightarrow \quad x_7 = 120$ Autos/h $\quad 0{,}5$

$x_6 = 20$ Autos/h

$x_2 = 80$ Autos/h

$x_3 = 110$ Autos/h

$x_4 = 70$ Autos/h

$0{,}5$

5

a) $p(x) = a(x+c)^2 + v$

$V(100/-2) \rightarrow p(x) = a(x-100)^2 - 2$ 0,5

A: $p(0) = -42$

$-42 = 10'000\,a - 2$

$a = -0{,}004$ 0,5

$\rightarrow p(x) = -0{,}004(x-100)^2 - 2$ 0,5

b) $g(x) = mx + q$

$m = \frac{\Delta g}{\Delta x} = \frac{0+42}{150-143} = 6$ 0,5

$g(150) = 0 \Rightarrow q = -6 \cdot 150 = -900$ 0,5

$g(x) = 6x - 900$ 0,5

c) $p(x) \cap g(x)$

$-0{,}004(x-100)^2 - 2 = 6x - 900$

Value-Taste: $x = 148{,}12$

$y = -11{,}26$ 1P

$B(148{,}12/-11{,}26)$

d) $d(PQ) \Rightarrow p(35) = -0{,}004(35-100)^2 - 2$

$p = -14{,}9$

$\Rightarrow d(PQ) = 14{,}9\,m$ 1P $\rightarrow Q(35/-14{,}9)$

4a) $R(t) = e^{-\left(\frac{t}{T}\right)^b}$

a) $R = e^{-\left(\frac{t}{T}\right)^b} \quad / \ln()$

$\ln(R) = -\left(\frac{t}{T}\right)^b$

$-\ln(R) = \left(\frac{t}{T}\right)^b$

$\sqrt[b]{-\ln(R)} = \frac{t}{T}$

$$T = \frac{t}{\sqrt[b]{-\ln(R)}}$$ 2P

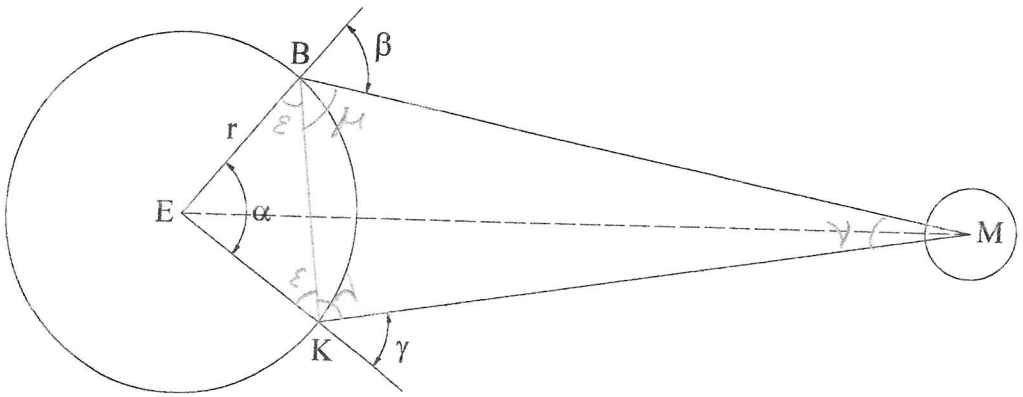
b) $t = 3a$

3% $\Rightarrow$ $R = 0,97$ 9P

$b = 2,3$

$$T = \frac{3}{\sqrt[2,3]{-\ln(0,97)}} = 13,63a$$ 9P

5



$\varepsilon = \frac{180° - \alpha}{2} = \frac{180° - 96,4411°}{2} = 46,7794°$

$\overline{BK}^2 = 2r^2 - 2r^2 \cos(\alpha) = 2 \cdot 6370^2 - 2 \cdot 6370^2 \cdot \cos(96,4411°)$

$\overline{BK}^2 = 7,611 \cdot 10^7 km^2 \Rightarrow \overline{BK} = 8724,46 km$

$\mu = 180° - \beta - \varepsilon = 180° - 41,2622 - 46,7794 = 91,9584°$

$\Delta = 180° - \mu - \varepsilon = 180° - 46,7603 - 46,7794 = 86,6603°$

$\nu = 180° - \mu - \Delta = 180° - 91,9584 - 86,6603 = 1,3814°$

$\frac{\overline{BM}}{\sin(\Delta)} = \frac{\overline{BK}}{\sin(\nu)} \Rightarrow \overline{BM} = \overline{BK} \cdot \frac{\sin(\Delta)}{\sin(\nu)} = 8724,46 \cdot \frac{\sin(86,6603°)}{\sin(1,3814°)}$

$\overline{BM} = 361'291 km$

$\overline{EM}^2 = r^2 + \overline{BM}^2 - 2r\overline{BM} \cdot \cos(\varepsilon + \mu)$

$\overline{EM}^2 = 6370^2 + 361'291^2 - 2 \cdot 6370 \cdot 361'291 \cdot \cos(138,738)$

$\overline{EM}^2 = 1,340 \cdot 10^{11} km^2$

$\overline{EM} = 366'094 km$

6 - Menge des Vitaminpräparates V_1: x
- Menge des Vitaminpräparates V_2: y } 0,5 P

Bedingungen

Nichtneg. $x, y \geq 0 \rightarrow x, y \in \mathbb{Q}^+$

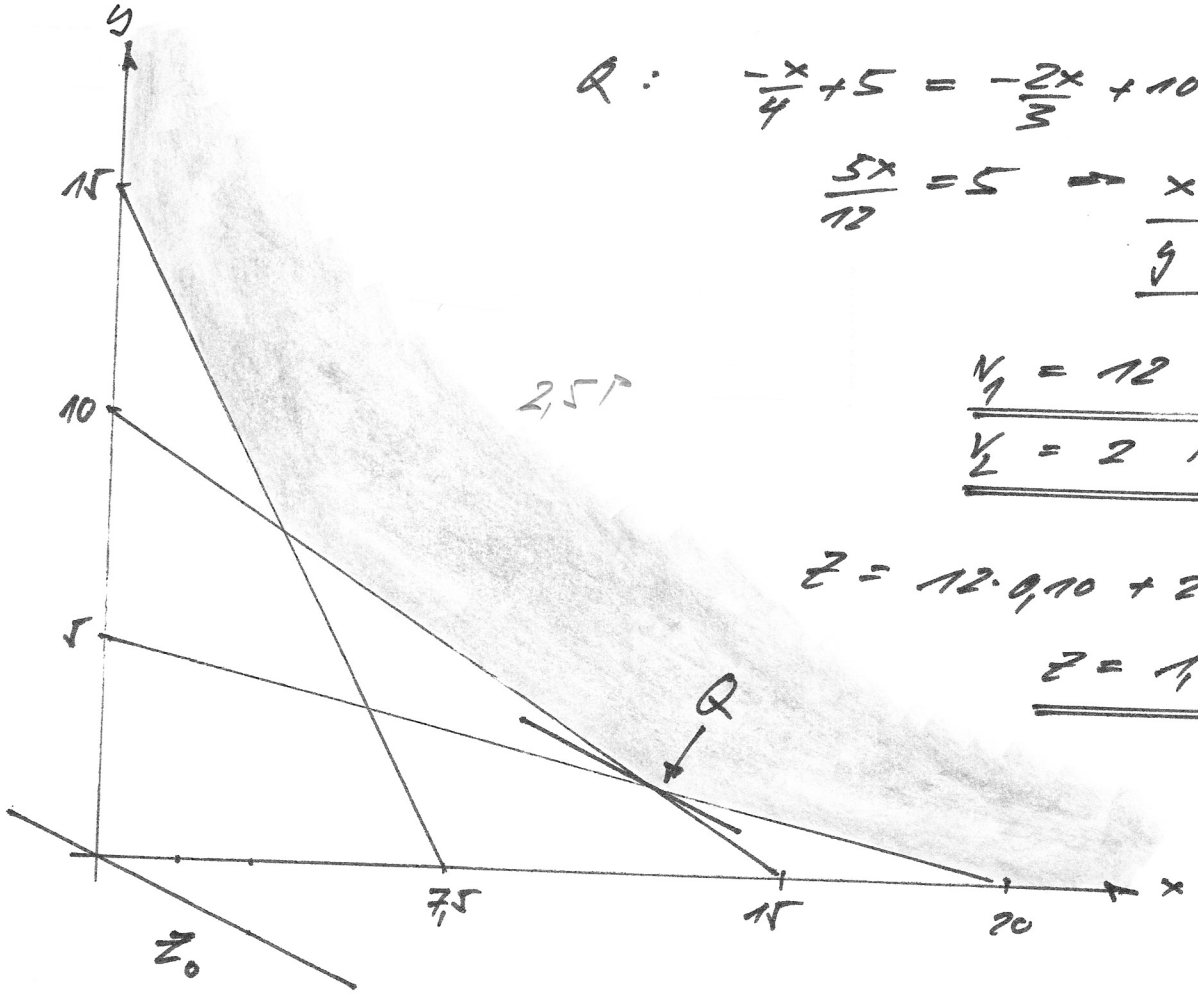
A: $0{,}10x + 0{,}15y \geq 1{,}50 \rightarrow y \geq \frac{-2x}{3} + 10$ 0,5

C: $20{,}00x + 10{,}00y \geq 150{,}00 \rightarrow y \geq -2x + 15$ 0,5

K: $1{,}00x + 4{,}00y \geq 20{,}00 \rightarrow y \geq -\frac{x}{4} + 5$ 0,5

$z = 0{,}10x + 0{,}20y$ 0,5

$y = -0{,}5x + 5z$



2,5 P

$Q: \quad -\frac{x}{4} + 5 = -\frac{2x}{3} + 10$

$\frac{5x}{12} = 5 \rightarrow x = 12$

$y = 2$

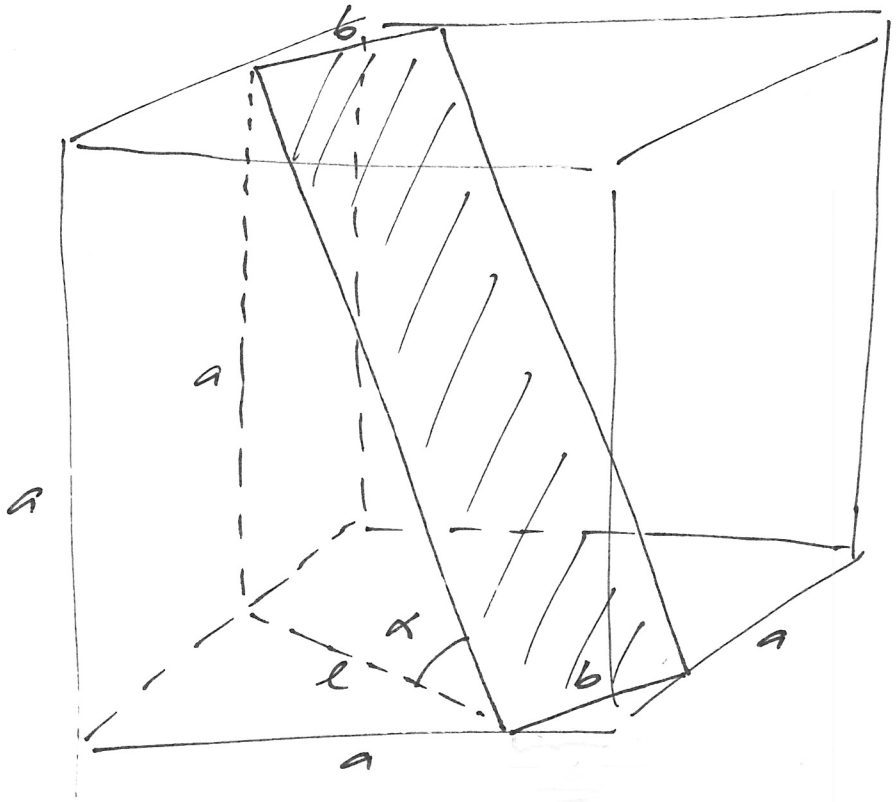
$V_1 = 12$ Präp.
$V_2 = 2$ Präp. } 0,5 P

$z = 12 \cdot 0{,}10 + 2 \cdot 0{,}20$

$z = 1{,}60$ GE 0,5 P

7

a)



a, b ⇒ 0,5P
α 0,5P

b) $\tan(\alpha) = \frac{a}{\ell}$, $\ell = a\sqrt{2} - b$

$$\underline{\underline{\tan(\alpha) = \frac{a}{a\sqrt{2} - b}}}$$ 1P

c) $$\underline{\underline{\alpha}} = \arctan\left(\frac{10}{10\sqrt{2} - 3}\right) = \underline{\underline{41{,}9°}}$$ 0,5

d) $\alpha = 45° \rightarrow \tan(45°) = 1$ 0,5

$$\rightarrow 1 = \frac{a}{a\sqrt{2} - b}$$

$$\underline{\underline{b}} = a\sqrt{2} - a = \underline{\underline{a(\sqrt{2} - 1)}}$$ 0,5

$$\rightarrow \underline{\underline{a = 10\,cm}}, \quad \underline{\underline{b = 4{,}14\,cm}}$$ 0,5