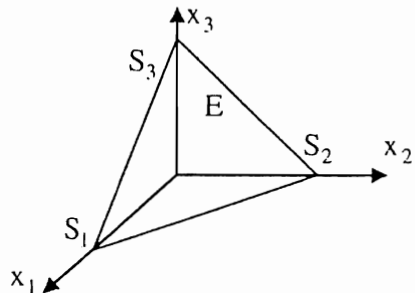


| Nr.   | Lösungshinweise zu BII 2015                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |   |                                                                                     |       |            | BE |   |   |   |       |            |   |   |   |   |    |    |   |   |   |   |   |    |   |   |   |   |    |    |   |
|-------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|-------------------------------------------------------------------------------------|-------|------------|----|---|---|---|-------|------------|---|---|---|---|----|----|---|---|---|---|---|----|---|---|---|---|----|----|---|
| 1.1   | $\mu_1 \vec{a} + \mu_2 \vec{b} + \mu_3 \vec{c}_k = \vec{0}; \begin{pmatrix} -1 & -2 & k+1 \\ 3 & 2 & -6k-7 \\ -2 & 0 & 5k \end{pmatrix} \begin{vmatrix} 0 \\ 0 \\ 0 \end{vmatrix} \rightarrow \begin{pmatrix} 2 & 0 & -5k-6 \\ -2 & 0 & 5k \end{pmatrix} \begin{vmatrix} 0 \\ 0 \end{vmatrix} \rightarrow \begin{pmatrix} 0 & 0 & -6 \end{pmatrix} \begin{vmatrix} 0 \end{vmatrix} \Rightarrow$<br>es gibt nur die Trivillösung, die Vektoren bilden unabhängig von k eine Basis.                                                                                                                                                                                                                                                                                  |   |                                                                                     |       |            | 4  |   |   |   |       |            |   |   |   |   |    |    |   |   |   |   |   |    |   |   |   |   |    |    |   |
| 1.2   | $\mu_1 \vec{a} + \mu_2 \vec{b} + \mu_3 \vec{c}_{-1} = \vec{d}; \begin{pmatrix} -1 & -2 & 0 \\ 3 & 2 & -1 \\ -2 & 0 & -5 \end{pmatrix} \begin{vmatrix} 0 \\ -3 \\ 9 \end{vmatrix} \rightarrow \begin{pmatrix} 2 & 0 & -1 \\ -2 & 0 & -5 \end{pmatrix} \begin{vmatrix} -3 \\ 9 \end{vmatrix} \rightarrow \begin{pmatrix} 0 & 0 & -6 \end{pmatrix} \begin{vmatrix} 6 \end{vmatrix} \Rightarrow$<br>$\mu_3 = -1; \mu_2 = 1; \mu_1 = -2; \vec{d} = -2\vec{a} + \vec{b} - \vec{c}_{-1};$                                                                                                                                                                                                                                                                                 |   |                                                                                     |       |            | 4  |   |   |   |       |            |   |   |   |   |    |    |   |   |   |   |   |    |   |   |   |   |    |    |   |
| 1.3   | $E: \vec{x} = \begin{pmatrix} 0 \\ -3 \\ 9 \end{pmatrix} + r \cdot \begin{pmatrix} -1 \\ 3 \\ -2 \end{pmatrix} + s \cdot \begin{pmatrix} -2 \\ 2 \\ 0 \end{pmatrix}; \begin{pmatrix} -1 & -2 \\ 3 & 2 \\ -2 & 0 \end{pmatrix} \begin{vmatrix} x_1 \\ x_2+3 \\ x_3-9 \end{vmatrix} \rightarrow \begin{pmatrix} 2 & 0 \\ -2 & 0 \end{pmatrix} \begin{vmatrix} x_1+x_2+3 \\ x_3-9 \end{vmatrix} \rightarrow$<br>$\begin{pmatrix} 0 & 0 \end{pmatrix} \begin{vmatrix} x_1+x_2+x_3-6 \end{vmatrix}; E: x_1+x_2+x_3-6=0;$                                                                                                                                                                                                                                                |   |                                                                                     |       |            | 4  |   |   |   |       |            |   |   |   |   |    |    |   |   |   |   |   |    |   |   |   |   |    |    |   |
| 1.4   | Achsenabschnittsform: $\frac{x_1}{6} + \frac{x_2}{6} + \frac{x_3}{6} = 1 \Rightarrow$<br>$S_1(6 0 0), S_2(0 6 0), S_3(0 0 6);$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |   |  |       |            | 4  |   |   |   |       |            |   |   |   |   |    |    |   |   |   |   |   |    |   |   |   |   |    |    |   |
| 1.5   | $g: \vec{x} = \begin{pmatrix} 1 \\ -7 \\ 0 \end{pmatrix} + k \cdot \begin{pmatrix} 1 \\ -6 \\ 5 \end{pmatrix};$ in E einsetzen:<br>$1+k-7-6k+5k-6=0 \Rightarrow -12=0 \Rightarrow g$<br>und E sind echt parallel                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |   |                                                                                     |       |            | 3  |   |   |   |       |            |   |   |   |   |    |    |   |   |   |   |   |    |   |   |   |   |    |    |   |
| 2.1   | Die Unternehmen benötigen jeweils 20% ihrer eigenen Produktion.<br>$\frac{8}{x_1} = 0,2 \Rightarrow x_1 = 40; \frac{2}{x_2} = 0,1 \Rightarrow x_2 = 20;$<br>$\frac{9}{x_3} = 0,3 \Rightarrow x_3 = 30;$ <table border="1"><tr><th></th><th>K</th><th>L</th><th>M</th><th>Markt</th><th>Produktion</th></tr><tr><td>K</td><td>8</td><td>2</td><td>9</td><td>21</td><td>40</td></tr><tr><td>L</td><td>4</td><td>4</td><td>3</td><td>9</td><td>20</td></tr><tr><td>M</td><td>8</td><td>4</td><td>6</td><td>12</td><td>30</td></tr></table>                                                                                                                                                                                             |   |                                                                                     |       |            |    | K | L | M | Markt | Produktion | K | 8 | 2 | 9 | 21 | 40 | L | 4 | 4 | 3 | 9 | 20 | M | 8 | 4 | 6 | 12 | 30 | 6 |
|       | K                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | L | M                                                                                   | Markt | Produktion |    |   |   |   |       |            |   |   |   |   |    |    |   |   |   |   |   |    |   |   |   |   |    |    |   |
| K     | 8                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 2 | 9                                                                                   | 21    | 40         |    |   |   |   |       |            |   |   |   |   |    |    |   |   |   |   |   |    |   |   |   |   |    |    |   |
| L     | 4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 4 | 3                                                                                   | 9     | 20         |    |   |   |   |       |            |   |   |   |   |    |    |   |   |   |   |   |    |   |   |   |   |    |    |   |
| M     | 8                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 4 | 6                                                                                   | 12    | 30         |    |   |   |   |       |            |   |   |   |   |    |    |   |   |   |   |   |    |   |   |   |   |    |    |   |
| 2.2   | $\vec{x} = \begin{pmatrix} 2x_2 \\ x_2 \\ 30 \end{pmatrix}; \begin{pmatrix} 0,8 & -0,1 & -0,3 \\ -0,1 & 0,8 & -0,1 \\ -0,2 & -0,2 & 0,8 \end{pmatrix} \cdot \begin{pmatrix} 2x_2 \\ x_2 \\ 30 \end{pmatrix} = \begin{pmatrix} 1,5x_2-9 \\ 0,6x_2-3 \\ -0,6x_2+24 \end{pmatrix}; \begin{cases} 1,5x_2-9 \geq 0 \Rightarrow x_2 \geq 6 \\ 0,6x_2-3 \geq 0 \Rightarrow x_2 \geq 5 \\ -0,6x_2+24 \geq 0 \Rightarrow x_2 \leq 40 \end{cases}$<br>$6 \leq x_2 \leq 40; s(x_2) = 1,5x_2 + 12$ wird maximal für $x_2 = 40$ , (steigende Gerade)                                                                                                                                                                                                                            |   |                                                                                     |       |            | 7  |   |   |   |       |            |   |   |   |   |    |    |   |   |   |   |   |    |   |   |   |   |    |    |   |
| 2.3   | $\begin{pmatrix} 0,8 & -0,1 & -0,3 \\ -0,1 & 0,8 & -0,1 \\ -0,2 & -0,2 & 0,8 \end{pmatrix} \cdot \begin{pmatrix} x_1 \\ x_2 \\ x_3 \end{pmatrix} = \begin{pmatrix} t^2 \\ 8 \\ 3-t \end{pmatrix}; \begin{pmatrix} 0,8 & -0,1 & -0,3 \\ -0,1 & 0,8 & -0,1 \\ -0,2 & -0,2 & 0,8 \end{pmatrix} \begin{vmatrix} t^2 \\ 8 \\ 3-t \end{vmatrix} \rightarrow$<br>$\begin{pmatrix} 0 & 6,3 & -1,1 \\ 0 & 1,8 & -1 \end{pmatrix} \begin{vmatrix} 64+t^2 \\ 13+t \end{vmatrix} \rightarrow \begin{pmatrix} 0 & 0 & 4,8 \end{pmatrix} \begin{vmatrix} 37+2t^2-7t \end{vmatrix}; x_3(t) = \frac{1}{4,8}(2t^2-7t+37);$<br>$x_3'(t) = \frac{1}{4,8}(4t-7); x_3'(t) = 0 \Rightarrow t = 1,75; \text{Minimalstelle, da der Graph der Funktion eine nach oben offene Parabel ist.}$ |   |                                                                                     |       |            | 8  |   |   |   |       |            |   |   |   |   |    |    |   |   |   |   |   |    |   |   |   |   |    |    |   |
| Summe |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |   |                                                                                     |       |            | 40 |   |   |   |       |            |   |   |   |   |    |    |   |   |   |   |   |    |   |   |   |   |    |    |   |