#### 1 Exercício 1

Considere as bases do Respaço vetorial R3,  $A = \{(4, 2, 0), (1, 1, 1), (5, 3, 3)\}$  e  $B = \{(1, 2, 1), (1, 5, 2), (1, 0, 1)\}$ . Exiba as matrizes de mudança de base MB $\rightarrow$ A e MA $\rightarrow$ B. Escreva também os vetores abaixo nas bases indicadas:  $\mathbf{v} = (0, 1, 2)\mathbf{A}$  em B  $\mathbf{v} = (1, 3, 1)\mathbf{B}$  em A

#### 2 Mudança B $\rightarrow A(b1)$ :

 $x.a_1 + y.a_2 + z.a_3 = b_1$ 

x.(4, 2, 0) + y.(1, -1, 1) + z.(5, 3, 3) = (1, -2, 1)

Inicio 
$$\begin{bmatrix} 4 & 1 & 5 & 1 \\ 2 & -1 & 3 & -2 \\ 0 & 1 & 3 & 1 \end{bmatrix} \mathbf{l2} \rightarrow l2 + l3 \begin{bmatrix} \mathbf{4} & \mathbf{1} & \mathbf{5} & \mathbf{1} \\ \mathbf{2} & \mathbf{0} & \mathbf{6} & -\mathbf{1} \\ \mathbf{0} & \mathbf{1} & \mathbf{3} & \mathbf{1} \end{bmatrix}$$

$$l1 \leftrightarrow l2 \begin{bmatrix} 2 & 0 & 6 & -1 \\ 4 & 1 & 5 & 1 \\ 0 & 1 & 3 & 1 \end{bmatrix} l2 \rightarrow l2 - 2.l1 \begin{bmatrix} 2 & 0 & 6 & -1 \\ 0 & 1 & 7 & 3 \\ 0 & 1 & 3 & 1 \end{bmatrix}$$

$$l3 \rightarrow l3 - l2 \begin{bmatrix} 2 & 0 & 6 & -1 \\ 0 & 1 & 7 & 3 \\ 0 & 0 & 10 & -2 \end{bmatrix} l2 \rightarrow 10.l2 - 7l3 \begin{bmatrix} 2 & 0 & 6 & -1 \\ 0 & 10 & 0 & 16 \\ 0 & 0 & 10 & -2 \end{bmatrix}$$

$$l1 \rightarrow 10.l1 - 6.l3 \begin{bmatrix} 20 & 0 & 0 & 2 \\ 0 & 10 & 0 & 16 \\ 0 & 0 & 10 & -2 \end{bmatrix} l1 \rightarrow l1/20 \begin{bmatrix} 1 & 0 & 0 & \frac{2}{20} \\ 0 & 10 & 0 & 16 \\ 0 & 0 & 10 & -2 \end{bmatrix}$$

$$l2 \rightarrow l2/10 \begin{bmatrix} 1 & 0 & 0 & \frac{2}{20} \\ 0 & 1 & 0 & \frac{16}{10} \\ 0 & 0 & 10 & -2 \end{bmatrix} l3 \rightarrow l3/10 \begin{bmatrix} 1 & 0 & 0 & \frac{2}{20} \\ 0 & 1 & 0 & \frac{16}{10} \\ 0 & 0 & 1 & \frac{-2}{10} \end{bmatrix}$$

Coordenadas  $M_B \to M_{A(b1)} : a = \frac{1}{10}; b = \frac{8}{5}; c = \frac{-1}{5}$ 

## 3 Mudança de $M_B \rightarrow M_{A(b2)}$ :

 $x.a_1 + y.a_2 + z.a_3 = b_2$ 

x.(4, 2, 0) + y.(1, -1, 1) + z.(5, 3, 3) = (1, 5, 2)

Início 
$$\begin{bmatrix} 4 & 1 & 5 & 1 \\ 2 & -1 & 3 & 5 \\ 0 & 1 & 3 & 2 \end{bmatrix} 12 \rightarrow l2 + l3 \begin{bmatrix} 4 & 1 & 5 & 1 \\ 2 & 0 & 6 & 7 \\ 0 & 1 & 3 & 2 \end{bmatrix}$$

$$11 \leftrightarrow 12 \begin{bmatrix} 2 & 0 & 6 & 7 \\ 4 & 1 & 5 & 1 \\ 0 & 1 & 3 & 2 \end{bmatrix} l2 \rightarrow l2 - 2.l1 \begin{bmatrix} 2 & 0 & 6 & 7 \\ 0 & 1 & -7 & -13 \\ 0 & 1 & 3 & 2 \end{bmatrix}$$

$$l3 \to 13 - l2 \begin{bmatrix} 2 & 0 & 6 & 7 \\ 0 & 1 & -7 & -13 \\ 0 & 0 & 10 & 15 \end{bmatrix} l3 \to l3/10 \begin{bmatrix} 2 & 0 & 6 & 7 \\ 0 & 1 & -7 & -13 \\ 0 & 0 & 1 & \frac{15}{10} \end{bmatrix}$$

$$l3 o ext{simplificando a fração: dividindo por 5} \left[ egin{array}{cccc} 2 & 0 & 6 & 7 \\ 0 & 1 & -7 & -13 \\ 0 & 0 & 1 & rac{3}{2} \end{array} 
ight] l2 o l2 + 7.l3 \left[ egin{array}{cccc} 2 & 0 & 6 & 7 \\ 0 & 1 & 0 & rac{-5}{2} \\ 0 & 0 & 1 & rac{3}{2} \end{array} 
ight]$$

$$l1 \rightarrow l1 - 6.l3 \begin{bmatrix} 2 & 0 & 0 & -2 \\ 0 & 1 & 0 & \frac{-5}{2} \\ 0 & 0 & 1 & \frac{3}{2} \end{bmatrix} l1 \rightarrow l1/2 \begin{bmatrix} 1 & 0 & 0 & -1 \\ 0 & 1 & 0 & \frac{-5}{2} \\ 0 & 0 & 1 & \frac{3}{2} \end{bmatrix}$$

Coordenadas  $\mathbf{M}_B \to M_{A(b2)}: a=-1; b=\frac{-5}{2}; \mathbf{c}=\frac{3}{2}$ 

# 4 Mudança de $M_B o M_{A(b3)}$ :

 $x.a_1 + y.a_2 + z.a_3 = b_3$ 

x.(4, 2, 0) + y.(1, -1, 1) + z.(5, 3, 3) = (1, 0, 1)

Inicio 
$$\begin{bmatrix} 4 & 1 & 5 & 1 \\ 2 & -1 & 3 & 0 \\ 0 & 1 & 3 & 1 \end{bmatrix} l2 \rightarrow l2 + l3 \begin{bmatrix} 4 & 1 & 5 & 1 \\ 2 & 0 & 6 & 1 \\ 0 & 1 & 3 & 1 \end{bmatrix}$$

$$11 \leftrightarrow l2 \begin{bmatrix} 2 & 0 & 6 & 1 \\ 4 & 1 & 5 & -1 \\ 0 & 1 & 3 & 1 \end{bmatrix} l2 \rightarrow l2 - 2.l1 \begin{bmatrix} 2 & 0 & 6 & 1 \\ 0 & 1 & -7 & -1 \\ 0 & 1 & 3 & 1 \end{bmatrix}$$

$$13 \rightarrow l3 - l2 \begin{bmatrix} 2 & 0 & 6 & 1 \\ 0 & 1 & -7 & -1 \\ 0 & 0 & 10 & 2 \end{bmatrix} l3 \rightarrow l3/10 \begin{bmatrix} 2 & 0 & 6 & 1 \\ 0 & 1 & -7 & -1 \\ 0 & 0 & 1 & \frac{2}{10} \end{bmatrix}$$

$$11 \rightarrow l1 - 6.l3 \begin{bmatrix} 2 & 0 & 0 & \frac{-1}{5} \\ 0 & 1 & -7 & -1 \\ 0 & 0 & 1 & \frac{2}{10} \end{bmatrix} l2 \rightarrow l2 + 7.l3 \begin{bmatrix} 2 & 0 & 0 & \frac{-1}{5} \\ 0 & 1 & 0 & \frac{2}{5} \\ 0 & 0 & 1 & \frac{2}{10} \end{bmatrix}$$

Coordenadas  $M_B \to M_{A(b3)} : a = \frac{-1}{10}; b = \frac{2}{5}; c = \frac{1}{5}$ 

### 5 Mudança de $\mathbf{A} o B_{(A1)}$

 $x.b_1 + y.b_2 + z.b_3 = a_1$ 

x.(1, -2, 1) + y.(1, 5, 2) + z.(1, 0, 1) = (4, 2, 0)

Início 
$$\begin{bmatrix} 1 & 1 & 1 & 4 \\ -2 & 5 & 0 & 2 \\ 1 & 2 & 1 & 0 \end{bmatrix} l3 \rightarrow 5.l3 - 2.l2 \begin{bmatrix} 1 & 1 & 1 & 4 \\ -2 & 5 & 0 & 2 \\ 9 & 0 & 5 & -4 \end{bmatrix}$$

$$11 \rightarrow 5.l1 - l2 \begin{bmatrix} 7 & 0 & 2 & 18 \\ -2 & 5 & 0 & 2 \\ 9 & 0 & 5 & -4 \end{bmatrix} l1 \rightarrow l1 - l3 \begin{bmatrix} -2 & 0 & 0 & 22 \\ -2 & 5 & 0 & 2 \\ 9 & 0 & 5 & -4 \end{bmatrix}$$

$$12 \rightarrow l2 - l1 \begin{bmatrix} -2 & 0 & 0 & 22 \\ 0 & 5 & 0 & -20 \\ 9 & 0 & 5 & -4 \end{bmatrix} l3 \rightarrow 2.l3 + 9.l1 \begin{bmatrix} -2 & 0 & 0 & 22 \\ 0 & 5 & 0 & -20 \\ 0 & 0 & 10 & 190 \end{bmatrix}$$

$$11 \rightarrow l1/-2 \begin{bmatrix} 1 & 0 & 0 & -11 \\ 0 & 5 & 0 & -20 \\ 0 & 0 & 10 & 190 \end{bmatrix} l2 \rightarrow l2/5 \begin{bmatrix} 1 & 0 & 0 & -11 \\ 0 & 1 & 0 & -4 \\ 0 & 0 & 10 & 190 \end{bmatrix}$$

$$13 \rightarrow l3/10 \left[ \begin{array}{cccc} 1 & 0 & 0 & -11 \\ 0 & 1 & 0 & -4 \\ 0 & 0 & 1 & 19 \end{array} \right]$$

Coordenadas  $M_A \to M_{B(a1)}: a = -11; b = -4; c = 19$ 

## 6 Mudança de $A \rightarrow B_{(A2)}$

 $x.b_1 + y.b_2 + z.b_3 = a_2$ 

x.(1, -2, 1) + y.(1, 5, 2) + z.(1, 0, 1) = (1, -1, 1)

Início 
$$\left[ \begin{array}{cccc} 1 & 1 & 1 & 1 \\ -2 & 5 & 0 & -1 \\ 1 & 2 & 1 & 1 \end{array} \right] l 3 \rightarrow l 3 - l 1 \left[ \begin{array}{cccc} 1 & 1 & 1 & 1 \\ -2 & 5 & 0 & -1 \\ 0 & 1 & 0 & 0 \end{array} \right]$$

$$12 \leftrightarrow l3 \begin{bmatrix} 1 & 1 & 1 & 1 \\ 0 & 1 & 0 & 0 \\ -2 & 5 & 0 & -1 \end{bmatrix} l1 \leftrightarrow l3 \begin{bmatrix} -2 & 5 & 0 & -1 \\ 0 & 1 & 0 & 0 \\ 1 & 1 & 1 & 1 \end{bmatrix}$$

$$11 \rightarrow -1.l1 \left[ \begin{array}{cccc} \mathbf{2} & \textbf{-5} & \mathbf{0} & \mathbf{1} \\ \mathbf{0} & \mathbf{1} & \mathbf{0} & \mathbf{0} \\ \mathbf{1} & \mathbf{1} & \mathbf{1} & \mathbf{1} \end{array} \right] l1 \rightarrow l1 + 5.l2 \left[ \begin{array}{cccc} \mathbf{2} & \mathbf{0} & \mathbf{0} & \mathbf{1} \\ \mathbf{0} & \mathbf{1} & \mathbf{0} & \mathbf{0} \\ \mathbf{1} & \mathbf{1} & \mathbf{1} & \mathbf{1} \end{array} \right]$$

$$11 \rightarrow l1/2 \begin{bmatrix} 1 & 0 & 0 & \frac{1}{2} \\ 0 & 1 & 0 & 0 \\ 1 & 1 & 1 & 1 \end{bmatrix} l3 \rightarrow l3 - l2 \begin{bmatrix} 1 & 0 & 0 & \frac{1}{2} \\ 0 & 1 & 0 & 0 \\ 1 & 0 & 1 & 1 \end{bmatrix}$$

$$13 \rightarrow l3 - l1 \begin{bmatrix} 1 & 0 & 0 & \frac{1}{2} \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & \frac{1}{2} \end{bmatrix}$$

Coordenadas  $M_A \rightarrow M_{B(a2)}$ :  $a = \frac{1}{2}$ ; b = 0;  $c = \frac{1}{2}$ 

### 7 Mudança de $A \rightarrow B_{(A3)}$

 $x.b_1 + y.b_2 + z.b_3 = a_3$ 

x.(1, -2, 1) + y.(1, 5, 2) + z.(1, 0, 1) = (5, 3, 3)

Início 
$$\begin{bmatrix} 1 & 1 & 1 & 5 \\ -2 & 5 & 0 & 3 \\ 1 & 2 & 1 & 3 \end{bmatrix} l3 \rightarrow 5.l3 - 2.l2 \begin{bmatrix} 1 & 1 & 1 & 5 \\ -2 & 5 & 0 & 3 \\ 9 & 0 & 5 & 9 \end{bmatrix}$$

$$11 \rightarrow 5.l1 - l2 \begin{bmatrix} 7 & 0 & 5 & 22 \\ -2 & 5 & 0 & 3 \\ 9 & 0 & 5 & 9 \end{bmatrix} l1 \rightarrow l1 - l3 \begin{bmatrix} -2 & 0 & 0 & 13 \\ -2 & 5 & 0 & 3 \\ 9 & 0 & 5 & 9 \end{bmatrix}$$

$$12 \rightarrow l2 - l1 \begin{bmatrix} -2 & 0 & 0 & 13 \\ 0 & 5 & 0 & -10 \\ 9 & 0 & 5 & 9 \end{bmatrix} l3 \rightarrow 2.l3 + 9.l1 \begin{bmatrix} -2 & 0 & 0 & 13 \\ 0 & 5 & 0 & -10 \\ 0 & 0 & 10 & 135 \end{bmatrix}$$

$$11 \rightarrow l1/-2 \begin{bmatrix} 1 & 0 & 0 & \frac{-13}{2} \\ 0 & 5 & 0 & -10 \\ 0 & 0 & 10 & 135 \end{bmatrix} l2 \rightarrow l2/5 \begin{bmatrix} 1 & 0 & 0 & \frac{-13}{2} \\ 0 & 1 & 0 & -2 \\ 0 & 0 & 10 & 135 \end{bmatrix}$$

Coordenadas  $\mathbf{M}_A \to M_{B(a3)}: a = \frac{-13}{2}; \ \mathbf{b} = \mathbf{-2}; \ \mathbf{c} = \frac{27}{2}$ 

# v = (1, 3, 1)B em A

$$\mathbf{M_{B}} \rightarrow_{\mathbf{A}} : \begin{bmatrix} \frac{1}{10} & -1 & \frac{-1}{10} \\ \frac{8}{5} & \frac{-5}{2} & \frac{2}{5} \\ \frac{-1}{5} & \frac{3}{2} & \frac{1}{5} \end{bmatrix} \cdot \begin{bmatrix} 1 \\ 3 \\ -1 \end{bmatrix} \rightarrow \begin{bmatrix} \frac{1}{10} * \mathbf{1} & -1 * 3 & \frac{-1}{10} * -1 \\ \frac{8}{5} * \mathbf{1} & \frac{-5}{2} * \mathbf{3} & \frac{2}{5} * -\mathbf{1} \\ \frac{-1}{5} * \mathbf{1} & \frac{3}{2} * 3 & \frac{1}{5} * -1 \end{bmatrix} = \begin{bmatrix} \frac{-14}{5} \\ \frac{-63}{10} \\ \frac{41}{10} \end{bmatrix}$$

# v = (0, 1, 2)A em B

$$\mathbf{M}_{A} \to_{B} : \begin{bmatrix} -11 & \frac{1}{2} & \frac{-13}{2} \\ 4 & 0 & -2 \\ 19 & \frac{1}{2} & \frac{27}{2} \end{bmatrix} \cdot \begin{bmatrix} 0 \\ 1 \\ 2 \end{bmatrix} \to \begin{bmatrix} -11 * 0 & \frac{1}{2} * 1 & \frac{-13}{2} * 2 \\ 4 * 0 & 0 * 1 & -2 * 2 \\ 19 * 0 & \frac{1}{2} * 1 & \frac{27}{2} * 2 \end{bmatrix} = \begin{bmatrix} \frac{-25}{2} \\ -4 \\ \frac{55}{2} \end{bmatrix}$$

$ \text{Início} \left[ \begin{array}{cccccccccccccccccccccccccccccccccccc$
$l2 \rightarrow l2 + l1 \begin{bmatrix} -1 & 1 & 2 & 1 & 2 & 1 & 3 & a \\ 0 & 1 & 4 & 1 & 2 & 0 & 3 & b+a \\ 1 & -1 & 1 & 0 & 2 & -1 & 2 & c \\ 1 & 1 & 1 & 1 & 0 & -1 & 0 & d \\ 0 & 1 & -1 & 2 & 2 & -1 & 2 & e \\ 1 & -1 & 1 & 1 & 0 & -1 & -1 & f \\ 1 & 0 & 1 & 1 & 2 & 1 & 2 & g \end{bmatrix}$
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$
$16 \rightarrow l6 + l1 \begin{bmatrix} -1 & 1 & 2 & 1 & 2 & 1 & 3 & a \\ 0 & 1 & 4 & 1 & 2 & 0 & 3 & b+a \\ 0 & 0 & 3 & 1 & 4 & 0 & 5 & c+a \\ 0 & 2 & 3 & 2 & 2 & 0 & 3 & d+a \\ 0 & 0 & 3 & 2 & 2 & 0 & 2 & f+a \\ 1 & 0 & 1 & 1 & 2 & 1 & 2 & g \end{bmatrix} l7 \rightarrow l7 + l1 \begin{bmatrix} -1 & 1 & 2 & 1 & 2 & 1 & 3 & a \\ 0 & 1 & 4 & 1 & 2 & 0 & 3 & b+a \\ 0 & 0 & 3 & 1 & 4 & 0 & 5 & c+a \\ 0 & 2 & 3 & 2 & 2 & 0 & 3 & d+a \\ 0 & 1 & -1 & 2 & 2 & -1 & 2 & e \\ 0 & 0 & 3 & 2 & 2 & 0 & 2 & f+a \\ 1 & 0 & 1 & 1 & 2 & 1 & 2 & g \end{bmatrix}$
$l1 \rightarrow l1 - l2 \begin{bmatrix} -1 & 0 & -2 & 0 & 0 & 1 & 0 & 2a+b \\ 0 & 1 & 4 & 1 & 2 & 0 & 3 & b+a \\ 0 & 0 & 3 & 1 & 4 & 0 & 5 & c+a \\ 0 & 2 & 3 & 2 & 2 & 0 & 3 & d+a \\ 0 & 0 & 3 & 2 & 2 & 0 & 2 & f+a \\ 0 & 1 & 3 & 2 & 4 & 2 & 5 & g+a \end{bmatrix} l4 \rightarrow l4/2 \begin{bmatrix} -1 & 0 & -2 & 0 & 0 & 1 & 0 & 2a+b \\ 0 & 1 & 4 & 1 & 2 & 0 & 3 & b+a \\ 0 & 0 & 3 & 1 & 4 & 0 & 5 & c+a \\ 0 & 1 & 3/2 & 0 & 0 & 0 & 3/2 & d+a/2 \\ 0 & 1 & -1 & 2 & 2 & -1 & 2 & e \\ 0 & 0 & 3 & 2 & 2 & 0 & 2 & f+a \\ 0 & 1 & 3 & 2 & 4 & 2 & 5 & g+a \end{bmatrix}$
$l4 \rightarrow l4 - l2 \begin{bmatrix} -1 & 0 & -2 & 0 & 0 & 1 & 0 & 2a+b \\ 0 & 1 & 4 & 1 & 2 & 0 & 3 & b+a \\ 0 & 0 & 3 & 1 & 4 & 0 & 5 & c+a \\ 0 & 0 & -5/2 & 0 & -1 & 0 & -3/2 & d+3a-2b/2 \\ 0 & 1 & -1 & 2 & 2 & -1 & 2 & e \\ 0 & 0 & 3 & 2 & 2 & 0 & 2 & f+a \\ 0 & 1 & 3 & 2 & 4 & 2 & 5 & g+a \end{bmatrix} \\ b \rightarrow l5 - l2 \begin{bmatrix} -1 & 0 & -2 & 0 & 0 & 1 & 0 & 2a+b \\ 0 & 1 & 4 & 1 & 2 & 0 & 3 & b+a \\ 0 & 0 & 3 & 1 & 4 & 0 & 5 & c+a \\ 0 & 0 & -5/2 & 0 & -1 & 0 & -3/2 & d+3a-2b/2 \\ 0 & 0 & -5 & 1 & 0 & -1 & -1 & e-b+a \\ 0 & 0 & 3 & 2 & 2 & 0 & 2 & f+a \\ 0 & 1 & 3 & 2 & 4 & 2 & 5 & g+a \end{bmatrix}$
$l7 \rightarrow l7 - l2 \begin{bmatrix} -1 & 0 & -2 & 0 & 0 & 1 & 0 & 2a+b \\ 0 & 1 & 4 & 1 & 2 & 0 & 3 & b+a \\ 0 & 0 & 3 & 1 & 4 & 0 & 5 & c+a \\ 0 & 0 & -5/2 & 0 & -1 & 0 & -3/2 & d+3a-2b/2 \\ 0 & 0 & -5 & 1 & 0 & -1 & -1 & e-b+a \\ 0 & 0 & 3 & 2 & 2 & 0 & 2 & f+a \\ 0 & 0 & -1 & 1 & 2 & 2 & 2 & g+2a-b \end{bmatrix} \\ l3 \rightarrow l3/3 \begin{bmatrix} -1 & 0 & -2 & 0 & 0 & 1 & 0 & 2a+b \\ 0 & 1 & 4 & 1 & 2 & 0 & 3 & b+a \\ 0 & 0 & 1 & 1/3 & 4/3 & 0 & 5/3 & c+a/3 \\ 0 & 0 & -5/2 & 0 & -1 & 0 & -3/2 & d+3a-2b/5 \\ 0 & 0 & -5 & 1 & 0 & -1 & -1 & e-b+a \\ 0 & 0 & 3 & 2 & 2 & 0 & 2 & f+a \\ 0 & 0 & -1 & 1 & 2 & 2 & 2 & g+2a-b \end{bmatrix}$
$l4 \rightarrow -2.5.l4 \begin{bmatrix} -1 & 0 & -2 & 0 & 0 & 1 & 0 & 2a+b \\ 0 & 1 & 4 & 1 & 2 & 0 & 3 & b+a \\ 0 & 0 & 1 & 1/3 & 4/3 & 0 & 5/3 & c+a/3 \\ 0 & 0 & 1 & 0 & 2/5 & 0 & 3/5 & -d+3a-2b/5 \\ 0 & 0 & -5 & 1 & 0 & -1 & -1 & e-b+a/5 \\ 0 & 0 & 3 & 2 & 2 & 0 & 2 & f+a \\ 0 & 0 & -1 & 1 & 2 & 2 & 2 & g+2a-b \end{bmatrix} \\ l5 \rightarrow l5/5 \begin{bmatrix} -1 & 0 & -2 & 0 & 0 & 1 & 0 & 2a+b \\ 0 & 1 & 4 & 1 & 2 & 0 & 3 & b+a \\ 0 & 0 & 1 & 1/3 & 4/3 & 0 & 5/3 & c+a/3 \\ 0 & 0 & 1 & 0 & 2/5 & 0 & 3/5 & -d+3a-2b/5 \\ 0 & 0 & -1 & 1/5 & 0 & -1/5 & -1/5 & e-b+a/5 \\ 0 & 0 & 3 & 2 & 2 & 0 & 2 & b+a/3 \\ 0 & 0 & -1 & 1 & 2 & 2 & 2 & g+2a-b \end{bmatrix}$
$l6 \rightarrow l6/3 \begin{bmatrix} -1 & 0 & -2 & 0 & 0 & 1 & 0 & 2a+b \\ 0 & 1 & 4 & 1 & 2 & 0 & 3 & b+a \\ 0 & 0 & 1 & 1/3 & 4/3 & 0 & 5/3 & c+a/3 \\ 0 & 0 & 1 & 0 & 2/5 & 0 & 3/5 & \frac{-3d-14a+6b-2c}{15} \\ 0 & 0 & -1 & 1/5 & 0 & -1/5 & -1/5 & e-b+a/5 \\ 0 & 0 & 1 & 2/3 & 2/3 & 0 & 2/3 & f+a/3 \\ 0 & 0 & -1 & 1 & 2 & 2 & 2 & g+2a-b \end{bmatrix} \\ l4 \rightarrow l4 - l3 \begin{bmatrix} -1 & 0 & -2 & 0 & 0 & 1 & 0 & 2a+b \\ 0 & 1 & 4 & 1 & 2 & 0 & 3 & b+a \\ 0 & 0 & 1 & 1/3 & 4/3 & 0 & 5/3 & c+a/3 \\ 0 & 0 & 0 & -1/3 & -14/15 & 0 & 16/15 & -3d-14a+6b-3c \\ 0 & 0 & -1 & 1/5 & 0 & -1/5 & -1/5 & e-b+a/5 \\ 0 & 0 & 1 & 2/3 & 2/3 & 0 & 2/3 & f+a/3 \\ 0 & 0 & -1 & 1 & 2 & 2 & 2 & g+2a-b \end{bmatrix}$
$l5 \rightarrow l5 + l3 \begin{bmatrix} -1 & 0 & -2 & 0 & 0 & 1 & 0 \\ 0 & 1 & 4 & 1 & 2 & 0 & 3 \\ 0 & 0 & 1 & 1/3 & 4/3 & 0 & 5/3 \\ 0 & 0 & 0 & -1/3 & -14/15 & 0 & 16/15 \\ 0 & 0 & 0 & 8/15 & 4/3 & -1/5 & 22/15 \\ 0 & 0 & 1 & 2/3 & 2/3 & 0 & 2/3 \\ 0 & 0 & -1 & 1 & 2 & 2 & 2 \end{bmatrix} \begin{bmatrix} 2a+b \\ b+a \\ c+a/3 \\ -3d-14a+6b-3c \\ 15 \\ 15 \\ 15 \\ 15 \\ 6+a/3 \\ 15 \end{bmatrix} \\ b+a \\ c+a/3 \\ -3d-14a+6b-3c \\ 15 \\ 15 \\ 15 \\ 15 \\ 15 \\ 15 \\ 15 \\ 1$
$l7 \rightarrow l7 + l3 \begin{bmatrix} -1 & 0 & -2 & 0 & 0 & 1 & 0 & 2a+b \\ 0 & 1 & 4 & 1 & 2 & 0 & 3 & b+a \\ 0 & 0 & 1 & 1/3 & 4/3 & 0 & 5/3 & c+a/3 \\ 0 & 0 & 0 & -1/3 & -14/15 & 0 & 16/15 & \frac{-3d-14a+6b-3c}{15} \\ 0 & 0 & 0 & 8/15 & 4/3 & -1/5 & 22/15 & \frac{8a+3e-3b+3c}{15} \\ 0 & 0 & 0 & 1/3 & -2/3 & 0 & -1 & \frac{1}{5}c/3 \\ 0 & 0 & 0 & 4/3 & 10/3 & 2 & 11/3 & \frac{3g+7a-3b+c}{3} \end{bmatrix} \\ l4 \rightarrow 3.l4 \begin{bmatrix} -1 & 0 & -2 & 0 & 0 & 1 & 0 & 2a+b \\ 0 & 1 & 4 & 1 & 2 & 0 & 3 & b+a \\ 0 & 0 & 1 & 1/3 & 4/3 & 0 & 5/3 & c+a/3 \\ 0 & 0 & 0 & 1 & 14/5 & 0 & 16/5 & \frac{-3d-14a+6b-3c}{3}c \\ 0 & 0 & 0 & 1 & 14/5 & 0 & 16/5 & \frac{-3d-14a+6b-3c}{5}c \\ 0 & 0 & 0 & 8/15 & 4/3 & -1/5 & 22/15 & \frac{8a+3e-3b+3c}{15}c \\ 0 & 0 & 0 & 1/3 & -2/3 & 0 & -1 & \frac{1}{5}c/3 \\ 0 & 0 & 0 & 4/3 & 10/3 & 2 & 11/3 & \frac{3g+7a-3b+c}{3} \end{bmatrix}$
$l5 \rightarrow 15/8.l5 \begin{bmatrix} -1 & 0 & -2 & 0 & 0 & 1 & 0 \\ 0 & 1 & 4 & 1 & 2 & 0 & 3 \\ 0 & 0 & 1 & 1/3 & 4/3 & 0 & 5/3 \\ 0 & 0 & 0 & 1 & 14/5 & 0 & 16/5 \\ 0 & 0 & 0 & 1 & 5/2 & -3/8 & 11/4 \\ 0 & 0 & 0 & 1/3 & -2/3 & 0 & -1 \\ 0 & 0 & 0 & 4/3 & 10/3 & 2 & 11/3 \end{bmatrix} \xrightarrow{3g+7a-3b+c} \\ \begin{bmatrix} -1 & 0 & -2 & 0 & 0 & 1 & 0 \\ 0 & 1 & 4 & 1 & 2 & 0 & 3 \\ 0 & 0 & 1 & 1/3 & 4/3 & 0 & 5/3 \\ 0 & 0 & 0 & 1 & 14/5 & 0 & 16/5 \\ 0 & 0 & 0 & 1 & 14/5 & 0 & 16/5 \\ 0 & 0 & 0 & 1 & 5/2 & -3/8 & 11/4 \\ 0 & 0 & 0 & 1 & 5/2 & -3/8 & 11/4 \\ 0 & 0 & 0 & 1 & -2 & 0 & -3 \\ 0 & 0 & 0 & 4/3 & 10/3 & 2 & 11/3 \end{bmatrix} \xrightarrow{3g+7a-3b+c} \\ \begin{bmatrix} -1 & 0 & -2 & 0 & 0 & 1 & 0 \\ 0 & 1 & 4 & 1 & 2 & 0 & 3 \\ 0 & 0 & 0 & 1 & 1/3 & 4/3 & 0 & 5/3 \\ 0 & 0 & 0 & 1 & 14/5 & 0 & 16/5 \\ 0 & 0 & 0 & 1 & 5/2 & -3/8 & 11/4 \\ 0 & 0 & 0 & 1 & -2 & 0 & -3 \\ 0 & 0 & 0 & 4/3 & 10/3 & 2 & 11/3 \end{bmatrix} \xrightarrow{3g+7a-3b+c} \\ \begin{bmatrix} -1 & 0 & -2 & 0 & 0 & 1 & 0 \\ 0 & 1 & 4 & 1 & 2 & 0 & 3 \\ 0 & 0 & 0 & 1 & 14/5 & 0 & 16/5 \\ 0 & 0 & 0 & 1 & 5/2 & -3/8 & 11/4 \\ 0 & 0 & 0 & 1 & -2 & 0 & -3 \\ 0 & 0 & 0 & 4/3 & 10/3 & 2 & 11/3 \end{bmatrix}$
$l5 \rightarrow l5 - l4 \begin{bmatrix} -1 & 0 & -2 & 0 & 0 & 1 & 0 & 2a+b \\ 0 & 1 & 4 & 1 & 2 & 0 & 3 & b+a \\ 0 & 0 & 1 & 1/3 & 4/3 & 0 & 5/3 & c+a/3 \\ 0 & 0 & 0 & 1 & 14/5 & 0 & 16/5 \\ 0 & 0 & 0 & 0 & -3/10 & -3/8 & -9/20 \\ 0 & 0 & 0 & 1 & 5/2 & 3/2 & 11/4 \end{bmatrix} \\ l6 \rightarrow l6 - l4 \begin{bmatrix} -1 & 0 & -2 & 0 & 0 & 1 & 0 & 2a+b \\ 0 & 1 & 4 & 1 & 2 & 0 & 3 & b+a \\ 0 & 0 & 1 & 1/3 & 4/3 & 0 & 5/3 & c+a/3 \\ 0 & 0 & 0 & 1 & 14/5 & 0 & 16/5 \\ 0 & 0 & 0 & 0 & -3/10 & -3/8 & -9/20 \\ 0 & 0 & 0 & 0 & -3/10 & -3/8 & -9/20 \\ 0 & 0 & 0 & 0 & -24/5 & 0 & -31/5 & \frac{-3d-14a+6b-}{40} \\ 0 & 0 & 0 & 0 & -24/5 & 0 & -31/5 & \frac{-72a+13e-+55b+15c-24d}{40} \\ 0 & 0 & 0 & 0 & 1 & 5/2 & 3/2 & 11/4 \end{bmatrix}$
$l7 \rightarrow l7 - l4 \begin{bmatrix} -1 & 0 & -2 & 0 & 0 & 1 & 0 &   & 2a+b \\ 0 & 1 & 4 & 1 & 2 & 0 & 3 &   & b+a \\ 0 & 0 & 1 & 1/3 & 4/3 & 0 & 5/3 &   & \frac{c+a}{3} \\ 0 & 0 & 0 & 1 & 14/5 & 0 & 16/5 &   & -\frac{-3d-14a+6b-5c}{5} \\ 0 & 0 & 0 & 0 & -3/10 & -3/8 & -9/20 &   & \frac{-72a+15e+33b-15c-24d}{40} \\ 0 & 0 & 0 & 0 & -3/10 & 3/2 & -9/20 &   & \frac{15g-21a+9b-15c-12d}{20} \end{bmatrix} \\ l5 \rightarrow -10/3.l4 \begin{bmatrix} -1 & 0 & -2 & 0 & 0 & 1 & 0 &   & 2a+b \\ 0 & 1 & 4 & 1 & 2 & 0 & 3 &   & b+a \\ 0 & 0 & 1 & 1/3 & 4/3 & 0 & 5/3 &   & \frac{c+a}{3} \\ 0 & 0 & 1 & 1/3 & 4/3 & 0 & 5/3 &   & \frac{c+a}{3} \\ 0 & 0 & 0 & 1 & 14/5 & 0 & 16/5 &   & -\frac{-3d-14a+6b-5c}{5} \\ 0 & 0 & 0 & 0 & 1 & 5/4 & 3/2 &   & -\frac{-24a+5e+11b-5c-8d}{4} \\ 0 & 0 & 0 & 0 & -24/5 & 0 & -31/5 &   & \frac{5f-10c-3d-14a+6b}{5} \\ 0 & 0 & 0 & 0 & -3/10 & 3/2 & -9/20 &   & \frac{15g-21a+9b-15c-12d}{20} \\ \end{bmatrix}$

3

$l6 \rightarrow -5/24.l6 \begin{bmatrix} -1 & 0 & -2 & 0 & 0 & 1 & 0 &   & 2a+b \\ 0 & 1 & 4 & 1 & 2 & 0 & 3 &   & b+a \\ 0 & 0 & 1 & 1/3 & 4/3 & 0 & 5/3 &   & \frac{c+a}{3} \\ 0 & 0 & 0 & 1 & 14/5 & 0 & 16/5 &   & -\frac{-3d-14a+6b-5c}{5} \\ 0 & 0 & 0 & 0 & 1 & 5/4 & 3/2 &   & -\frac{24a+5c+11b-5c-8d}{4} \\ 0 & 0 & 0 & 0 & 1 & 0 & 31/24 &   & -\frac{5f-10c-3d-14a+6b}{24} \\ 0 & 0 & 0 & 0 & -3/10 & 3/2 & -9/20 &   & \frac{15g-21a+9b-15c-12d}{20} \end{bmatrix} \\ I7 \rightarrow -10/3.l7 \\ \begin{bmatrix} -1 & 0 & -2 & 0 & 0 & 1 & 0 &   & 2a+b \\ 0 & 1 & 4 & 1 & 2 & 0 & 3 &   & b+a \\ 0 & 0 & 1 & 1/3 & 4/3 & 0 & 5/3 &   & \frac{c+a}{3} \\ 0 & 0 & 0 & 1 & 14/5 & 0 & 16/5 &   & -\frac{3d-14a+6b-5c}{5} \\ 0 & 0 & 0 & 1 & 14/5 & 0 & 16/5 &   & -\frac{3d-14a+6b-5c}{5} \\ 0 & 0 & 0 & 0 & 1 & 5/4 & 3/2 &   & -\frac{24a+5c+11b-5c-8d}{4} \\ 0 & 0 & 0 & 0 & 1 & 0 & 31/24 &   & \frac{5f-10c-3d-14a+6b}{24} \\ 0 & 0 & 0 & 0 & 1 & -5 & 3/2 &   & -\frac{5g+7a+3b-5c-4d}{2} \end{bmatrix}$
$l6 \rightarrow l6 - l5 \begin{bmatrix} -1 & 0 & -2 & 0 & 0 & 1 & 0 &   & 2a+b \\ 0 & 1 & 4 & 1 & 2 & 0 & 3 &   & b+a \\ 0 & 0 & 1 & 1/3 & 4/3 & 0 & 5/3 &   & \frac{c+a}{3} \\ 0 & 0 & 0 & 1 & 14/5 & 0 & 16/5 &   & -\frac{3d-14a+6b-5c}{5} \\ 0 & 0 & 0 & 0 & 1 & 5/4 & 3/2 &   & -\frac{24a+5e+11b-5c-8d}{4} \\ 0 & 0 & 0 & 0 & 0 & -5/4 & -5/24 &   & \frac{-20c+30e-5f-45d-130a+60b}{24} \\ 0 & 0 & 0 & 0 & 1 & -5 & 3/2 &   & -\frac{5g+7a+3b-5c-4d}{2} \end{bmatrix} \end{bmatrix} \\ I7 \rightarrow l7 - l5 \begin{bmatrix} -1 & 0 & -2 & 0 & 0 & 1 & 0 &   & 2a+b \\ 0 & 1 & 4 & 1 & 2 & 0 & 3 &   & b+a \\ 0 & 0 & 1 & 1/3 & 4/3 & 0 & 5/3 &   & \frac{c+a}{3} \\ 0 & 0 & 0 & 1 & 14/5 & 0 & 16/5 &   & -\frac{3d-14a+6b-5c}{5} \\ 0 & 0 & 0 & 1 & 14/5 & 0 & 16/5 &   & -\frac{3d-14a+6b-5c}{5} \\ 0 & 0 & 0 & 0 & 1 & 5/4 & 3/2 &   & -\frac{24a+5e+11b-5c-8d}{4} \\ 0 & 0 & 0 & 0 & 0 & -5/4 & -5/24 &   & \frac{-20c+30e-5f-45d-130a+60b}{24} \\ 0 & 0 & 0 & 0 & 0 & -5/4 & -5/24 &   & \frac{-3aa+5e-110g+5b+5c}{4} \end{bmatrix}$
$l6 \rightarrow -4/5.l6 \begin{bmatrix} -1 & 0 & -2 & 0 & 0 & 1 & 0 &   & 2a+b \\ 0 & 1 & 4 & 1 & 2 & 0 & 3 &   & b+a \\ 0 & 0 & 1 & 1/3 & 4/3 & 0 & 5/3 &   & \frac{c+a}{3} \\ 0 & 0 & 0 & 1 & 14/5 & 0 & 16/5 &   & -\frac{3d-14a+6b-5c}{5} \\ 0 & 0 & 0 & 0 & 1 & 5/4 & 3/2 &   & -\frac{24a+5e+11b-5c-8d}{4} \\ 0 & 0 & 0 & 0 & 0 & 1 & 1/6 &   & -\frac{4c+6e-f-9d-26a+12b}{6} \\ 0 & 0 & 0 & 0 & 0 & -25/4 & 0 &   & \frac{-38a+5e-10g+5b+5c}{4} \end{bmatrix} \\ I7 \rightarrow -4/25.l7 \begin{bmatrix} -1 & 0 & -2 & 0 & 0 & 1 & 0 &   & 2a+b \\ 0 & 1 & 4 & 1 & 2 & 0 & 3 &   & b+a \\ 0 & 0 & 1 & 1/3 & 4/3 & 0 & 5/3 &   & \frac{c+a}{3} \\ 0 & 0 & 1 & 1/3 & 4/3 & 0 & 5/3 &   & \frac{c+a}{3} \\ 0 & 0 & 0 & 1 & 14/5 & 0 & 16/5 &   & -\frac{3d-14a+6b-5c}{5} \\ 0 & 0 & 0 & 0 & 1 & 14/5 & 0 & 16/5 &   & -\frac{3d-14a+6b-5c}{5} \\ 0 & 0 & 0 & 0 & 1 & 5/4 & 3/2 &   & -\frac{24a+5e+11b-5c-8d}{4} \\ 0 & 0 & 0 & 0 & 0 & 1 & 1/6 &   & -\frac{4c+6e-f-9d-26a+12b}{6} \\ 0 & 0 & 0 & 0 & 0 & 1 & 1/6 &   & -\frac{4c+6e-f-9d-26a+12b}{6} \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 &   & -\frac{38a+5e-10g+5b+5c}{4} \end{bmatrix}$
$l7 \rightarrow l7 - l6 \begin{bmatrix} -1 & 0 & -2 & 0 & 0 & 1 & 0 &   & 2a+b \\ 0 & 1 & 4 & 1 & 2 & 0 & 3 &   & b+a \\ 0 & 0 & 1 & 1/3 & 4/3 & 0 & 5/3 &   & \frac{c+a}{3} \\ 0 & 0 & 0 & 1 & 14/5 & 0 & 16/5 &   & -\frac{-3d-14a+6b-5c}{5} \\ 0 & 0 & 0 & 0 & 1 & 5/4 & 3/2 &   & -\frac{-24a+5c+11b-5c-8d}{4} \\ 0 & 0 & 0 & 0 & 0 & 1 & 1/6 &   & -\frac{-4c+6c-f-9d-26a+12b}{6} \\ 0 & 0 & 0 & 0 & 0 & -1/6 &   & \frac{120c-422a+270b-130c-225d+60g-25f}{150} \end{bmatrix} \\ l7 \rightarrow -6.l7 \begin{bmatrix} -1 & 0 & -2 & 0 & 0 & 1 & 0 &   & 2a+b \\ 0 & 1 & 4 & 1 & 2 & 0 & 3 &   & b+a \\ 0 & 0 & 1 & 1/3 & 4/3 & 0 & 5/3 &   & \frac{c+a}{3} \\ 0 & 0 & 0 & 1 & 1/45 & 0 & 16/5 &   & -\frac{-3d-14a+6b-5c}{5} \\ 0 & 0 & 0 & 1 & 14/5 & 0 & 16/5 &   & -\frac{-3d-14a+6b-5c}{5} \\ 0 & 0 & 0 & 0 & 1 & 5/4 & 3/2 &   & -\frac{-24a+5c+11b-5c-8d}{4} \\ 0 & 0 & 0 & 0 & 1 & 1/6 &   & -\frac{-4c+6c-f-9d-26a+12b}{6} \\ 0 & 0 & 0 & 0 & 0 & 1 & 1/6 &   & -\frac{-4c+6c-f-9d-26a+12b}{25} \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 &   & -\frac{120c-422a+270b-130c-225d+60g-25f}{25} \end{bmatrix}$
$l6 \rightarrow l6 - (1/6.l7) \left[ \begin{array}{c ccccccccccccccccccccccccccccccccccc$
$l4 \rightarrow l4 - (16/5.l7) \left[ \begin{array}{c ccccccccccccccccccccccccccccccccccc$
$12 \rightarrow l2 - (3.l7) \left[ \begin{array}{c ccccccccccccccccccccccccccccccccccc$
$11 \rightarrow l1 - l6 \begin{bmatrix} -1 & 0 & -2 & 0 & 0 & 0 & 0 &   & \frac{12a+5c+30b-10g+5c}{25} \\ 0 & 1 & 4 & 1 & 2 & 0 & 0 &   & \frac{360c+835b-1214a-390c-675d+180g-75f}{25} \\ 0 & 0 & 1 & 1/3 & 4/3 & 0 & 0 &   & \frac{120c-125c-417a+270b-255d+60g-25f}{15} \\ 0 & 0 & 0 & 1 & 14/5 & 0 & 0 &   & \frac{1920c-3525d-3402a+4170b-1955c+960g-400f}{125} \\ 0 & 0 & 0 & 0 & 1 & 0 & 0 &   & \frac{60c-1061a+685b-315c+575d+155g-75f}{50} \\ 0 & 0 & 0 & 0 & 1 & 0 &   & \frac{10g-5c-5c+38a-5b}{25} \\ 0 & 0 & 0 & 0 & 0 & 1 &   & \frac{10g-5c-5c+38a-5b}{25} \\ 0 & 0 & 0 & 0 & 0 & 1 &   & \frac{10g-5c-5c+38a-5b}{25} \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 &   & \frac{10g-5c-5c+38a-5b}{25} \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 &   & \frac{10g-5c-5c+38a-5b}{25} \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 &   & \frac{10g-5c-5c+38a-5b}{25} \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 &   & \frac{10g-5c-5c+38a-5b}{25} \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 &   & \frac{10g-5c-5c+38a-5b}{25} \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 &   & \frac{10g-5c-5c+38a-5b}{25} \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 &   & \frac{10g-5c-5c+38a-5b}{25} \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 &   & \frac{10g-5c-5c+38a-5b}{25} \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 &   & \frac{10g-5c-5c+38a-5b}{25} \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 &   & \frac{10g-5c-5c+38a-5b}{25} \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 &   & \frac{10g-5c-5c+38a-5b}{25} \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 &   & \frac{10g-5c-5c+38a-5b}{25} \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 &   & \frac{10g-5c-5c+38a-5b}{25} \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 &   & \frac{10g-5c-5c+38a-5b}{25} \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 &   & \frac{10g-5c-5c+38a-5b}{25} \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 &   & \frac{10g-5c-5c+38a-5b}{25} \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 &   & \frac{10g-5c-5c+38a-5b}{25} \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 &   & \frac{10g-5c-5c+38a-5b}{25} \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 &   & \frac{10g-5c-5c+38a-5b}{25} \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 &   & \frac{10g-5c-5c+38a-5b}{25} \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 &   & \frac{10g-5c-5c+38a-5b}{25} \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 &   & \frac{10g-5c-5c+38a-5b}{25} \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 &   & \frac{10g-5c-5c+38a-5b}{25} \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 &   & \frac{10g-5c-5c+38a-5b}{25} \\ 0 & 0 & 0 & 0 & $
$13 \rightarrow l3 - (4/3.l5) \begin{bmatrix} -1 & 0 & -2 & 0 & 0 & 0 & 0 &   & \frac{12a+5c+30b-10g+5c}{25} \\ 0 & 1 & 4 & 1 & 2 & 0 & 0 &   & \frac{360c+835b-1214a-390c-675d+180g-75f}{25} \\ 0 & 0 & 1 & 1/3 & 0 & 0 & 0 &   & \frac{260g+620e-605c-2237a+1370b-1275d-125f}{75} \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 &   & \frac{16g+60e-302d+161a-25b+10c-16f}{5} \\ 0 & 0 & 0 & 1 & 0 & 0 &   & \frac{60e-1061a+685b-315c+575d+155g-75f}{50} \\ 0 & 0 & 0 & 0 & 1 & 0 &   & \frac{10g-5e-5c+38a-5b}{25} \\ 0 & 0 & 0 & 0 & 0 & 1 &   & \frac{10g-5e-5c+38a-5b}{25} \\ 0 & 0 & 0 & 0 & 0 & 1 &   & \frac{10g-5e-5c+38a-5b}{25} \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 &   & \frac{10g-6e-325d+60g-25f}{25} \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 &   & \frac{10g-6e-325d+60g-25f}{25} \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 &   & \frac{10g-6e-325d+60g-25f}{25} \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 &   & \frac{10g-6e-325d+60g-25f}{25} \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 &   & \frac{10g-6e-325d+60g-25f}{25} \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 &   & \frac{10g-6e-325d+60g-25f}{25} \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 &   & $

$l2 \rightarrow l2 - (4.l3)$	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	$0  0  0  0  \left   \frac{330g + 655e - 6048a + 3080b - 1295c + 470d - 90f}{75}  \right $
	$0  1  0  0  0  0  \left  \begin{array}{c} -480g - 1070e - 3070b + 5883a + 1330c + 1565d + 195f \\ 75 \end{array} \right  \qquad 0  1  0  0$	$0  0  0  \left  \begin{array}{cc} -480g - 1070e - 3070b + 5883a + 1330c + 1565d + 195f \\ 75 \end{array} \right $
	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	$0  0  0     \frac{180g + 320e - 655c - 3042a + 1495b + 235d - 45f}{75}$
	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$
	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	$0  1  0  0 \mid \frac{60e - 1061a + 685b - 315c + 575d + 155g - 75f}{50}$
	$0  0  0  0  1  0 \mid \frac{10g - 5e - 5c + 38a - 5b}{25}$	$0  0  1  0 \mid \frac{10g - 5e - 5c + 38a - 5b}{25}$
	$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	0 0 1 $\left  -\frac{120e - 422a + 270b - 130c - 225d + 60g - 25f}{25} \right $

l1  o -1.l1	1	0	0	0	0	0	0	$-\ \frac{330g + 655e - 6048a + 3080b - 1295c + 470d - 90f}{75}$
	0	1	0	0	0	0	0	$\frac{-480g - 1070e - 3070b + 5883a + 1330c + 1565d + 195f}{75}$
	0	0	1	0	0	0	0	$\frac{180g + 320e - 655c - 3042a + 1495b + 235d - 45f}{75}$
	0	0	0	1	0	0	0	$\frac{16g + 60e - 302d + 161a - 25b + 10c - 16f}{5}$
	0	0	0	0	1	0	0	$\frac{60e - 1061a + 685b - 315c + 575d + 155g - 75f}{50}$
	0	0	0	0	0	1	0	$\frac{10g - 5e - 5c + 38a - 5b}{25}$
	0	0	0	0	0	0	1	$-\frac{120e-422a+270b-130c-225d+60g-25f}{25}$
	l							

### 11 Coordenadas

Portanto o conjunto forma base para o espaço vetorial R7 e as coordenadas são B =  $\frac{216}{5}$ ; -23; 21;  $\frac{-241}{5}$ ;  $\frac{217}{10}$ ; 15;  $\frac{19}{5}$