Algebra Linear

Anabelle Elizabeth Araújo de Souza Pedro Henrique Levy Fermino Ferreira

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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: $\mathbf{v} = (0, 1, 2)$ A em B $\mathbf{v} = (1, 3, 1)$ B em A

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)

4x + y + 5z = 12x - y + 3z = -2

y + 3z = 14x + y + 5z = 1

4x + y + 5z = 12x - y + 3z = -2

6x + 8z = -12x - y + 3z = -2

y + 3z = 12x + 6z = -1

6x + 8z = -1

2x + 6z = -1(-3)6x + 8z = -1

-6x - 18z = 3

-10z = 2 z = -2/10z = -1/5

2x + 6z = -1

 $2x + 6 \cdot (-1/5) = -1$

 $\mathbf{x} = \mathbf{1}/\mathbf{10}$

y + 3z = 1y + 3(-1/5) = 1

-1+3/5

 ${f y}=8/5$

Mudança B $\rightarrow A(b2)$

4 x+y+5 z=1 2 x=y+3 z=5

y+3 z=2 4 x+y+5 z=1

2 x-y+3 z=5

2 x-y+3 z=5 y+3=2

6 x+8 x=6 2 x+6 z=7(-3)

-10 z=-15 z=3 / 2

 $\mathbf{x} = -1$

2 x+**6** $\cdot (3/2) = 7$

 $y + 3 \cdot (3/2) = 2$ $\mathbf{y} = -\mathbf{5}/\mathbf{2}$

Mudança B $\rightarrow A(b3)$

4x + y + 5z = 1

2x - y + 3z = 0y + 3z = 1

4x + y = 5z = 1

2x - y + 3z = 0

2x - y + 3z = 0y + 3z = 1

6x + 8z = 1

2x + 6z = 1 $\mathbf{x} = -1/10$

z = 1/5y + 3(1/5) = 1

y + 3/5 = 1y = 2/5

Mudança A \rightarrow B(a1)x. $\mathbf{b}_1 + y.b_2 + z.b_3 = a_1$

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

x + y + z = 4-2x + 5y = 2

x + 2y + z = 0x + y + z = 4(.2)

 $\begin{aligned}
 x + y + z &= 4(.2) \\
 -2x + 5y &= 2
 \end{aligned}$

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

-2x + 2y + 2z = 8
-2x + 5y = 2

7y + 2z = 10

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

-y = 4 $\mathbf{y} = -4$

-2x + 5(-4) = 2

-20 -2x = 2 -2x = 22

 $\mathbf{x} = -11$

 $\mathbf{z}=\mathbf{19}$

7y + 2z = 10 $7 \cdot (-4) + 2z = 10$

Mudança A ightarrow B(a2)

x + y + z = 1-2x + 5y = -1

 $\mathbf{x} + \mathbf{y} + \mathbf{z} = \mathbf{1} \cdot (2)$ -2x + 5y = -1

x + 2y + z = 1

x + y + z = 1z = 2y + z = 1

2x + 2y = 2z = 2-2x + 5y = -1

7y + 2z = 1 $\mathbf{y} = \mathbf{0}$

7.0 + 2z = 1 $\mathbf{z} = \mathbf{1/2}$

-2x + 0 = -1-2x = -1 $\mathbf{x} = \mathbf{1/2}$

-2x + 0 = -1

Mudança A $\rightarrow B(a3)$

x + y + z = 5-2x + 5y = 3

x + 2y + z = 3

x + y + z = 5-2x + 5y = 3

x + y + z = 5

x + y + z = 5x + 2y + z = 3

7y + 2z = 13y = -2

7y + 2z = 13y = -2

 $7 \cdot (-2) = 2z = 13$ z = 27/2 -2x + 5(-2) = 3 -2x - 10 = 13 -2x = 13x = -13/2

	$\frac{1}{10}$	-1	$\frac{-1}{10}$		「 1 ⁻		$\int \frac{1}{10} {}_{*}1$	-1_*3	$\frac{-1}{10}*(-1)$		$\begin{bmatrix} \frac{-25}{2} \end{bmatrix}$	
$\mathbf{M_B} o_{\mathbf{A}}$:	$\frac{8}{5}$	$\frac{-5}{2}$	$\frac{2}{5}$	3	\rightarrow	$\frac{8}{5}*1$	$\frac{-5}{2} * 3$	$\frac{2}{5}*(-1)$	=	-4		
$\mathbf{M_B} ightarrow_{\mathbf{A}}$:	$\frac{-1}{5}$	$\frac{3}{2}$	$\frac{1}{5}$		-1		$\frac{-1}{5}$!	$\frac{3}{2}$ *3	$\frac{1}{5}*(-1)$		$\frac{55}{2}$	
	L		-	J	L.	J	L		-	J	L J	

		$\frac{1}{2}$	$\frac{-13}{2}$	0 -		\[-11_*0	$\frac{1}{2} * 1$	$\frac{-13}{2}$ *2		$\frac{-14}{5}$]
$\mathbf{M}_A o_B$:	4	$\begin{bmatrix} -11 & \frac{1}{2} & \frac{-13}{2} \\ 4 & 0 & -2 \\ 19 & \frac{1}{2} & \frac{27}{2} \end{bmatrix}.$	1	\rightarrow	4_*0	0*1	$-2_{*}2$	=	$\frac{-63}{10}$		
	19	$\frac{1}{2}$	$\frac{27}{2}$	2		19*0	$\frac{1}{2}$ * 1	$\frac{27}{2} * 2$		$\frac{41}{10}$	
	L		_	L.		L				L .]

2 Exercício 2

Considere o conjunto $S = \{(1, 1, 1, 1, 1), (2, 0, 1, 1, 3), (3, 1, 0, 2, 4), (2, 2, 5, 8, 1), (0, 1, 0, 2, 3)\}.$

• S é LI ou LD?

	1	2	3	2	0	0	lΓ	1	2	3	2	0	0
	1	0	1	2	1	0		1	0	1	2	1	0
S =	1	-1	0	5	0	0	13 ← <i>l</i> 4 − <i>l</i> 3	0	2	2	3	2	0
	1	1	2	8	2	0	$ \boxed{ \mathbf{l3} \leftarrow l4 - l3 } $	1	1	2	8	2	0
	1	3	4	-1	3	0		1	3	4	-1	3	0

$$l2 \rightarrow l2 - l3 \begin{bmatrix} 0 & 2 & 2 & 0 & -1 & 0 \\ 1 & 0 & 1 & -1 & 0 & 0 \\ 0 & 0 & 0 & 3 & 1 & 0 \\ 1 & 1 & 2 & 8 & 2 & 0 \\ 1 & 3 & 4 & -1 & 3 & 0 \end{bmatrix} l4 \rightarrow l4 - 3l3 \begin{bmatrix} 0 & 2 & 2 & 0 & -1 & 0 \\ 1 & 0 & 1 & -1 & 0 & 0 \\ 0 & 0 & 0 & 3 & 1 & 0 \\ 1 & 1 & 2 & -1 & -1 & 0 \\ 1 & 3 & 4 & -1 & 3 & 0 \end{bmatrix}$$

$$l5
ightarrow l5 - l1 egin{bmatrix} 0 & 2 & 2 & 0 & -1 & 0 \ 1 & 0 & 1 & -1 & 0 & 0 \ 0 & 0 & 0 & 3 & 1 & 0 \ 1 & 1 & 2 & -1 & -1 & 0 \ 1 & 1 & 2 & -1 & 4 & 0 \end{bmatrix} \ l5
ightarrow l5 - l4 egin{bmatrix} 0 & 2 & 2 & 0 & -1 & 0 \ 1 & 0 & 1 & -1 & 0 & 0 \ 0 & 0 & 0 & 3 & 1 & 0 \ 1 & 1 & 2 & -1 & -1 & 0 \ 0 & 0 & 0 & -0 & 5 & 0 \ \end{bmatrix}$$

$$l4 \rightarrow l4 - l1 \begin{bmatrix} 0 & 2 & 2 & 0 & 0 & 0 \\ 1 & 0 & 1 & -1 & 0 & 0 \\ 0 & 0 & 0 & 3 & 1 & 0 \\ 1 & -1 & 0 & -1 & -1 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 \end{bmatrix} l3 \rightarrow l3 - l5 \begin{bmatrix} 0 & 2 & 2 & 0 & 0 & 0 \\ 1 & 0 & 1 & -1 & 0 & 0 \\ 0 & 0 & 0 & 3 & 0 & 0 \\ 1 & -1 & 0 & -1 & -1 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 \end{bmatrix}$$

$$l3 \leftrightarrow 14 \begin{bmatrix} 0 & 2 & 2 & 0 & 0 & 0 \\ 1 & 0 & 1 & -1 & 0 & 0 \\ 1 & -1 & 0 & -1 & -1 & 0 \\ 0 & 0 & 0 & 3 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 \end{bmatrix} l4 \rightarrow l4/3 \begin{bmatrix} 0 & 2 & 2 & 0 & 0 & 0 \\ 1 & 0 & 1 & -1 & 0 & 0 \\ 1 & -1 & 0 & -1 & -1 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 \end{bmatrix}$$

$$l3 \rightarrow 13 + l4 \begin{bmatrix} 0 & 2 & 2 & 0 & 0 & 0 \\ 1 & 0 & 1 & 0 & 0 & 0 \\ 1 & -1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 \end{bmatrix} l1 \rightarrow 2l2 - l1 \begin{bmatrix} 2 & -2 & 0 & 0 & 0 & 0 \\ 1 & 0 & 1 & 0 & 0 & 0 \\ 1 & -1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 \end{bmatrix}$$

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

R: Portanto, é LD

Forma base do R-espaço vetorial R5? R: Não forma base, pois é LD

3 Exercício 3

Considere o conjunto W = $\{(x, y, z, w, t, u) \mid x, y, z, w, t, u \in R \land x + y + w + z + t + u = 0 \land y - w - z = 0 \land w + t - x = 0\} \subseteq R^6$.

Mostre que conjunto W é um subespaço do R-espaço vetorial \mathbb{R}^6 . t - x = 0

t = xy - w - z = 0

y = w + z $x + y + w + z + t + u = 0 \rightarrow x + w + z + w + z + x + u = 0$

 $u = -x - y - w - z - t \rightarrow u = -2x - 2w - 2z$ $W = \{(x, w + z, z, w, x, -x - w - z - w - z - x)\} \rightarrow$

 $W = \{(x, w + z, z, w, x, -2x - 2w - 2z) | x, z, w \in R\}$

I) $0 \in Wparax = 0z = 0w = 0$

 $(w, w, w, w, w, -w) \rightarrow (x, w + z, z, w, x, -2x-2w-2z)$ = (0, 0, 0, 0, 0, -0)

=0

Logo, $0 \in W$

II) u, $v \in W \rightarrow u + v \in W$, sendo:

 $u = (u1, u2, u3, u4, u5, -u6) \rightarrow (x_1, w_1 + z_1, z_1, w_1, x_1, -2x_1-2w_1-2z_1)$ $v = (v1, v2, v3, v4, v5, -v6) \rightarrow (x_2, w_2 + z_2, z_2, w_2, x_2, -2x_2-2w_2-2z_2)$

 $\mathbf{u} + \mathbf{v} = (\mathbf{x}_1 + x_2, (w_1 + z_1) + (w_2 + z_2), z_1 + z_2, w_1 + w_2, x_1 + x_2, (-2x_1 - 2w_1 - 2z_2) + (-2x_2 - 2w_2 - 2z_2))$ $\mathbf{u} + \mathbf{v} = (\mathbf{x}_1 + x_2, w_1 + z_1 + w_2 + z_2, z_1 + z_2, w_1 + w_2, x_1 + x_2, -2x_1 - 2x_2, -2w_1 - 2w_2, -2z_1 - 2z_2)$

Logo, $u + v \in W$

III) $a \in R, v \in W \rightarrow av \in W, sendo$: $v = (v1, v2, v3, v4, v5, -v6) \rightarrow (x, w + z, z, w, x, -2x-2w-2z)$ $av = a \cdot (x_1, w_1 + z_1, z_1, w_1, x_1, -2x_1 - 2w_1 - 2z_1)$

av = $(a. x_1, a.w_1 + z_1, a.z_1, a.w_1, a.x_1, a. -2x_1 - 2w_1 - 2z_1)$ $av = (ax_1, aw_1w_2, az_1, aw_1, ax_1, a - 2x_1 - 2w_1 - 2z_1)$ Logo, av $\in W$.

Logo W é subespaço vetorial de R6.

• O conjunto W = $\{(x, y, z) \mid x, y, z \in R \land x - z = 1 \land y + x = 0\}$ é um subsespaço vetorial de R3? Esboce graficamente W.

 $x - z = 1 \ a \ x = 1 + z$ y + x = 0 à y + 1 + z = 0 à y = -1 - z.

 $W = \{(1 + z, -1 - z, z)\}$

I) $0 \in W, paraz = 0$

 $(1 + z, -1 - z, z) \rightarrow (1 + 0, -1 - 0, 0) = (1, -1, 0).$ Logo 0 NÃO pertence a W para z=0. Portanto, W NÃO é subespaço vetorial.

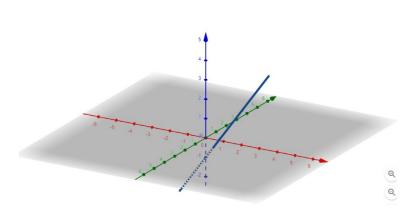


Figure 1: Representação gráfica.

• Invente seu subespaço vetorial em qualquer R n com n maior igual a 2. Mostre que o conjunto apresentado é de fato um subespaço vetorial. Não vale usar nenhum exemplo da aula ou da prova

 $Z = \{(x, y, z) \mid 2y + z = 0 \land x + y = 0\}$ 2y + z = 0x + y = 0z = -2yx = -y

Z = (-y, y, -2y) $Z = \{(-z, z, -z) \mid Z \in R\}$ $I)0 \in Z, paraz = 0$

 $(z, z, z) \to (-y, y, -2y)$ $y \to 0$ (-y, y, -2y) = (-0, 0, -0) = (0, 0, 0)Logo, $0 \in Z$

II) u, $v \in Z \to u + v \in Z$, sendo: u = (-y1, y1, -2y1)v = (-y2, y2, -2y2)u + v = (-y, y, -2y) + (-y2, y2, -2y2)u + v = (-y1-y2, y1+y2, -2y-2y2)

Logo, $u + v \in Z$ III) a $\in R, v \in Z \rightarrow av \in Z.Sendo$: $v = (v1, v2, v3) \rightarrow (-y, y, -2y)$ $a.v = a \cdot (-y, y, -2y)$

a.v = (a. (-y), a. y, a. (-2y))

4 Exercício 4

 $\text{Mostre que o conjunto } \{(1,\,1,\,1,\,0,\,1,\,1),(1,\,0,\,1,\,1,\,1,\,0),(2,\,2,\,1,\,1,\,1,\,1),(1,\,0,\,0,\,1,\,2,\,1,\,1),(2,\,0,\,2,\,0,\,2),(1,\,1,\,1,\,1,\,1),(3,\,0,\,2,\,0,\,2,\,1,\,2)\} \text{ forma uma base para o Respaço vetorial R7. Escreva o vetor } (0,\,1,\,1,\,1,\,1,\,1),(1,\,0,\,1,\,1,\,1,\,1),(1,\,0,\,1,\,1,\,1,\,1),(1,\,0,\,1,\,1,\,1,\,1),(1,\,0,\,1,\,1),(1,\,0,\,1,\,1),(1,\,0,\,1,\,1),(1,\,0,\,1,\,1),(1,\,0,\,1,\,1),(1,\,0,\,1,\,1),(1,\,0,\,1,\,1),(1,\,0,\,1,\,1),(1,\,0,\,1,\,1),(1,\,0,\,1,\,1),(1,\,0,\,1),(1$

$\text{Início} \left[\begin{array}{cccccccccccccccccccccccccccccccccccc$
$l2 \rightarrow l2 + l1 \begin{bmatrix} -1 & 1 & 2 & 1 & 2 & 1 & 3 & a \\ 0 & 1 & 4 & 1 & 2 & 0 & 3 & b+a \\ 1 & -1 & 1 & 0 & 2 & -1 & 2 & c \\ 1 & 1 & 1 & 1 & 0 & -1 & 0 & d \\ 0 & 1 & -1 & 2 & 2 & -1 & 2 & e \\ 1 & -1 & 1 & 1 & 0 & -1 & -1 & f \\ 1 & 0 & 1 & 1 & 2 & 1 & 2 & g \end{bmatrix}$
$13 \rightarrow l3 + l1 \begin{bmatrix} -1 & 1 & 2 & 1 & 2 & 1 & 3 & & a \\ 0 & 1 & 4 & 1 & 2 & 0 & 3 & & b+a \\ 0 & 0 & 3 & 1 & 4 & 0 & 5 & & c+a \\ 1 & 1 & 1 & 1 & 0 & -1 & 0 & 0 & d \\ 0 & 1 & -1 & 2 & 2 & -1 & 2 & & e \\ 1 & -1 & 1 & 1 & 0 & -1 & -1 & & f \\ 1 & 0 & 1 & 1 & 2 & 1 & 2 & & g \end{bmatrix}$ $l4 \rightarrow l4 + l1$ $\begin{bmatrix} -1 & 1 & 2 & 1 & 2 & 1 & 3 & & a \\ 0 & 1 & 4 & 1 & 2 & 0 & 3 & & b+a \\ 0 & 0 & 3 & 1 & 4 & 0 & 5 & & c+a \\ 0 & 2 & 3 & 2 & 2 & 0 & 3 & & d+a \\ 0 & 1 & -1 & 2 & 2 & -1 & 2 & & e \\ 1 & -1 & 1 & 1 & 0 & -1 & -1 & & f \\ 1 & 0 & 1 & 1 & 2 & 1 & 2 & & g \end{bmatrix}$
$16 \rightarrow l6 + l1 \begin{bmatrix} -1 & 1 & 2 & 1 & 2 & 1 & 3 & a \\ 0 & 1 & 4 & 1 & 2 & 0 & 3 & b+a \\ 0 & 0 & 3 & 1 & 4 & 0 & 5 & c+a \\ 0 & 2 & 3 & 2 & 2 & 0 & 3 & d+a \\ 0 & 1 & -1 & 2 & 2 & -1 & 2 & e \\ 0 & 0 & 3 & 2 & 2 & 0 & 2 & f+a \\ 1 & 0 & 1 & 1 & 2 & 1 & 2 & g \end{bmatrix} l7 \rightarrow l7 + l1 \begin{bmatrix} -1 & 1 & 2 & 1 & 2 & 1 & 3 & a \\ 0 & 1 & 4 & 1 & 2 & 0 & 3 & b+a \\ 0 & 0 & 3 & 1 & 4 & 0 & 5 & c+a \\ 0 & 0 & 3 & 1 & 4 & 0 & 5 & c+a \\ 0 & 2 & 3 & 2 & 2 & 0 & 3 & d+a \\ 0 & 1 & -1 & 2 & 2 & -1 & 2 & e \\ 0 & 0 & 3 & 2 & 2 & 0 & 2 & f+a \\ 0 & 1 & 3 & 2 & 4 & 2 & 5 & g+a \end{bmatrix}$
$l1 \rightarrow l1 - l2 \begin{bmatrix} -1 & 0 & -2 & 0 & 0 & 1 & 0 & 2a+b \\ 0 & 1 & 4 & 1 & 2 & 0 & 3 & b+a \\ 0 & 0 & 3 & 1 & 4 & 0 & 5 & c+a \\ 0 & 2 & 3 & 2 & 2 & 0 & 3 & d+a \\ 0 & 1 & -1 & 2 & 2 & -1 & 2 & e \\ 0 & 0 & 3 & 2 & 2 & 0 & 2 & f+a \\ 0 & 1 & 3 & 2 & 4 & 2 & 5 & g+a \end{bmatrix} \\ l4 \rightarrow l4/2 \begin{bmatrix} -1 & 0 & -2 & 0 & 0 & 1 & 0 & 2a+b \\ 0 & 1 & 4 & 1 & 2 & 0 & 3 & b+a \\ 0 & 0 & 3 & 1 & 4 & 0 & 5 & c+a \\ 0 & 0 & 3 & 1 & 4 & 0 & 5 & c+a \\ 0 & 1 & 3/2 & 0 & 0 & 0 & 3/2 & d+a/2 \\ 0 & 1 & -1 & 2 & 2 & -1 & 2 & e \\ 0 & 0 & 3 & 2 & 2 & 0 & 2 & f+a \\ 0 & 1 & 3 & 2 & 4 & 2 & 5 & g+a \end{bmatrix}$
$l4 \rightarrow l4 - l2 \begin{bmatrix} -1 & 0 & -2 & 0 & 0 & 1 & 0 & 2a+b \\ 0 & 1 & 4 & 1 & 2 & 0 & 3 & b+a \\ 0 & 0 & 3 & 1 & 4 & 0 & 5 & c+a \\ 0 & 0 & -5/2 & 0 & -1 & 0 & -3/2 & d+3a-2b/2 \\ 0 & 1 & -1 & 2 & 2 & -1 & 2 & e \\ 0 & 0 & 3 & 2 & 2 & 0 & 2 & f+a \\ 0 & 1 & 3 & 2 & 4 & 2 & 5 & g+a \end{bmatrix} \\ l5 \rightarrow l5 - l2 \begin{bmatrix} -1 & 0 & -2 & 0 & 0 & 1 & 0 & 2a+b \\ 0 & 1 & 4 & 1 & 2 & 0 & 3 & b+a \\ 0 & 0 & 3 & 1 & 4 & 0 & 5 & c+a \\ 0 & 0 & -5/2 & 0 & -1 & 0 & -3/2 & d+3a-2b/2 \\ 0 & 0 & -5 & 1 & 0 & -1 & -1 & e-b+a \\ 0 & 0 & 3 & 2 & 2 & 0 & 2 & f+a \\ 0 & 1 & 3 & 2 & 4 & 2 & 5 & g+a \end{bmatrix}$
$l7 \rightarrow l7 - l2 \begin{bmatrix} -1 & 0 & -2 & 0 & 0 & 1 & 0 & 2a+b \\ 0 & 1 & 4 & 1 & 2 & 0 & 3 & b+a \\ 0 & 0 & 3 & 1 & 4 & 0 & 5 & c+a \\ 0 & 0 & -5/2 & 0 & -1 & 0 & -3/2 & d+3a-2b/2 \\ 0 & 0 & -5 & 1 & 0 & -1 & -1 & e-b+a \\ 0 & 0 & 3 & 2 & 2 & 0 & 2 & f+a \\ 0 & 0 & -1 & 1 & 2 & 2 & 2 & g+2a-b \end{bmatrix} \\ l3 \rightarrow l3/3 \begin{bmatrix} -1 & 0 & -2 & 0 & 0 & 1 & 0 & 2a+b \\ 0 & 1 & 4 & 1 & 2 & 0 & 3 & b+a \\ 0 & 0 & 1 & 1/3 & 4/3 & 0 & 5/3 & c+a/3 \\ 0 & 0 & -5/2 & 0 & -1 & 0 & -3/2 & d+3a-2b/5 \\ 0 & 0 & -5/2 & 0 & -1 & 0 & -3/2 & d+3a-2b/5 \\ 0 & 0 & -5 & 1 & 0 & -1 & -1 & e-b+a \\ 0 & 0 & 3 & 2 & 2 & 0 & 2 & f+a \\ 0 & 0 & 3 & 2 & 2 & 0 & 2 & f+a \\ 0 & 0 & -1 & 1 & 2 & 2 & 2 & g+2a-b \end{bmatrix}$
$l4 \rightarrow -2.5.l4 \begin{bmatrix} -1 & 0 & -2 & 0 & 0 & 1 & 0 & 2a+b \\ 0 & 1 & 4 & 1 & 2 & 0 & 3 & b+a \\ 0 & 0 & 1 & 1/3 & 4/3 & 0 & 5/3 & c+a/3 \\ 0 & 0 & 1 & 0 & 2/5 & 0 & 3/5 & -d+3a-2b/5 \\ 0 & 0 & -5 & 1 & 0 & -1 & -1 & e-b+a/5 \\ 0 & 0 & 3 & 2 & 2 & 0 & 2 & f+a \\ 0 & 0 & -1 & 1 & 2 & 2 & 2 & g+2a-b \end{bmatrix} \\ l5 \rightarrow l5/5 \begin{bmatrix} -1 & 0 & -2 & 0 & 0 & 1 & 0 & 2a+b \\ 0 & 1 & 4 & 1 & 2 & 0 & 3 & b+a \\ 0 & 0 & 1 & 1/3 & 4/3 & 0 & 5/3 & c+a/3 \\ 0 & 0 & 1 & 0 & 2/5 & 0 & 3/5 & -d+3a-2b/5 \\ 0 & 0 & -1 & 1/5 & 0 & -1/5 & -1/5 & e-b+a/5 \\ 0 & 0 & 3 & 2 & 2 & 0 & 2 & b+a/3 \\ 0 & 0 & -1 & 1 & 2 & 2 & 2 & g+2a-b \end{bmatrix}$
$l6 \rightarrow l6/3 \begin{bmatrix} -1 & 0 & -2 & 0 & 0 & 1 & 0 & 2a+b \\ 0 & 1 & 4 & 1 & 2 & 0 & 3 & b+a \\ 0 & 0 & 1 & 1/3 & 4/3 & 0 & 5/3 & c+a/3 \\ 0 & 0 & 1 & 0 & 2/5 & 0 & 3/5 & -3d-14a+6b-2c \\ 0 & 0 & -1 & 1/5 & 0 & -1/5 & -1/5 & e-b+a/5 \\ 0 & 0 & 1 & 2/3 & 2/3 & 0 & 2/3 & f+a/3 \\ 0 & 0 & -1 & 1 & 2 & 2 & 2 & g+2a-b \end{bmatrix} \\ l4 \rightarrow l4 - l3 \begin{bmatrix} -1 & 0 & -2 & 0 & 0 & 1 & 0 & 2a+b \\ 0 & 1 & 4 & 1 & 2 & 0 & 3 & b+a \\ 0 & 0 & 1 & 1/3 & 4/3 & 0 & 5/3 & c+a/3 \\ 0 & 0 & 0 & -1/3 & -14/15 & 0 & 16/15 & -3d-14a+6b-3c \\ 0 & 0 & -1 & 1/5 & 0 & -1/5 & -1/5 & e-b+a/5 \\ 0 & 0 & 1 & 2/3 & 2/3 & 0 & 2/3 & f+a/3 \\ 0 & 0 & -1 & 1 & 2 & 2 & 2 & g+2a-b \end{bmatrix}$
$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} -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 & 1 & 2/3 & 2/3 & 0 & 2/3 \\ 0 & 0 & -1 & 1 & 2 & 2 & 2 \end{bmatrix} \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 & -1/3 & -14/15 & 0 & 16/15 \\ 0 & 0 & 0 & 8/15 & 4/3 & -1/5 & 22/15 \\ 0 & 0 & 0 & 1/3 & -2/3 & 0 & -1 \\ 0 & 0 & -1 & 1 & 2 & 2 & 2 \end{bmatrix} \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 & 0 & 1/3 & -2/3 & 0 & -1 \\ 0 & 0 & -1 & 1 & 2 & 2 & 2 \end{bmatrix} \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 & 0 & 1/3 & -2/3 & 0 & -1 \\ 0 & 0 & -1 & 1 & 2 & 2 & 2 \end{bmatrix} \begin{bmatrix} -1 & 0 & -2 & 0 & 0 & 1 & 0 \\ 0 & 1 & 4 & 1 & 2 & 0 & 3 \\ 0 & 0 & 0 & -1/3 & -14/15 & 0 & 16/15 \\ 0 & 0 & 0 & 8/15 & 4/3 & -1/5 & 22/15 \\ 0 & 0 & 0 & 1/3 & -2/3 & 0 & -1 \\ 0 & 0 & -1 & 1 & 2 & 2 & 2 \end{bmatrix} \begin{bmatrix} -1 & 0 & -2 & 0 & 0 & 1 & 0 \\ 0 & 1 & 4 & 1 & 2 & 0 & 3 \\ 0 & 0 & 0 & -1/3 & -14/15 & 0 & 16/15 \\ 0 & 0 & 0 & 8/15 & 4/3 & -1/5 & 22/15 \\ 0 & 0 & 0 & 1/3 & -2/3 & 0 & -1 \\ 0 & 0 & -1 & 1 & 2 & 2 & 2 \end{bmatrix} \begin{bmatrix} -1 & 0 & -2 & 0 & 0 & 1 & 0 \\ 0 & 1 & 4 & 1 & 2 & 0 & 3 \\ 0 & 0 & 0 & -1/3 & -14/15 & 0 & 16/15 \\ 0 & 0 & 0 & 8/15 & 4/3 & -1/5 & 22/15 \\ 0 & 0 & 0 & -1 & 1 & 2 & 2 & 2 \end{bmatrix} \begin{bmatrix} -1 & 0 & -2 & 0 & 0 & 1 & 0 \\ 0 & 1 & 4 & 1 & 2 & 0 & 3 \\ 0 & 0 & 0 & -1/3 & -14/15 & 0 & 16/15 \\ 0 & 0 & 0 & 0 & 1/3 & -2/3 & 0 & -1 \\ 0 & 0 & 0 & -1 & 1 & 2 & 2 & 2 \end{bmatrix} \begin{bmatrix} -1 & 0 & -2 & 0 & 0 & 1 & 0 \\ 0 & 0 & 1 & 1/3 & 4/3 & 0 & 5/3 \\ 0 & 0 & 0 & -1/3 & -14/15 & 0 $
$l7 \rightarrow l7 + l3 \begin{bmatrix} -1 & 0 & -2 & 0 & 0 & 1 & 0 & 2a+b \\ 0 & 1 & 4 & 1 & 2 & 0 & 3 & b+a \\ 0 & 0 & 1 & 1/3 & 4/3 & 0 & 5/3 & c+a/3 \\ 0 & 0 & 0 & -1/3 & -14/15 & 0 & 16/15 & \frac{-3d-14a+6b-3c}{15} \\ 0 & 0 & 0 & 8/15 & 4/3 & -1/5 & 22/15 & \frac{8a+3e-3b+3c}{15} \\ 0 & 0 & 0 & 1/3 & -2/3 & 0 & -1 & f-c/3 \\ 0 & 0 & 0 & 4/3 & 10/3 & 2 & 11/3 & \frac{3g+7a-3b+c}{3} \end{bmatrix} \\ l4 \rightarrow 3.l4 \begin{bmatrix} -1 & 0 & -2 & 0 & 0 & 1 & 0 & 2a+b \\ 0 & 1 & 4 & 1 & 2 & 0 & 3 & b+a \\ 0 & 0 & 1 & 1/3 & 4/3 & 0 & 5/3 & c+a/3 \\ 0 & 0 & 0 & 1 & 14/5 & 0 & 16/5 & \frac{-3d-14a+6b-3c}{5} \\ 0 & 0 & 0 & 8/15 & 4/3 & -1/5 & 22/15 & \frac{8a+3e-3b+3c}{15} \\ 0 & 0 & 0 & 8/15 & 4/3 & -1/5 & 22/15 & \frac{8a+3e-3b+3c}{15} \\ 0 & 0 & 0 & 1/3 & -2/3 & 0 & -1 & f-c/3 \\ 0 & 0 & 0 & 4/3 & 10/3 & 2 & 11/3 & \frac{3g+7a-3b+c}{3} \end{bmatrix}$
$l5 \rightarrow 15/8.l5 \begin{bmatrix} -1 & 0 & -2 & 0 & 0 & 1 & 0 & 2a+b \\ 0 & 1 & 4 & 1 & 2 & 0 & 3 & b+a \\ 0 & 0 & 1 & 1/3 & 4/3 & 0 & 5/3 & c+a/3 \\ 0 & 0 & 0 & 1 & 14/5 & 0 & 16/5 \\ 0 & 0 & 0 & 1 & 5/2 & -3/8 & 11/4 \\ 0 & 0 & 0 & 1/3 & -2/3 & 0 & -1 \\ 0 & 0 & 0 & 4/3 & 10/3 & 2 & 11/3 \end{bmatrix} \xrightarrow{\begin{array}{c} 2a+b \\ b+a \\ -3d-14a+6b-3c \\ 8a+3e-3b+3c \\ 8a+3e-3b+3c \\ 6-c/3 \\ 3 & 0 & 0 & 1 & 1/2 & 0 & 3 \\ 0 & 0 & 1 & 1/3 & 4/3 & 0 & 5/3 \\ 0 & 0 & 0 & 1 & 1/4 & 0 & 16/5 \\ 0 & 0 & 0 & 1 & 1/4 & 0 & 16/5 \\ 0 & 0 & 0 & 1 & 1/2 & 0 & 3 \\ 0 & 0 & 0 & 1 & 1/3 & 0 & 16/5 \\ 0 & 0 & 0 & 1 & 5/2 & -3/8 & 11/4 \\ 0 & 0 & 0 & 1 & -2 & 0 & -3 & \frac{8a+3e-3b+3c}{8a+3e-3b+3c} \\ 0 & 0 & 0 & 1 & -2 & 0 & -3 & \frac{6a+3e-3b+3c}{3a+3e-3b+3c} \\ 0 & 0 & 0 & 0 & 1 & -2 & 0 & -3 & \frac{3g+7a-3b+c}{3} \end{array} \end{bmatrix}$
$l5 \rightarrow l5 - l4 \begin{bmatrix} -1 & 0 & -2 & 0 & 0 & 1 & 0 & 2a+b \\ 0 & 1 & 4 & 1 & 2 & 0 & 3 & b+a \\ 0 & 0 & 1 & 1/3 & 4/3 & 0 & 5/3 & c+a/3 \\ 0 & 0 & 0 & 1 & 14/5 & 0 & 16/5 & \frac{-3d-14a+6b-}{5} \\ 0 & 0 & 0 & 0 & -3/10 & -3/8 & -9/20 & \frac{8a+3e-3b+3c}{8} \\ 0 & 0 & 0 & 1 & -2 & 0 & -3 & f-c \\ 0 & 0 & 0 & 1 & 5/2 & 3/2 & 11/4 & \frac{3g+7a-3b+c}{4} \end{bmatrix} \\ l6 \rightarrow l6 - l4 \begin{bmatrix} -1 & 0 & -2 & 0 & 0 & 1 & 0 & 2a+b \\ 0 & 1 & 4 & 1 & 2 & 0 & 3 & b+a \\ 0 & 0 & 1 & 1/3 & 4/3 & 0 & 5/3 & c+a/3 \\ 0 & 0 & 0 & 1 & 14/5 & 0 & 16/5 & \frac{-3d-14a+6b-}{5} \\ 0 & 0 & 0 & 1 & 14/5 & 0 & 16/5 & \frac{-3d-14a+6b-}{5} \\ 0 & 0 & 0 & 0 & -3/10 & -3/8 & -9/20 & \frac{-3d-14a+6b-}{5} \\ 0 & 0 & 0 & 0 & -24/5 & 0 & -31/5 & f-c \\ 0 & 0 & 0 & 1 & 5/2 & 3/2 & 11/4 & \frac{3g+7a-3b+c}{4} \end{bmatrix}$
$ 17 \rightarrow 17 - 14 \left[\begin{array}{cccccccccccccccccccccccccccccccccccc$

4

$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} $
$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+5c+11b-5c-8d}{4} \\ 0 & 0 & 0 & 0 & 0 & -5/4 & -5/24 & & \frac{-20c+30c-5f-45d-130a+60b}{24} \\ 0 & 0 & 0 & 0 & 0 & 1 & -5 & 3/2 & & -\frac{5g+7a+3b-5c-4d}{2} \end{bmatrix} $
$l6 \rightarrow -4/5.l6 \begin{bmatrix} -1 & 0 & -2 & 0 & 0 & 1 & 0 & & 2a+b \\ 0 & 1 & 4 & 1 & 2 & 0 & 3 & & b+a \\ 0 & 0 & 1 & 1/3 & 4/3 & 0 & 5/3 & & \frac{c+a}{3} \\ 0 & 0 & 0 & 1 & 14/5 & 0 & 16/5 & & -\frac{3d-14a+6b-5c}{5} \\ 0 & 0 & 0 & 0 & 1 & 5/4 & 3/2 & & -\frac{24a+5e+11b-5c-8d}{4} \\ 0 & 0 & 0 & 0 & 0 & 1 & 1/6 & & -\frac{4c+6e-f-9d-26a+12b}{6} \\ 0 & 0 & 0 & 0 & 0 & -25/4 & 0 & & \frac{-38a+5e-10g+5b+5c}{4} \end{bmatrix} \right] \\ = -4/25.l7 \begin{cases} -1 & 0 & -2 & 0 & 0 & 1 & 0 & & 2a+b & \\ 0 & 1 & 4 & 1 & 2 & 0 & 3 & & b+a & \\ 0 & 0 & 1 & 1/3 & 4/3 & 0 & 5/3 & & \frac{c+a}{3} & \\ 0 & 0 & 1 & 1/3 & 4/3 & 0 & 5/3 & & \frac{c+a}{3} & \\ 0 & 0 & 0 & 1 & 1/4/5 & 0 & 16/5 & & -\frac{3d-14a+6b-5c}{5} & \\ 0 & 0 & 0 & 1 & 1/4/5 & 0 & 16/5 & & -\frac{24a+5e+11b-5c-8d}{4} & \\ 0 & 0 & 0 & 0 & 1 & 5/4 & 3/2 & & -\frac{24a+5e+11b-5c-8d}{4} & \\ 0 & 0 & 0 & 0 & 0 & 1 & 1/6 & & -\frac{4c+6e-f-9d-26a+12b}{6} & \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 & 1/6 & & -\frac{38a+5e-10g+5b+5c}{4} & \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & & -\frac{38a+5e-10g+5b+5c}{4} & \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & & -\frac{38a+5e-10g+5b+5c}{4} & \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & & -\frac{38a+5e-10g+5b+5c}{4} & \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & & -\frac{38a+5e-10g+5b+5c}{4} & \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & & -\frac{38a+5e-10g+5b+5c}{4} & \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & & -\frac{38a+5e-10g+5b+5c}{4} & & -\frac{3a+5e-10g+5b+5c}{4} & &$
$l7 \rightarrow l7 - l6 \begin{bmatrix} -1 & 0 & -2 & 0 & 0 & 1 & 0 & & 2a+b \\ 0 & 1 & 4 & 1 & 2 & 0 & 3 & & b+a \\ 0 & 0 & 1 & 1/3 & 4/3 & 0 & 5/3 & & \frac{c+a}{3} \\ 0 & 0 & 0 & 1 & 14/5 & 0 & 16/5 & & -\frac{3d-14a+6b-5c}{5} \\ 0 & 0 & 0 & 0 & 1 & 5/4 & 3/2 & & -\frac{-24a+5e+11b-5c-8d}{6} \\ 0 & 0 & 0 & 0 & 0 & 1 & 1/6 & & -\frac{4c+6e-f-9d-26a+12b}{6} \\ 0 & 0 & 0 & 0 & 0 & 0 & -1/6 & & \frac{120e-422a+270b-130e-225d+60g-25f}{150} \end{bmatrix} \\ l7 \rightarrow -6.l7 \\ \begin{bmatrix} -1 & 0 & -2 & 0 & 0 & 1 & 0 & & 2a+b \\ 0 & 1 & 4 & 1 & 2 & 0 & 3 & & b+a \\ 0 & 0 & 1 & 1/3 & 4/3 & 0 & 5/3 & & \frac{c+a}{3} \\ 0 & 0 & 0 & 1 & 1/5 & 0 & 16/5 & & -\frac{3d-14a+6b-5c}{5} \\ 0 & 0 & 0 & 1 & 1/5 & 0 & 16/5 & & -\frac{3d-14a+6b-5c}{5} \\ 0 & 0 & 0 & 0 & 1 & 5/4 & 3/2 & & -\frac{-24a+5e+11b-5c-8d}{4} \\ 0 & 0 & 0 & 0 & 1 & 5/4 & 3/2 & & -\frac{-24a+5e+11b-5c-8d}{4} \\ 0 & 0 & 0 & 0 & 0 & 1 & 1/6 & & -\frac{4c+6e-f-9d-26a+12b}{6} \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 & & -\frac{120e-422a+270b-130e-225d+60g-25f}{25} \end{bmatrix}$
$l6 \rightarrow l6 - (1/6.l7) \left[\begin{array}{c ccccccccccccccccccccccccccccccccccc$
$l4 \rightarrow l4 - (16/5.l7) \left[\begin{array}{c ccccccccccccccccccccccccccccccccccc$
$ 2\rightarrow l2-(3.l7) \left[\begin{array}{c c c c c c c c c c c c c c c c c c c $
$11 \rightarrow l1 - l6 \\ \begin{array}{c ccccccccccccccccccccccccccccccccccc$
$13 \rightarrow l3 - (1/3.l4) \left[\begin{array}{c ccccccccccccccccccccccccccccccccccc$

	-1	0	-2	0	0	0	()	$\frac{12a + 5e + 30b - 10g + 5c}{25}$		-1	0	0	0	0	0	0	$\begin{array}{ c c c c c c c c c c c c c c c c c c c$
	0	1	0	0	0	0	()	-480g - 1070e - 3070b + 5883a + 1330c + 1565d + 195f 75		0	1	0	0	0	0	0	$\begin{array}{ c c c c c c c c c c c c c c c c c c c$
	0	0	1	0	0	0	()	$\frac{180g + 320e - 655c - 3042a + 1495b + 235d - 45f}{75}$		0	0	1	0	0	0	0	$\begin{array}{ c c c c c c c c c c c c c c c c c c c$
$12 \rightarrow l2 - (4.l3)$	0	0	0	1	0	0	()	$\frac{16g + 60e - 302d + 161a - 25b + 10c - 16f}{5}$		0	0	0	1	0	0	0	$\frac{16g + 60e - 302d + 161a - 25b + 10c - 16f}{5}$
	0	0	0	0	1	0	()	$\frac{60e - 1061a + 685b - 315c + 575d + 155g - 75f}{50}$		0	0	0	0	1	0	0	$\begin{array}{ c c c c c c c c c c c c c c c c c c c$
	0	0	0	0	0	1	()	$\frac{10g - 5e - 5c + 38a - 5b}{25}$		0	0	0	0	0	1	0	$\frac{10g - 5e - 5c + 38a - 5b}{25}$
	0	0	0	0	0	0	1	1	$-\frac{120e - 422a + 270b - 130c - 225d + 60g - 25f}{25}$		0	0	0	0	0	0	1	$-\frac{120e - 422a + 270b - 130c - 225d + 60g - 25f}{25}$

	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	$\frac{180g + 320e - 655c - 3042a + 1495b + 235d - 45f}{75}$
$l1 \rightarrow -1.l1$	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							

5 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; $\frac{19}{5}$