$$A = \begin{bmatrix} 0 & 2 & -1 \\ 3 & 5 & 6 \\ 4 & 4 & 8 \end{bmatrix}.$$

$$M_{11} = \begin{vmatrix} \cancel{3} & \cancel{1} & \cancel{-4} \\ \cancel{2} & 5 & 6 \\ \cancel{1} & 4 & 8 \end{vmatrix} = \begin{vmatrix} 5 & 6 \\ 4 & 8 \end{vmatrix} = 16.$$

$$M_{32} = \begin{vmatrix} 3 & 1 & -4 \\ 2 & 5 & 6 \\ 1 & 4 & 8 \end{vmatrix} = \begin{vmatrix} 3 & -4 \\ 2 & 6 \end{vmatrix} = 26.$$

$$\begin{bmatrix} + & - & + & - & \cdots \\ - & + & - & + & \cdots \\ + & - & + & - & \cdots \\ - & + & - & + & \cdots \\ \vdots & \vdots & \vdots & \vdots & \ddots \end{bmatrix}$$

$$A = \begin{bmatrix} 3 & 1 & 0 \\ -2 & -4 & 3 \\ 5 & 4 & -2 \end{bmatrix}$$

$$A = \begin{bmatrix} 1 & 0 & 0 & -1 \\ 3 & 1 & 2 & 2 \\ 1 & 0 & -2 & 1 \\ 2 & 0 & 0 & 1 \end{bmatrix}.$$

$$\det(A) = 1 \cdot \begin{vmatrix} 1 & 0 & -1 \\ 1 & -2 & 1 \\ 2 & 0 & 1 \end{vmatrix} = \begin{vmatrix} 1 & 0 & -1 \\ 1 & -2 & 1 \\ 2 & 0 & 1 \end{vmatrix}.$$

$$
\begin{aligned}
\begin{vmatrix} a_{11} & 0 & 0 & 0 \\ a_{21} & a_{22} & 0 & 0 \\ a_{31} & a_{32} & a_{33} & 0 \\ a_{41} & a_{42} & a_{43} & a_{44} \end{vmatrix} &= a_{11} \begin{vmatrix} a_{22} & 0 & 0 \\ a_{32} & a_{33} & 0 \\ a_{42} & a_{43} & a_{44} \end{vmatrix} \\
&= a_{11} a_{22} \begin{vmatrix} a_{33} & 0 \\ a_{43} & a_{44} \end{vmatrix} \\
&= a_{11} a_{22} a_{33} |a_{44}| \\
&= a_{11} a_{22} a_{33} a_{44}
\end{aligned}
$$

$$
\begin{vmatrix} a_{11} & a_{12} & a_{13} & \cdots & a_{1n} \\ 0 & a_{22} & a_{23} & \cdots & a_{2n} \\ 0 & 0 & a_{33} & \cdots & a_{3n} \\ \vdots & & & \ddots & \\ 0 & 0 & 0 & \cdots & a_{nn} \end{vmatrix} = a_{11} \begin{vmatrix} a_{22} & a_{23} & \cdots & a_{2n} \\ 0 & a_{33} & \cdots & a_{3n} \\ \vdots & & \ddots & \\ 0 & 0 & \cdots & a_{nn} \end{vmatrix} - a_{12} \begin{vmatrix} 0 & a_{23} & \cdots & a_{2n} \\ 0 & a_{33} & \cdots & a_{3n} \\ \vdots & & \ddots & \\ 0 & 0 & \cdots & a_{nn} \end{vmatrix}
$$

$$
+ a_{13} \begin{vmatrix} 0 & a_{22} & \cdots & a_{2n} \\ 0 & 0 & \cdots & a_{3n} \\ \vdots & & \ddots & \\ 0 & 0 & \cdots & a_{nn} \end{vmatrix} + \cdots + (-1)^{1+n} a_{1n} \begin{vmatrix} 0 & a_{22} & \cdots & a_{2\,n-1} \\ 0 & 0 & \cdots & a_{3\,n-1} \\ \vdots & & \ddots & \\ 0 & 0 & \cdots & 0 \end{vmatrix}
$$

$$\det(A) = a_{11}\begin{vmatrix} a_{22} & a_{23} & \cdots & a_{2n} \\ 0 & a_{33} & \cdots & a_{3n} \\ \vdots & & \ddots & \\ 0 & 0 & \cdots & a_{nn} \end{vmatrix} = a_{11}a_{22}a_{33}\cdots a_{nn}$$

$$\begin{vmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{vmatrix} \qquad \left|\begin{array}{ccc|cc} a_{11} & a_{12} & a_{13} & a_{11} & a_{12} \\ a_{21} & a_{22} & a_{23} & a_{21} & a_{22} \\ a_{31} & a_{32} & a_{33} & a_{31} & a_{32} \end{array}\right.$$

$$
\begin{vmatrix} a_{11} & a_{12} & a_{13} \\ a_{21} & a_{22} & a_{23} \\ a_{31} & a_{32} & a_{33} \end{vmatrix} = a_{11} \begin{vmatrix} a_{22} & a_{23} \\ a_{32} & a_{33} \end{vmatrix} - a_{12} \begin{vmatrix} a_{21} & a_{23} \\ a_{31} & a_{33} \end{vmatrix} + a_{13} \begin{vmatrix} a_{21} & a_{22} \\ a_{31} & a_{32} \end{vmatrix}
$$

$$
\begin{aligned}
&= a_{11}(a_{22}a_{33} - a_{23}a_{32}) - a_{12}(a_{21}a_{33} - a_{23}a_{31}) + a_{13}(a_{21}a_{32} - a_{22}a_{31}) \\
&= a_{11}a_{22}a_{33} + a_{12}a_{23}a_{31} + a_{13}a_{21}a_{32} - a_{13}a_{22}a_{31} - a_{12}a_{21}a_{33} - a_{11}a_{23}a_{32}
\end{aligned}
$$

$$\det(A) = \begin{array}{|ccc|cc} & & 0 & 36 & 4 \\ 3 & 1 & 0 & 3 & 1 \\ -2 & -4 & 3 & -2 & -4 \\ 5 & 4 & -2 & 5 & 4 \\ & & 24 & 15 & 0 \end{array}$$

$$= (24 + 15 + 0) - (0 + 36 + 4)$$

$$= -1$$

$$\begin{vmatrix} 1 & 0 & 0 & 0 \\ 0 & 3 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{vmatrix} = 3$$

El segundo renglón de I_4 fue multiplicado por 3

$$\begin{vmatrix} 0 & 0 & 0 & 1 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 1 & 0 & 0 & 0 \end{vmatrix} = -1$$

El primer y último renglón de I_4 fueron intercambiados

$$\begin{vmatrix} 1 & 0 & 0 & 7 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{vmatrix} = 1$$

Se sumo 7 veces el último renglón de I_4 al último renglón

$$\begin{bmatrix} 1 & -2 & 7 \\ -4 & 8 & 5 \\ 2 & -4 & 3 \end{bmatrix}, \qquad \begin{bmatrix} 3 & -1 & 4 & -5 \\ 6 & -2 & 5 & 2 \\ 5 & 8 & 1 & 4 \\ -9 & 3 & -12 & 15 \end{bmatrix}, \qquad \begin{bmatrix} 1 & 0 & 4 & -5 & 3 \\ 3 & -1 & 1 & 2 & 9 \\ -2 & 9 & 1 & 4 & -6 \\ 4 & 1 & -2 & 0 & 12 \\ -1 & 0 & 8 & 7 & -3 \end{bmatrix}.$$

$$A = \begin{bmatrix} 0 & 1 & 5 \\ 3 & -6 & 9 \\ 2 & 6 & 1 \end{bmatrix}.$$

$$
\begin{aligned}
\det(A) = \begin{vmatrix} 0 & 1 & 5 \\ 3 & -6 & 9 \\ 2 & 6 & 1 \end{vmatrix} &= -\begin{vmatrix} 3 & -6 & 9 \\ 0 & 1 & 5 \\ 2 & 6 & 1 \end{vmatrix} && \text{El primer y segundo renglón de } A \text{ fueron intercambiados} \\
&= -3\begin{vmatrix} 1 & -2 & 3 \\ 0 & 1 & 5 \\ 2 & 6 & 1 \end{vmatrix} && \text{Se tomó un múltiplo común de 3 del primer renglón} \\
&= -3\begin{vmatrix} 1 & -2 & 3 \\ 0 & 1 & 5 \\ 0 & 10 & -5 \end{vmatrix} && \text{Se sumó } -2 \text{ veces el primer renglón al tercer renglón} \\
&= -3\begin{vmatrix} 1 & -2 & 3 \\ 0 & 1 & 5 \\ 0 & 0 & -55 \end{vmatrix} && \text{Se sumó } -10 \text{ veces el segundo renglón al tercer renglón} \\
&= (-3)\big((1)(1)(-55)\big) && \text{Al ser triangular superior, el determinante es el producto de las componentes de la diagonal} \\
&= 165
\end{aligned}
$$

$$A = \begin{bmatrix} 1 & 0 & 0 & 3 \\ 2 & 7 & 0 & 6 \\ 0 & 6 & 3 & 0 \\ 7 & 3 & 1 & -5 \end{bmatrix}.$$

$$\det(A) = \begin{vmatrix} 1 & 0 & 0 & 0 \\ 2 & 7 & 0 & 0 \\ 0 & 6 & 3 & 0 \\ 7 & 3 & 1 & -26 \end{vmatrix} = (1)(7)(3)(-26) = -546.$$

$$A = \begin{bmatrix} 3 & 5 & -2 & 6 \\ 1 & 2 & -1 & 1 \\ 2 & 4 & 1 & 5 \\ 3 & 7 & 5 & 3 \end{bmatrix}.$$

$$\det(A) = \begin{vmatrix} 3 & 5 & -2 & 6 \\ 1 & 2 & -1 & 1 \\ 2 & 4 & 1 & 5 \\ 3 & 7 & 5 & 3 \end{vmatrix} = \begin{vmatrix} 0 & -1 & 1 & 3 \\ 1 & 2 & -1 & 1 \\ 0 & 0 & 3 & 3 \\ 0 & 1 & 8 & 0 \end{vmatrix}$$

Se sumó -2 veces el segundo renglón al tercer renglón, y se sumó -3 veces el segundo renglón al primer y último renglón

$$= -\begin{vmatrix} -1 & 1 & 3 \\ 0 & 3 & 3 \\ 1 & 8 & 0 \end{vmatrix}$$

Expandimos por cofactores a lo largo de la primer columna

$$= -\begin{vmatrix} -1 & 1 & 3 \\ 0 & 3 & 3 \\ 0 & 9 & 3 \end{vmatrix}$$

Se sumó 1 vez el primer renglón al segundo renglón

$$= -(-1)\begin{vmatrix} 3 & 3 \\ 9 & 3 \end{vmatrix}$$

Expandimos por cofactores a lo largo de la primer columna

$$= -18$$

$$\begin{vmatrix} ka_{11} & ka_{12} & ka_{13} \\ ka_{21} & ka_{22} & ka_{23} \\ ka_{31} & ka_{32} & ka_{33} \end{vmatrix} = k^3 \begin{vmatrix} a_{11} & a_{12} & a_{13} \\ a_{21} & a_{22} & a_{23} \\ a_{31} & a_{32} & a_{33} \end{vmatrix}.$$

$$\begin{vmatrix} 1 & 7 & 5 \\ 2 & 0 & 3 \\ 1+0 & 4+1 & 7+(-1) \end{vmatrix} = \begin{vmatrix} 1 & 7 & 5 \\ 2 & 0 & 3 \\ 1 & 4 & 7 \end{vmatrix} + \begin{vmatrix} 1 & 7 & 5 \\ 2 & 0 & 3 \\ 0 & 1 & -1 \end{vmatrix}.$$

$$A = \begin{bmatrix} 1 & 2 & 3 & 4 \\ 1 & 0 & 1 & 0 \\ 2 & 4 & 6 & 8 \\ 0 & 1 & 3 & 2 \end{bmatrix}$$

$$A = \begin{bmatrix} 3 & 2 & -1 \\ 1 & 6 & 3 \\ 2 & -4 & 0 \end{bmatrix}.$$

$$\begin{bmatrix} C_{11} & C_{12} & \cdots & C_{1n} \\ C_{21} & C_{22} & \cdots & C_{2n} \\ \vdots & \vdots & & \vdots \\ C_{n1} & C_{n2} & \cdots & C_{nn} \end{bmatrix}$$

$$\begin{bmatrix} 12 & 6 & -16 \\ 4 & 2 & 16 \\ 12 & -10 & 16 \end{bmatrix}$$

$$\operatorname{adj}(A) = \begin{bmatrix} 12 & 4 & 12 \\ 6 & 2 & -10 \\ -16 & 16 & 16 \end{bmatrix}.$$

$$A\,\mathrm{adj}(A) = \begin{bmatrix} a_{11} & a_{12} & \cdots & a_{1n} \\ a_{21} & a_{22} & \cdots & a_{2n} \\ \vdots & \vdots & & \vdots \\ a_{i1} & a_{i2} & \cdots & a_{in} \\ \vdots & \vdots & & \vdots \\ a_{n1} & a_{n2} & \cdots & a_{nn} \end{bmatrix} \begin{bmatrix} C_{11} & C_{21} & \cdots & C_{j1} & \cdots & C_{n1} \\ C_{12} & C_{22} & \cdots & C_{j2} & \cdots & C_{n2} \\ \vdots & \vdots & & \vdots & & \vdots \\ C_{1n} & C_{2n} & \cdots & C_{jn} & \cdots & C_{nn} \end{bmatrix}.$$

$$A\,\operatorname{adj}(A) = \begin{bmatrix} \det(A) & 0 & \cdots & 0 \\ 0 & \det(A) & \cdots & 0 \\ \vdots & \vdots & & \vdots \\ 0 & 0 & \cdots & \det(A) \end{bmatrix} = \det(A)I.$$

$$A^{-1} = \frac{1}{\det(A)}\,\mathrm{adj}(A) = \frac{1}{64}\begin{bmatrix} 12 & 4 & 12 \\ 6 & 2 & -10 \\ -16 & 16 & 16 \end{bmatrix} = \begin{bmatrix} \frac{12}{64} & \frac{4}{64} & \frac{12}{64} \\ \frac{6}{64} & \frac{2}{64} & -\frac{10}{64} \\ -\frac{16}{64} & \frac{16}{64} & \frac{16}{64} \end{bmatrix}.$$

$$D = \begin{vmatrix} 0 & x & y & z \\ x & 0 & z & y \\ y & z & 0 & x \\ z & y & x & 0 \end{vmatrix}.$$

$$\begin{vmatrix} x+y+z & x & y & z \\ x+y+z & 0 & z & y \\ x+y+z & z & 0 & x \\ x+y+z & y & x & 0 \end{vmatrix} = (x+y+z)\begin{vmatrix} 1 & x & y & z \\ 1 & 0 & z & y \\ 1 & z & 0 & x \\ 1 & y & x & 0 \end{vmatrix}.$$

$$\begin{vmatrix} x-y-z & x & y & z \\ x-z-y & 0 & z & y \\ y+z-x & z & 0 & x \\ z+y-x & y & x & 0 \end{vmatrix} = (y+z-x)\begin{vmatrix} -1 & x & y & z \\ -1 & 0 & z & y \\ 1 & z & 0 & x \\ 1 & y & x & 0 \end{vmatrix}.$$

$$\begin{vmatrix} y-x-z & x & y & z \\ x+z-y & 0 & z & y \\ y-z-x & z & 0 & x \\ z+x-y & y & x & 0 \end{vmatrix} = (x-y+z)\begin{vmatrix} -1 & x & y & z \\ 1 & 0 & z & y \\ -1 & z & 0 & x \\ 1 & y & x & 0 \end{vmatrix}.$$

$$\begin{vmatrix} z-x-y & x & y & z \\ x+y-z & 0 & z & y \\ y+x-z & z & 0 & x \\ z-y-x & y & x & 0 \end{vmatrix} = (x+y-z)\begin{vmatrix} -1 & x & y & z \\ 1 & 0 & z & y \\ 1 & z & 0 & x \\ -1 & y & x & 0 \end{vmatrix}.$$

$$D_n = \begin{vmatrix} 1 & x_1 & x_1^2 & \cdots & x_1^{n-1} \\ 1 & x_2 & x_2^2 & \cdots & x_2^{n-1} \\ \vdots & & & \ddots & \\ 1 & x_n & x_n^2 & \cdots & x_n^{n-1} \end{vmatrix}.$$

$$C_{nn} = (-1)^{n+n} D_{n-1} = \begin{vmatrix} 1 & x_1 & x_1^2 & \cdots & x_1^{n-2} \\ 1 & x_2 & x_2^2 & \cdots & x_2^{n-2} \\ \vdots & & & \ddots & \\ 1 & x_{n-1} & x_{n-1}^2 & \cdots & x_{n-1}^{n-2} \end{vmatrix}.$$

$$D_n = \begin{vmatrix} a_1 & x & x & \cdots & x \\ x & a_2 & x & \cdots & x \\ x & x & a_3 & \cdots & x \\ \vdots & & & \ddots & \\ x & x & x & \cdots & a_n \end{vmatrix}.$$

$$D_n = \begin{vmatrix} a_1 & x & \cdots & x & x \\ x & a_2 & \cdots & x & x \\ \vdots & & \ddots & & \vdots \\ x & x & \cdots & a_{n-1} & x \\ x & x & \cdots & x & x \end{vmatrix} + \begin{vmatrix} a_1 & x & \cdots & x & 0 \\ x & a_2 & \cdots & x & 0 \\ \vdots & & \ddots & & \vdots \\ x & x & \cdots & a_{n-1} & 0 \\ x & x & \cdots & x & a_n - x \end{vmatrix}.$$

$$D_n = \begin{vmatrix} 5 & 3 & 0 & 0 & \cdots & 0 & 0 \\ 2 & 5 & 3 & 0 & \cdots & 0 & 0 \\ 0 & 2 & 5 & 3 & \cdots & 0 & 0 \\ \vdots & & & & & & \\ 0 & 0 & 0 & 0 & \cdots & 2 & 5 \end{vmatrix}.$$

$$D_n = \begin{vmatrix} a_1 + b_1 & a_1 + b_2 & \dots & a_1 + b_n \\ a_2 + b_1 & a_2 + b_2 & \dots & a_2 + b_n \\ \vdots & \vdots & \ddots & \vdots \\ a_n + b_1 & a_n + b_2 & \dots & a_n + b_n \end{vmatrix}.$$

$$D_3 = \begin{vmatrix} a_1 & a_1 & a_1 \\ a_2+b_1 & a_2+b_2 & a_2+b_3 \\ a_3+b_1 & a_3+b_2 & a_3+b_3 \end{vmatrix} + \begin{vmatrix} b_1 & b_2 & b_3 \\ a_2+b_1 & a_2+b_2 & a_2+b_3 \\ a_3+b_1 & a_3+b_2 & a_3+b_3 \end{vmatrix}$$

$$= \begin{vmatrix} a_1 & a_1 & a_1 \\ a_2 & a_2 & a_2 \\ a_3+b_1 & a_3+b_2 & a_3+b_3 \end{vmatrix} + \begin{vmatrix} a_1 & a_1 & a_1 \\ b_1 & b_2 & b_3 \\ a_3+b_1 & a_3+b_2 & a_3+b_3 \end{vmatrix}$$

$$+ \begin{vmatrix} b_1 & b_2 & b_3 \\ a_2 & a_2 & a_2 \\ a_3+b_1 & a_3+b_2 & a_3+b_3 \end{vmatrix} + \begin{vmatrix} b_1 & b_2 & b_3 \\ b_1 & b_2 & b_3 \\ a_3+b_1 & a_3+b_2 & a_3+b_3 \end{vmatrix}$$

$$= \begin{vmatrix} a_1 & a_1 & a_1 \\ a_2 & a_2 & a_2 \\ a_3 & a_3 & a_3 \end{vmatrix} + \begin{vmatrix} a_1 & a_1 & a_1 \\ a_2 & a_2 & a_2 \\ b_1 & b_2 & b_3 \end{vmatrix} + \begin{vmatrix} a_1 & a_1 & a_1 \\ b_1 & b_2 & b_3 \\ a_3 & a_3 & a_3 \end{vmatrix} + \begin{vmatrix} a_1 & a_1 & a_1 \\ b_1 & b_2 & b_3 \\ b_1 & b_2 & b_3 \end{vmatrix}$$

$$+ \begin{vmatrix} b_1 & b_2 & b_3 \\ a_2 & a_2 & a_2 \\ a_3 & a_3 & a_3 \end{vmatrix} + \begin{vmatrix} b_1 & b_2 & b_3 \\ a_2 & a_2 & a_2 \\ b_1 & b_2 & b_3 \end{vmatrix} + \begin{vmatrix} b_1 & b_2 & b_3 \\ b_1 & b_2 & b_3 \\ a_3 & a_3 & a_3 \end{vmatrix} + \begin{vmatrix} b_1 & b_2 & b_3 \\ b_1 & b_2 & b_3 \\ b_1 & b_2 & b_3 \end{vmatrix}$$

$$D = \begin{vmatrix} a_{11} & a_{12} & a_{13} \\ a_{21} & a_{22} & a_{23} \\ a_{31} & a_{32} & a_{33} \end{vmatrix}, \quad D' = \begin{vmatrix} a_{11}+x & a_{12}+x & a_{13}+x \\ a_{21}+x & a_{22}+x & a_{23}+x \\ a_{31}+x & a_{32}+x & a_{33}+x \end{vmatrix}.$$

$$
\begin{aligned}
D' = &\begin{vmatrix} a_{11} & a_{12} & a_{13} \\ a_{21} & a_{22} & a_{23} \\ a_{31} & a_{32} & a_{33} \end{vmatrix} + \begin{vmatrix} x & x & x \\ a_{21} & a_{22} & a_{23} \\ a_{31} & a_{32} & a_{33} \end{vmatrix} + \begin{vmatrix} a_{11} & a_{12} & a_{13} \\ x & x & x \\ a_{31} & a_{32} & a_{33} \end{vmatrix} + \begin{vmatrix} a_{11} & a_{12} & a_{13} \\ a_{21} & a_{22} & a_{23} \\ x & x & x \end{vmatrix} \\
&+ \begin{vmatrix} x & x & x \\ x & x & x \\ a_{31} & a_{32} & a_{33} \end{vmatrix} + \begin{vmatrix} x & x & x \\ a_{21} & a_{22} & a_{23} \\ x & x & x \end{vmatrix} + \begin{vmatrix} a_{11} & a_{12} & a_{13} \\ x & x & x \\ x & x & x \end{vmatrix} + \begin{vmatrix} x & x & x \\ x & x & x \\ x & x & x \end{vmatrix} \\
= &\, D + \begin{vmatrix} x & x & x \\ a_{21} & a_{22} & a_{23} \\ a_{31} & a_{32} & a_{33} \end{vmatrix} + \begin{vmatrix} a_{11} & a_{12} & a_{13} \\ x & x & x \\ a_{31} & a_{32} & a_{33} \end{vmatrix} + \begin{vmatrix} a_{11} & a_{12} & a_{13} \\ a_{21} & a_{22} & a_{23} \\ x & x & x \end{vmatrix}
\end{aligned}
$$

$$\begin{vmatrix} x & x & x \\ a_{21} & a_{22} & a_{23} \\ a_{31} & a_{32} & a_{33} \end{vmatrix} = x \sum_{j=1}^{3} C_{1j}, \quad \begin{vmatrix} a_{11} & a_{12} & a_{13} \\ x & x & x \\ a_{31} & a_{32} & a_{33} \end{vmatrix} = x \sum_{j=1}^{3} C_{2j},$$

$$\begin{vmatrix} a_{11} & a_{12} & a_{13} \\ a_{21} & a_{22} & a_{23} \\ x & x & x \end{vmatrix} = x \sum_{j=1}^{3} C_{3j}.$$

$$D = \begin{vmatrix} a_{11} & a_{12} & \dots & a_{1n} \\ a_{21} & a_{22} & \cdots & a_{2n} \\ \vdots & & \ddots & \vdots \\ a_{n1} & a_{n2} & \dots & a_{nn} \end{vmatrix}, \quad D' = \begin{vmatrix} a_{11}+x & a_{12}+x & \dots & a_{1n}+x \\ a_{21}+x & a_{22}+x & \cdots & a_{2n}+x \\ \vdots & & \ddots & \vdots \\ a_{n1}+x & a_{n2}+x & \dots & a_{nn}+x \end{vmatrix}.$$

$$D = \begin{vmatrix} a_1 - x & 0 & 0 & \cdots & 0 \\ 0 & a_2 - x & 0 & \cdots & 0 \\ 0 & 0 & a_3 - x & \cdots & 0 \\ \vdots & & & \ddots & \\ 0 & 0 & 0 & \cdots & a_n - x \end{vmatrix}.$$

$$\mathbb{b} = \begin{bmatrix} b_1 \\ b_2 \\ \vdots \\ b_n \end{bmatrix}.$$

$$\mathbb{x} = A^{-1}\mathbb{b} = \frac{1}{\det(A)}\,\mathrm{adj}(A)\mathbb{b} = \frac{1}{\det(A)}\begin{bmatrix} C_{11} & C_{21} & \cdots & C_{n1} \\ C_{12} & C_{22} & \cdots & C_{n2} \\ \vdots & & \ddots & \vdots \\ C_{1n} & C_{2n} & \cdots & C_{nn} \end{bmatrix}\begin{bmatrix} b_1 \\ b_2 \\ \vdots \\ b_n \end{bmatrix}.$$

$$\mathbb{x} = \frac{1}{\det(A)} \begin{bmatrix} b_1 C_{11} + b_2 C_{21} + \cdots + b_n C_{n1} \\ b_1 C_{12} + b_2 C_{22} + \cdots + b_n C_{n2} \\ \vdots \\ b_1 C_{1n} + b_2 C_{2n} + \cdots + b_n C_{nn} \end{bmatrix}.$$

$$A_j = \begin{bmatrix} a_{11} & a_{12} & \cdots & a_{1\,j-1} & b_1 & a_{1\,j+1} & \cdots & a_{1n} \\ a_{21} & a_{22} & \cdots & a_{2\,j-1} & b_2 & a_{2\,j+1} & \cdots & a_{2n} \\ \vdots & \vdots & & \vdots & \vdots & \vdots & & \vdots \\ a_{n1} & a_{n2} & \cdots & a_{n\,j-1} & b_n & a_{n\,j+1} & \cdots & a_{nn} \end{bmatrix}.$$

$$A = \begin{bmatrix} 1 & 0 & 2 \\ -3 & 4 & 6 \\ -1 & -2 & 3 \end{bmatrix} \quad A_1 = \begin{bmatrix} 6 & 0 & 2 \\ 30 & 4 & 6 \\ 8 & -2 & 3 \end{bmatrix}$$

$$A_2 = \begin{bmatrix} 1 & 6 & 2 \\ -3 & 30 & 6 \\ -1 & 8 & 3 \end{bmatrix} \quad A_3 = \begin{bmatrix} 1 & 0 & 6 \\ -3 & 4 & 30 \\ -1 & -2 & 8 \end{bmatrix}$$

$$W(x) = \begin{vmatrix} f_1(x) & f_2(x) & \cdots & f_n(x) \\ f_1'(x) & f_2'(x) & \cdots & f_n'(x) \\ \vdots & \vdots & & \vdots \\ f_1^{(n-1)}(x) & f_2^{(n-1)}(x) & \cdots & f_n^{(n-1)}(x) \end{vmatrix}$$

$$\begin{bmatrix} f_1(x) & f_2(x) & \cdots & f_n(x) \\ f_1'(x) & f_2'(x) & \cdots & f_n'(x) \\ \vdots & \vdots & & \vdots \\ f_1^{(n-1)}(x) & f_2^{(n-1)}(x) & \cdots & f_n^{(n-1)}(x) \end{bmatrix} \begin{bmatrix} k_1 \\ k_2 \\ \vdots \\ k_n \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \\ \vdots \\ 0 \end{bmatrix}$$

$$S = \frac{1}{2}\,\mathrm{abs}\left(\begin{vmatrix} x_1 & y_1 & 1 \\ x_2 & y_2 & 1 \\ x_3 & y_3 & 1 \end{vmatrix}\right),$$

$$S = \frac{1}{2} \operatorname{abs} \left(\begin{vmatrix} -5 & 0 & 1 \\ 7 & 0 & 1 \\ 0 & 6 & 1 \end{vmatrix} \right) = \frac{1}{2}(72) = 36 \text{ unidades}^2.$$

$$
\begin{aligned}
S &= \frac{1}{2}\,\text{abs}\left(\begin{vmatrix} 0 & 0 & 1 \\ 2 & 4 & 1 \\ 7 & 2 & 1 \end{vmatrix}\right) + \frac{1}{2}\,\text{abs}\left(\begin{vmatrix} 0 & 0 & 1 \\ 7 & 2 & 1 \\ 5 & -3 & 1 \end{vmatrix}\right) + \frac{1}{2}\,\text{abs}\left(\begin{vmatrix} 0 & 0 & 1 \\ 5 & -3 & 1 \\ 3 & -5 & 1 \end{vmatrix}\right) \\
&= \frac{1}{2}(24 + 31 + 16) \\
&= \frac{71}{2}\ \text{unidades}^2
\end{aligned}
$$

$$\mathbb{x} = \begin{pmatrix} x_1 \\ x_2 \\ x_3 \end{pmatrix}, \quad \mathbb{y} = \begin{pmatrix} y_1 \\ y_2 \\ y_3 \end{pmatrix}$$

$$\mathbb{u} = \begin{pmatrix} u_1 \\ u_2 \\ u_3 \end{pmatrix}, \quad \mathbb{v} = \begin{pmatrix} v_1 \\ v_2 \\ v_3 \end{pmatrix}$$

$$\mathbb{u} = \begin{pmatrix} 0 \\ 1 \\ 2 \end{pmatrix}, \quad \mathbb{v} = \begin{pmatrix} 0 \\ 5 \\ 0 \end{pmatrix}.$$

$$\mathbb{0} = \begin{pmatrix} 0 \\ 0 \\ 0 \end{pmatrix}, \quad \mathbb{u} = \begin{pmatrix} u_1 \\ u_2 \\ u_3 \end{pmatrix}, \quad \mathbb{v} = \begin{pmatrix} v_1 \\ v_2 \\ v_3 \end{pmatrix}$$

$$\mathbb{u} = \begin{pmatrix} u_1 \\ u_2 \\ u_3 \end{pmatrix}, \quad \mathbb{v} = \begin{pmatrix} v_1 \\ v_2 \\ v_3 \end{pmatrix}, \quad \mathbb{w} = \begin{pmatrix} w_1 \\ w_2 \\ w_3 \end{pmatrix}$$

$$\mathbb{v} - \mathbb{u} = \begin{pmatrix} v_1 - u_1 \\ v_2 - u_2 \\ v_3 - u_3 \end{pmatrix}, \quad \mathbb{w} - \mathbb{u} = \begin{pmatrix} w_1 - u_1 \\ w_2 - u_2 \\ w_3 - u_3 \end{pmatrix}.$$

$$\mathbb{u} = \begin{pmatrix} 1 \\ 0 \\ 0 \end{pmatrix}, \quad \mathbb{v} = \begin{pmatrix} 0 \\ 1 \\ 0 \end{pmatrix}, \quad \mathbb{w} = \begin{pmatrix} 0 \\ 0 \\ 1 \end{pmatrix}.$$

$$\mathbb{v} - \mathbb{u} = \begin{pmatrix} -1 \\ 1 \\ 0 \end{pmatrix}, \quad \mathbb{w} - \mathbb{u} = \begin{pmatrix} -1 \\ 0 \\ 1 \end{pmatrix}.$$

$$\beta = \begin{pmatrix} x \\ y \\ z \end{pmatrix}$$

$$\beta = k \begin{pmatrix} u_2 v_3 - u_3 v_2 \\ u_3 v_1 - u_1 v_3 \\ u_1 v_2 - u_2 v_1 \end{pmatrix}.$$

$$\mathbb{u} \times \mathbb{v} = \begin{pmatrix} u_2 v_3 - u_3 v_2 \\ u_3 v_1 - u_1 v_3 \\ u_1 v_2 - u_2 v_1 \end{pmatrix}.$$

$$V = \text{abs}\left(\begin{vmatrix} u_1 & v_1 & w_1 \\ u_2 & v_2 & w_2 \\ u_3 & v_3 & w_3 \end{vmatrix}\right).$$

$$\mathbb{x}_1 = \begin{pmatrix} 1 \\ 0 \\ 0 \end{pmatrix}, \quad \mathbb{x}_2 = \begin{pmatrix} 0 \\ 2 \\ 0 \end{pmatrix}, \quad \mathbb{x}_3 = \begin{pmatrix} 0 \\ 0 \\ 1 \end{pmatrix}.$$

$$V = \text{abs}\left(\begin{vmatrix} 1 & 0 & 0 \\ 0 & 2 & 0 \\ 0 & 0 & 1 \end{vmatrix}\right) = 2 \text{ unidades}^3.$$