① $\begin{vmatrix} 3 & -5 \\ 2 & 6 \end{vmatrix}$

$3(6) - 2(-5) = 18 + 10 =$ **28** ①

② $\begin{vmatrix} 4 & 1 \\ 0 & -3 \end{vmatrix}$

$4(-3) - 0(1) = -12 - 0 =$ **-12** ②

③ $\begin{vmatrix} -1 & 0 & 2 \\ 3 & 1 & 4 \\ 2 & 0 & -6 \end{vmatrix}$ $\xrightarrow{\begin{matrix} e_2 + 3e_1 \to e_2 \\ e_3 + 2e_1 \to e_3 \end{matrix}}$ $\begin{vmatrix} -1 & 0 & 2 \\ 0 & 1 & 10 \\ 0 & 0 & -2 \end{vmatrix}$

$|B| = (-1)(1)(-2) = 2$ $\quad |B| = c\,|A|$

$|B| = |A|$

$|A| = 2$ ③

④ $\begin{vmatrix} 2 & 1 & -1 \\ 3 & -2 & 0 \\ 5 & 1 & 6 \end{vmatrix}$ $\longrightarrow$ $\begin{matrix} 2 & 1 & -1 & 2 & 1 \\ 3 & -2 & 0 & 3 & -2 \\ 5 & 1 & 6 & 5 & 1 \end{matrix}$

$2(-2)(6) + (1)(0)(5) + (-1)(3)(1) - 5(-2)(-1) + 1(0)(2)$

$+ 6(3)(1) = -24 + 0 - 3 - (10 + 0 + 18) = -27 - 28$

$|A| = -55$ ④

(5) $\begin{vmatrix} -3 & 2 & 4 \\ 1 & -1 & 2 \\ -1 & 4 & 0 \end{vmatrix} \xrightarrow[3e_3 - e_1]{3e_2 + e_1} \begin{vmatrix} -3 & 2 & 4 \\ 0 & -1 & 10 \\ 0 & 10 & -4 \end{vmatrix}$ 3x 3x

96×3

$e_3 + 10e_2 \to e_3 \longrightarrow \begin{vmatrix} -3 & 2 & 4 \\ 0 & -1 & 10 \\ 0 & 0 & 96 \end{vmatrix}$

$|B| = 96(-1)(-3)$

$|B| = 288$

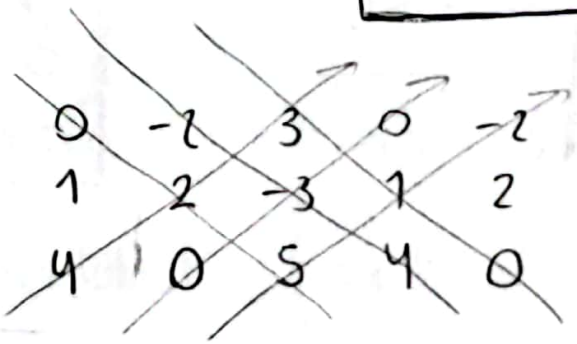
$9 \overline{)288}$ 32, 18

$|B| = c|A| \quad = \quad |B| = 3(3)|A| \qquad 288 = 9|A|$

$|A| = \frac{288}{9} = 32$

(5) $\boxed{|A| = 32}$

(6) $\begin{vmatrix} 0 & -2 & 3 \\ 1 & 2 & -3 \\ 4 & 0 & 5 \end{vmatrix}$



$0(2)(5) + (-2)(-3)(4) + 3(1)(0) - 4(2)(3) + (0)(-3)(0) + 5(1)(-2) = 0 + 24 + 0 - (24 + 0 - 10)$

$24 - 14 = 10$

(6) $\boxed{|A| = 10}$

(7) $\begin{vmatrix} -2 & 3 & 6 \\ 4 & 1 & 8 \\ -2 & 0 & 0 \end{vmatrix}$ $\xrightarrow{\begin{matrix} e_2 + 2e_1 \to e_2 \\ e_3 - e_1 \to e_3 \end{matrix}}$ $\begin{vmatrix} -2 & 3 & 6 \\ 0 & 7 & 20 \\ 0 & -3 & -6 \end{vmatrix}$ $\longrightarrow$

$= -2\,C_1 + 0C_2 + 0C_3$

$C_{f1} = \begin{vmatrix} 7 & 20 \\ -3 & -6 \end{vmatrix} = 7(-6) - (-3)(20) = -42 + 60 = 6$

$-2(18) = \underline{-36}$

(7) $\boxed{|A| = -36}$

(8) $\begin{vmatrix} 2 & -1 & 3 \\ 4 & 0 & 6 \\ 5 & -2 & 3 \end{vmatrix}$ $\xrightarrow{\begin{matrix} e_2 - 2e_1 \to e_2 \\ e_3(2) \to e_3 \end{matrix}}$ $\begin{vmatrix} 2 & -1 & 3 \\ 0 & 2 & 0 \\ 10 & -4 & 6 \end{vmatrix}$ $\begin{matrix} 2x \\ 2x \end{matrix}$

$e_3 - 5e_1 \longrightarrow \begin{vmatrix} 2 & -1 & 3 \\ 0 & 2 & 0 \\ 0 & 1 & -9 \end{vmatrix}$ $2e_3 - e_2 \longrightarrow \begin{vmatrix} 2 & -1 & 3 \\ 0 & 2 & 0 \\ 0 & 0 & -18 \end{vmatrix}$

$|B| = 2(2)(-18) = -72$

$|B| = c|A|$ $\quad -72 = 2(2)|A|$

$-72 = 4|A|$

$\frac{-72}{4} = |A|$

(8) $\boxed{|A| = -18}$

$\begin{array}{r} 18 \\ \times 2 \\ \hline 36 \\ \times 2 \\ \hline 72 \end{array}$

$\begin{array}{r|l} & -18 \\ -4 & 72 \\ & 32 \end{array}$

(9)

$$\begin{vmatrix} 1 & -1 & 2 & 4 \\ 0 & -3 & 5 & 6 \\ 1 & 4 & 0 & 3 \\ 0 & 5 & -6 & 7 \end{vmatrix} \xrightarrow{e_3 - e_1 \to e_3} \begin{vmatrix} 1 & -1 & 2 & 4 \\ 0 & -3 & 5 & 6 \\ 0 & -5 & 2 & 1 \\ 0 & 5 & -6 & 7 \end{vmatrix} \quad e_2(5) \to e_2 \quad \times 5 \quad \times 3 \quad \times 3$$

$$\begin{vmatrix} 1 & -1 & 2 & 4 \\ 0 & -15 & 25 & 30 \\ 0 & 5 & -2 & -1 \\ 0 & 5 & -6 & 7 \end{vmatrix} \xrightarrow[e_4(3) \to e_4]{e_3(3)\, e_3} \begin{vmatrix} 1 & -1 & 2 & 4 \\ 0 & -15 & 25 & 30 \\ 0 & 15 & -6 & -3 \\ 0 & 15 & -18 & 21 \end{vmatrix} \xrightarrow[e_4 + e_2 \to e_4]{e_3 + e_2 \to e_3}$$

$$\begin{vmatrix} 1 & -1 & 2 & 4 \\ 0 & -15 & 25 & 30 \\ 0 & 0 & 19 & 27 \\ 0 & 0 & 7 & 51 \end{vmatrix}$$

$$\begin{array}{r} 51 \\ \times\ 19 \\ \hline 459 \\ 51 \\ \hline 969 \end{array} \qquad \begin{array}{r} 27 \\ \times\ 7 \\ \hline 189 \end{array} \qquad \begin{array}{r} 780 \\ \times\ 15 \\ \hline 13900 \\ 780 \\ \hline 11700 \end{array}$$

$$\begin{array}{r} 969 \\ -189 \\ \hline 780 \end{array}$$

$$45 \overline{)\,11700} \quad 260 \quad (270)$$

$$|B| = 1(-15)(19(51) - (27)(7))$$

$$|B| = -15(969 - 189) \qquad |B| = -15(780)$$

$$|B| = c|A| \qquad -11700 = 5(3)(3)|A|$$

$$-11700 = 5(9)|A|$$

$$-11700 = 45|A|$$

$$|A| = \frac{-11700}{45}$$

(9)

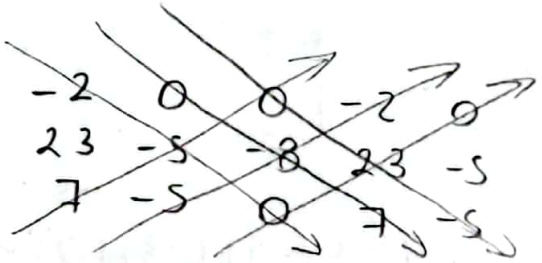
$$\boxed{|A| = -260}$$

(10) $\begin{vmatrix} 2 & -3 & 1 & 4 \\ 0 & -2 & 0 & 0 \\ 3 & 7 & -1 & 2 \\ 4 & 1 & -3 & 8 \end{vmatrix}$ $e_3(2)\to e_3$, $e_4-2e_1\to e_4$ $\begin{vmatrix} 2 & -3 & 1 & 4 \\ 0 & -2 & 0 & 0 \\ 6 & 14 & -2 & 4 \\ 0 & 7 & -5 & 0 \end{vmatrix}$ ×2

e_3-3e_1 $\begin{vmatrix} 2 & -3 & 1 & 4 \\ 0 & -2 & 0 & 0 \\ 0 & 23 & -5 & -8 \\ 0 & 7 & -5 & 0 \end{vmatrix}$

$|B| = 2C_{f1}$

$C_{f1} = \begin{vmatrix} -2 & 0 & 0 \\ 23 & -5 & -8 \\ 7 & -5 & 0 \end{vmatrix}$ →



$7(-5)(0)+(-5)(-8)(-2)+0(23)(0)-(-2)(-5)(0)+(0)(-8)(7)-0(23)(-5) = -80$

$|B| = -2(-80) = 160$

$|B| = c|A|$ $\quad -160 = -2|A|$

$|A| = \frac{-160}{-2} = +80$ (10)

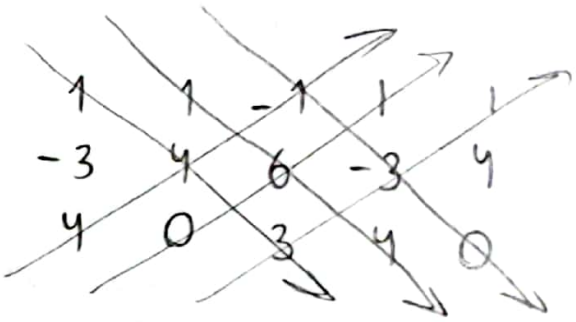
$|A| = 80$

(11)
$$\begin{vmatrix} 1 & 1 & -1 & 0 \\ -3 & 4 & 6 & 0 \\ 2 & 5 & -1 & 3 \\ 4 & 0 & 3 & 0 \end{vmatrix} \qquad \begin{vmatrix} + & - & + & - \\ - & + & - & + \\ + & - & + & - \\ - & + & - & + \end{vmatrix}$$

$$|A| = -0C_{f1} + 0C_{f2} - 3C_{f3} + 0C_{f4}$$

$$|A| = -3C_{f3}$$

$$C_{f3} = \begin{vmatrix} 1 & 1 & -1 \\ -3 & 4 & 6 \\ 4 & 0 & 3 \end{vmatrix} \rightarrow$$



$$1(4)(3) + 1(6)(4) + (-1)(-3)(0) - 4(4)(-1) + (0)(6)(1) + 3(-3)(1)$$

$$12 + 24 - (-16 - 9) = 36 - (-25) = 36 + 25 = 61$$

$$|A| = -3(61)$$ (11)

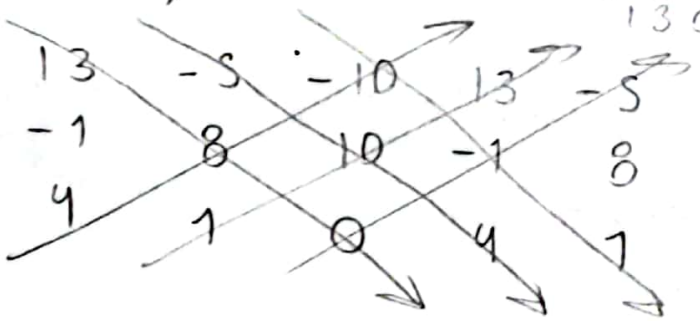
$$\boxed{|A| = -183}$$

(12) $\begin{vmatrix} 3 & -1 & 2 & 1 \\ 4 & 3 & 1 & -2 \\ -1 & 0 & 2 & 3 \\ 6 & 2 & 5 & 2 \end{vmatrix} \xrightarrow[e_3(3)\to e_3]{e_2(3)\to e_2} \begin{vmatrix} 3 & -1 & 2 & 1 \\ 12 & 9 & 3 & -6 \\ -3 & 0 & 6 & 9 \\ 6 & 2 & 5 & 2 \end{vmatrix}$ $\times 3$ $\times 3$

$\begin{vmatrix} 3 & -1 & 2 & 1 \\ 0 & 13 & -5 & -10 \\ 0 & -1 & 8 & 10 \\ 0 & 4 & 1 & 0 \end{vmatrix}$ $\begin{vmatrix} + & - & + & - \\ - & + & - & + \\ + & - & + & - \\ - & + & - & + \end{vmatrix}$

$|B| = 3C_{f1} - 0C_{f2} + 0C_{f3} - 0C_{f4}$

$C_{f1} = \begin{vmatrix} 13 & -5 & -10 \\ -1 & 8 & 10 \\ 4 & 1 & 0 \end{vmatrix}$



$C_{f1} = 13(8)(0) + (-5)(10)(4) + (-10)(-1)(1) - 4(8)(-10) + 1(10)(13) + 0(-1)(-5)$

$-200 + 10 - (-320 + 130) = -190 - (-190)$

$C_{f1} = -190 + 190 = 0$

$|B| = 3|0| = 0$ $\quad |B| = c|A| \quad 0 = 9|A|$

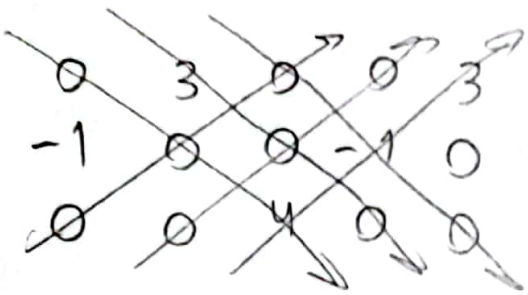
$|A| = \frac{0}{9} = 0$ $\quad \boxed{|A| = 0}$ (12)

(13) $\begin{vmatrix} 2 & 0 & 0 & 0 \\ 0 & 0 & 3 & 0 \\ 0 & -1 & 0 & 0 \\ 0 & 0 & 0 & 4 \end{vmatrix}$

$|A| = 2\,C_{f1} - 0C_{f2} + 0C_{f3} - 0C_{f4}$

$|A| = 2C_{f1}$

$C_{f1} = \begin{vmatrix} 0 & 3 & 0 \\ -1 & 0 & 0 \\ 0 & 0 & 4 \end{vmatrix}$



$C_{f1} = 0 + 0 + 0 - (0 + 0 + 4(-1)(3))$

$C_{f1} = -(-12)$

$C_{f1} = 12$

$|A| = 2(12)$

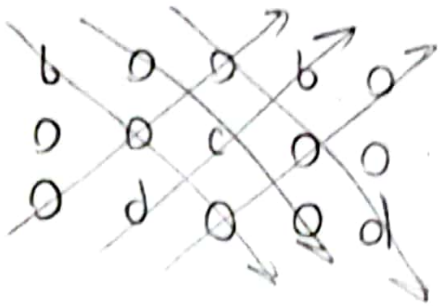
(13) $\boxed{|A| = 24}$

(14) $\begin{vmatrix} 0 & a & 0 & 0 \\ b & 0 & 0 & 0 \\ 0 & 0 & 0 & c \\ 0 & 0 & d & 0 \end{vmatrix}$ $\begin{vmatrix} + & - & + & - \\ - & + & - & + \\ + & - & + & - \\ - & + & - & + \end{vmatrix}$

$|A| = 0C_{f1} - aC_{f2} + 0C_{f3} - 0C_{f4}$

$|A| = -aC_{f2}$

C_{f2} $\begin{vmatrix} b & 0 & 0 \\ 0 & 0 & c \\ 0 & d & 0 \end{vmatrix}$



$C_{f2} = 0 - dcb$ $|A| = -a(-dcb)$ $\boxed{|A| = abcd}$

$C_{f2} = -dcb$

(15)
$$\begin{vmatrix} 1 & 2 & 0 & 0 \\ 3 & -2 & 0 & 0 \\ 0 & 0 & 1 & -5 \\ 0 & 0 & 7 & 2 \end{vmatrix} \xrightarrow[e_4 - 7e_1 \to e_4]{e_2 - 3e_1 \to e_2} \begin{vmatrix} 1 & 2 & 0 & 0 \\ 0 & -8 & 0 & 0 \\ 0 & 0 & 1 & -5 \\ 0 & 0 & 0 & 37 \end{vmatrix}$$

$$|A| = 1(-8)(1)(37) \qquad \begin{array}{r} 5 \\ \times\ 37 \\ \hline 8 \\ \hline 296 \end{array}$$

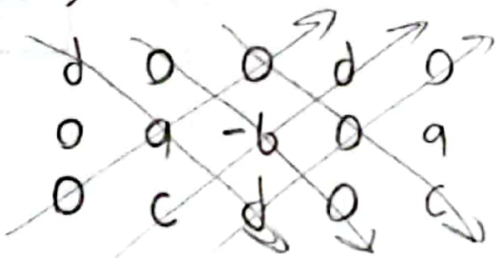
$$|A| = -296$$

(15)
$$\boxed{|A| = -296}$$

(16)
$$\begin{vmatrix} a & b & 0 & 0 \\ c & d & 0 & 0 \\ 0 & 0 & a & -b \\ 0 & 0 & c & d \end{vmatrix} \cdot \begin{vmatrix} + & - & + & - \\ - & + & - & + \\ + & - & + & - \\ - & + & - & + \end{vmatrix}$$

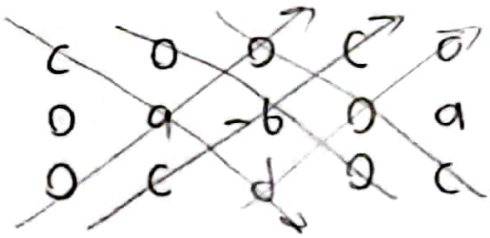
$$|A| = a C_{f1} - b C_{f2} + 0 C_{f3} - 0 C_{f4} \qquad |A| = a C_{f1} - b C_{f2}$$

$$C_{f1} = \begin{vmatrix} d & 0 & 0 \\ 0 & a & -b \\ 0 & c & d \end{vmatrix}$$



$$C_{f1} = dad - (-bdc) = d^2a + bdc$$

$$C_{f2} = \begin{vmatrix} c & 0 & 0 \\ 0 & a & -b \\ 0 & c & d \end{vmatrix}$$



(16)
$$\boxed{|A| = a^2d^2 - b^2c^2}$$

$$C_{f2} = cad - (-bc^2) = cad + bc^2$$

$$|A| = a(d^2a + bdc) - b(cad + bc^2)$$

$$|A| = a^2d^2 + abcd - abcd + b^2c^2$$

(17)
$$\begin{vmatrix} 2 & -1 & 0 & 4 & 1 \\ 3 & 1 & -1 & 2 & 0 \\ 3 & 2 & -2 & 5 & 1 \\ 0 & 0 & 4 & -1 & 6 \\ 3 & 2 & 1 & -1 & 1 \end{vmatrix} \xrightarrow{\substack{e_2 \times 2 \to e_2 \\ e_3 \times 2 \to e_3 \\ e_5 \times 2 \to e_5}} \begin{vmatrix} 2 & -1 & 0 & 4 & 1 \\ 6 & 2 & -2 & 4 & 0 \\ 6 & 4 & -4 & 10 & 2 \\ 0 & 0 & 4 & -1 & 6 \\ 6 & 4 & 2 & -2 & 2 \end{vmatrix}$$

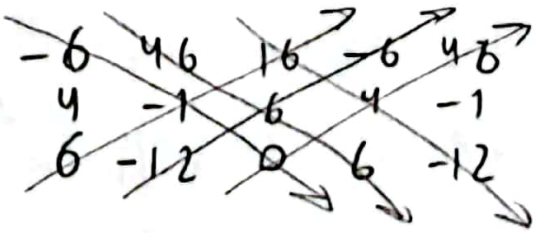
$\times 2$
$\times 2$
$\times 2$
$\times 8$
$\times 5$
$\times 40$

$$\xrightarrow{\substack{e_2 - 3e_1 \to e_2 \\ e_3 - 3e_1 \to e_3 \\ e_5 - 3e_1 \to e_5}} \begin{vmatrix} 2 & -1 & 0 & 4 & 1 \\ 0 & 5 & -2 & -8 & -3 \\ 0 & 7 & -4 & -2 & -1 \\ 0 & 0 & 4 & -1 & 6 \\ 0 & 7 & 2 & -14 & -1 \end{vmatrix} \xrightarrow{e_5 - e_3 \to e_5}$$

$$\begin{vmatrix} 2 & -1 & 0 & 4 & 1 \\ 0 & 5 & -2 & -8 & -3 \\ 0 & 7 & -4 & -2 & -1 \\ 0 & 0 & 4 & -1 & 6 \\ 0 & 0 & 6 & -12 & 0 \end{vmatrix} \xrightarrow{e_3 \times 5 \to e_3} \begin{vmatrix} 2 & -1 & 0 & 4 & 1 \\ 0 & 5 & -2 & -8 & -3 \\ 0 & 35 & -20 & -10 & -5 \\ 0 & 0 & 4 & -1 & 6 \\ 0 & 0 & 6 & -12 & 0 \end{vmatrix} \xrightarrow{e_3 - 7e_2 \to e_3}$$

$$\begin{vmatrix} 2 & -1 & 0 & 4 & 1 \\ 0 & 5 & -2 & -8 & -3 \\ 0 & 0 & -6 & 46 & 16 \\ 0 & 0 & 4 & -1 & 6 \\ 0 & 0 & 6 & -12 & 0 \end{vmatrix}$$

$$|C| = \begin{vmatrix} -6 & 46 & 16 \\ 4 & -1 & 6 \\ 6 & -12 & 0 \end{vmatrix}$$



$|B| = 2(5)(|C|)$

$|C| = 1656 - 768 - (-96 + 432)$

$|6| = 888 - 336$

$|C| = 552$

$|B| = 10(552)$

$|B| = 5520$

(17)

$|B| = c|A|$

$5520 = 40|A|$

$|A| = \frac{5520}{40} = 138$

$$\boxed{|A| = 138}$$

(18)

$$\begin{vmatrix} 1 & -1 & 2 & 0 & 0 \\ 3 & 1 & 4 & 0 & 0 \\ 2 & -1 & 5 & 0 & 0 \\ 0 & 0 & 0 & 2 & 3 \\ 0 & 0 & 0 & -1 & 4 \end{vmatrix} \xrightarrow[e_3 - 2e_1 \to e_3]{e_2 - 3e_1 \to e_2} \begin{vmatrix} 1 & -1 & 2 & 0 & 0 \\ 0 & 4 & -2 & 0 & 0 \\ 0 & 1 & 1 & 0 & 0 \\ 0 & 0 & 0 & 2 & 3 \\ 0 & 0 & 0 & -1 & 4 \end{vmatrix}$$

$e_3(x4) \to e_3$

$$\begin{vmatrix} 1 & -1 & 2 & 0 & 0 \\ 0 & 4 & -2 & 0 & 0 \\ 0 & 4 & 4 & 0 & 0 \\ 0 & 0 & 0 & 2 & 3 \\ 0 & 0 & 0 & -1 & 4 \end{vmatrix} \xrightarrow{e_3 - e_2} \begin{vmatrix} 1 & -1 & 2 & 0 & 0 \\ 0 & 4 & -2 & 0 & 0 \\ 0 & 0 & 6 & 0 & 0 \\ 0 & 0 & 0 & 2 & 3 \\ 0 & 0 & 0 & -1 & 4 \end{vmatrix} \times 4$$

$|B| = 1(4)(6)(2(4) - 3(-1))$

$|B| = 24(8+3) = 24(11) = 264$

$|B| = c|A|$

$264 = 4|A|$ $\quad |A| = \frac{264}{4} = 66$ (18)

$$\boxed{|A| = 66}$$

(19)

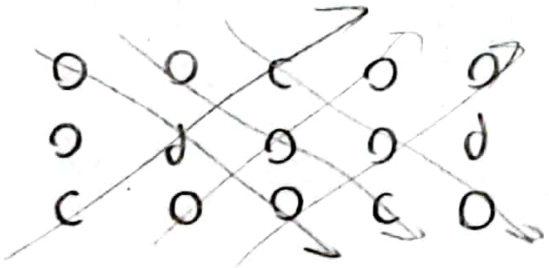
$$\begin{vmatrix} a & 0 & 0 & 0 & 0 \\ 0 & 0 & b & 0 & 0 \\ 0 & 0 & 0 & 0 & c \\ 0 & 0 & 0 & d & 0 \\ 0 & e & 0 & 0 & 0 \end{vmatrix} \qquad \begin{vmatrix} + & - & + & - & + \\ - & + & - & + & - \\ + & - & + & - & + \\ - & + & - & + & - \\ + & - & + & - & + \end{vmatrix}$$

$$|A| = a C_{f1} - 0 C_{f2} + 0 C_{f3} - 0 C_{f4} + 0 C_{f5}$$

$$C_{f1} = \begin{vmatrix} 0 & b & 0 & 0 \\ 0 & 0 & 0 & c \\ 0 & 0 & d & 0 \\ c & 0 & 0 & 0 \end{vmatrix}$$

$$C_{f1} = -b K_{f2}$$

$$K_{f2} = \begin{vmatrix} 0 & 0 & c \\ 0 & d & 0 \\ c & 0 & 0 \end{vmatrix}$$



$$K_{f2} = -(cde)$$

$$-b(-cde) = bcde$$

$$a(bcde) = abcde$$

(2q)

$$|A| = abcde$$

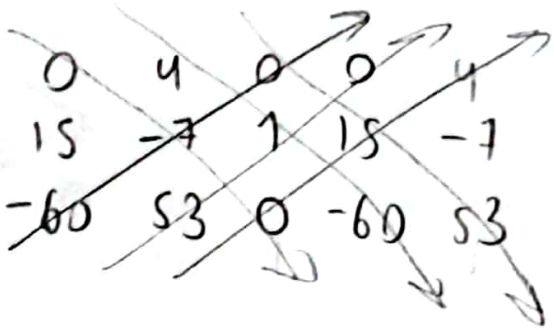
(20)
$$\begin{vmatrix} 2 & 5 & -6 & 8 & 0 \\ 0 & 1 & -7 & 6 & 0 \\ 0 & 0 & 0 & 4 & 0 \\ 0 & 2 & 1 & 5 & 1 \\ 4 & -1 & 5 & 3 & 0 \end{vmatrix} \xrightarrow{e_5 - 2e_1 \to e_5} \begin{vmatrix} 2 & 5 & -6 & 8 & 0 \\ 0 & 1 & -7 & 6 & 0 \\ 0 & 0 & 0 & 4 & 0 \\ 0 & 2 & 1 & 5 & 1 \\ 0 & -11 & 17 & -13 & 0 \end{vmatrix}$$

$e_4 - 2e_2 \to e_4$
$e_5 + 11e_1 \to e_5$

$$\begin{vmatrix} 2 & 5 & -6 & 8 & 0 \\ 0 & 1 & -7 & 6 & 0 \\ 0 & 0 & 0 & 4 & 0 \\ 0 & 0 & 15 & -7 & 1 \\ 0 & 0 & -60 & 53 & 0 \end{vmatrix}$$

$$|A| = 2(1)(|B|)$$

$$|B| = \begin{vmatrix} 0 & 4 & 0 \\ 15 & -7 & 1 \\ -60 & 53 & 0 \end{vmatrix}$$



$$|B| = -240 + 0 - (0)$$

$$|B| = -240$$

$$|A| = 2(-240)$$

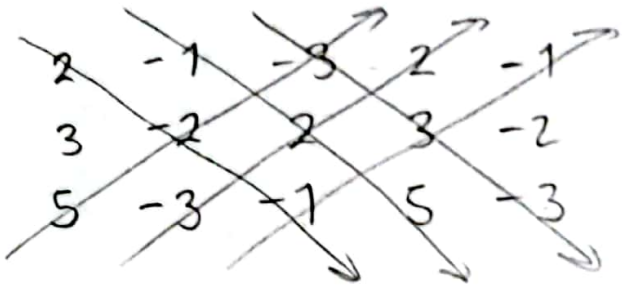
(20)

$$|A| = -480$$

(21) a) $2x - y - 3z = 5$
$3x - 2y + 2z = 5$
$5x - 3y - z = 16$

$$\left[\begin{array}{ccc|c} 2 & -1 & -3 & 5 \\ 3 & -2 & 2 & 5 \\ 5 & -3 & -1 & 16 \end{array}\right]$$

$$\Delta s \begin{vmatrix} 2 & -1 & -3 \\ 3 & -2 & 2 \\ 5 & -3 & -1 \end{vmatrix}$$



$\Delta s = 4 - 10 + 27 - (30 - 12 + 3)$

$\Delta s = 21 - (21)$

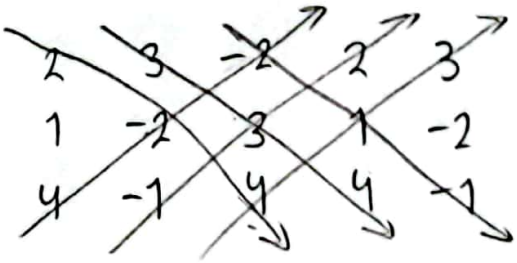
$\Delta s = 0$ → Infinidad de soluciones o no hay solución al sistema

(21)

(22) $2x + 3y - 2z = 5$
$x - 2y + 3z = 2$
$4x - y + 4z = 1$

$$\left[\begin{array}{ccc|c} 2 & 3 & -2 & 5 \\ 1 & -2 & 3 & 2 \\ 4 & -1 & 4 & 1 \end{array}\right]$$

$$\Delta s = \begin{vmatrix} 2 & 3 & -2 \\ 1 & -2 & 3 \\ 4 & -1 & 4 \end{vmatrix}$$



12 x 3 = 36

$\Delta s = -16 + 36 + 2 - (16 - 6 + 12)$

$\Delta s = 22 - 22$

$\Delta s = 0$ → Infinidad de soluciones o no hay solución al sistema

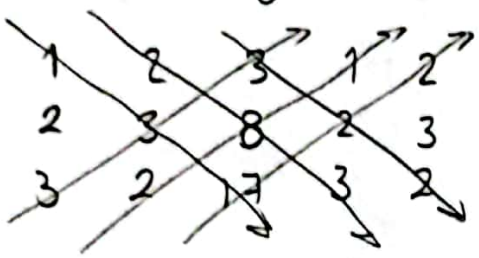
(22)

(23) $x + 2y + 3z = 3$

c) $2x + 3y + 8z = 4$

$3x + 2y + 17z = 1$

$$\left[\begin{array}{ccc|c} 1 & 2 & 3 & 3 \\ 2 & 3 & 8 & 4 \\ 3 & 2 & 17 & 1 \end{array}\right]$$



$\Delta s = 51 + 48 + 12 - (27 + 16 + 68)$

$\Delta s = 111 - 111$

$\Delta s = 0$ → Infinidad de soluciones o no hay solución al sistema

(23)

(24)

$$A = \begin{pmatrix} 1 & 3 & -1 & 2 \\ 0 & 11 & -5 & 3 \\ 2 & -5 & 3 & 1 \\ 4 & 1 & 1 & 5 \end{pmatrix} \longrightarrow \begin{vmatrix} 1 & 3 & -1 & 2 \\ 0 & 11 & -5 & 3 \\ 2 & -5 & 3 & 1 \\ 4 & 1 & 1 & 5 \end{vmatrix}$$

$e_3 - 2e_1 \to c_3$

$\longrightarrow$

$e_4 - 4e_1 \to e_4$

$$\begin{vmatrix} 1 & 3 & -1 & 2 \\ 0 & 11 & -5 & 3 \\ 0 & -11 & 5 & -3 \\ 0 & -11 & 5 & -3 \end{vmatrix}$$

$e_4 + e_2 \to c_4$

$e_3 + e_2 \to e_3$

$$\begin{vmatrix} 1 & 3 & -1 & 2 \\ 0 & 11 & -5 & 3 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \end{vmatrix}$$

(24)

$\Delta_S = 0$

(25)

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

(25)

Como una fila es de ceros la determinante del sistema es 0