$$(1,2,3),\ (2,3,1),\ (3,1,2)$$

$$\underline{A} = \begin{pmatrix} 1 & 2 \\ 2 & 1 \end{pmatrix} \to \det(\underline{A}) = |\underline{A}| = \begin{vmatrix} 1 & 2 \\ 2 & 1 \end{vmatrix} = 1\cdot 1 - 2\cdot 2 = \underline{\underline{-3}}$$

$$|\underline{B}| = \begin{vmatrix} 1 & 2 & 3 \\ 2 & 1 & 2 \\ 3 & 2 & 1 \end{vmatrix} = 1\cdot \begin{vmatrix} 1 & 2 \\ 2 & 1 \end{vmatrix} - 2 \begin{vmatrix} 2 & 2 \\ 3 & 1 \end{vmatrix} + 3\cdot \begin{vmatrix} 2 & 1 \\ 3 & 2 \end{vmatrix} =$$

$$= (1\cdot 1 - 2\cdot 2) - 2(2\cdot 1 - 2\cdot 3) + 3(2\cdot 2 - 1\cdot 3) =$$

$$= -3 - 2(-4) + 3(1) = \underline{8}$$

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

$$= -(2\cdot 4 - 4\cdot 3) + (1\cdot 4 - 4\cdot 2) - (1\cdot 3 - 2\cdot 2) =$$

$$= +4 - 4 + 1 = \underline{\underline{+1}}$$

$$\begin{vmatrix} 1 & 2 & 3 \\ 2 & 1 & 2 \\ 3 & 2 & 1 \end{vmatrix} = 1\cdot 1\cdot 1 + 2\cdot 2\cdot 3 + 3\cdot 2\cdot 2 - 3\cdot 1\cdot 3 - 2\cdot 2\cdot 1 - 1\cdot 2\cdot 2 =$$

$$= 1 + 12 + 12 - 9 - 4 - 4 = \underline{\underline{8}}$$

$$\begin{vmatrix} 2 & 1 \\ 1 & 2 \end{vmatrix} = 2\cdot 2 - 1\cdot 1 = \underline{\underline{3}}$$

$\underline{\underline{\text{áll}}}$: $(\underline{a},\underline{b},\underline{c}) = \begin{vmatrix} a_1 & a_2 & a_3 \\ b_1 & b_2 & b_3 \\ c_1 & c_2 & c_3 \end{vmatrix}$; $= + \begin{vmatrix} a_1 & a_2 & a_3 \\ b_1 & b_2 & b_3 \\ c_1 & c_2 & c_3 \end{vmatrix}$ ued

$\underline{\underline{\text{biz}}}$:

$$(\underline{a},\underline{b},\underline{c}) = (\underline{a} \times \underline{b}) \cdot \underline{c} = \Big[(a_2 b_3 - a_3 b_2)\underline{e}_1 +$$

$$+ (a_3 b_1 - a_1 b_3)\underline{e}_2 + (a_1 b_2 - a_2 b_1)\underline{e}_3\Big] \cdot \begin{pmatrix} c_1 \\ c_2 \\ c_3 \end{pmatrix} =$$

$$= \begin{vmatrix} a_2 & a_3 \\ b_2 & b_3 \end{vmatrix} c_1 + \begin{vmatrix} a_3 & a_1 \\ b_3 & b_1 \end{vmatrix} c_2 + \begin{vmatrix} a_1 & a_2 \\ b_1 & b_2 \end{vmatrix} c_3 = \begin{vmatrix} c_1 & c_2 & c_3 \\ a_1 & a_2 & a_3 \\ b_1 & b_2 & b_3 \end{vmatrix} = - \begin{vmatrix} a_1 & a_2 & a_3 \\ c_1 & c_2 & c_3 \\ b_1 & b_2 & b_3 \end{vmatrix} =$$

$$|\underline{A}| = \begin{vmatrix} 2 & 1 \\ 1 & 2 \end{vmatrix} = 2\cdot 2 - 1\cdot 1 = \underline{\underline{3}}$$

$$|\underline{B}| = \begin{vmatrix} 1 & 2 \\ 2 & 1 \end{vmatrix} = 1\cdot 1 - 2\cdot 2 = \underline{\underline{-3}}$$

$$|\underline{C}| = \begin{vmatrix} 1 & 2 \\ 1 & 2 \end{vmatrix} = 1\cdot 2 - 2\cdot 1 = \underline{\underline{0}}$$

$$|\underline{D}| = \begin{vmatrix} 2 & 1 \\ 3 & 6 \end{vmatrix} = 2\cdot 6 - 1\cdot 3 = \underline{\underline{9}}$$

$$|\underline{E}| = \begin{vmatrix} 2 & 1 \\ 4 & 8 \end{vmatrix} = 16 - 4 = \underline{\underline{12}}$$

$\underline{A} ; \underline{E}$

$$\underline{G} = \begin{vmatrix} 2 & 1 \\ 5 & 4 \end{vmatrix} = 2\cdot 4 - 1\cdot 5 = \underline{\underline{3}}$$

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

$$\begin{pmatrix} 1 & 2 & 3 \\ 0 & 1 & 2 \\ 0 & 0 & 1 \end{pmatrix}$$

$$|\underline{A}| = \begin{vmatrix} 2 & 1 \\ 1 & 2 \end{vmatrix} = \begin{vmatrix} 2 & 1 \\ 0 & \frac{3}{2} \end{vmatrix} = \underline{\underline{3}}$$

$(II) - \frac{1}{2}(I)$

$$\begin{vmatrix} 1 & 3 & 2 & -1 \\ -2 & -3 & 0 & 2 \\ -1 & 3 & 6 & 1 \\ -1 & 2 & 0 & 0 \end{vmatrix} = \begin{vmatrix} 1 & 3 & 2 & -1 \\ 0 & 3 & 4 & 0 \\ 0 & 6 & 8 & 0 \\ 0 & 5 & 2 & -1 \end{vmatrix} = \begin{vmatrix} 1 & 3 & 2 & -1 \\ 0 & 3 & 4 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & -\frac{14}{3} & -1 \end{vmatrix} = 0$$

$(II) + 2(I)$

$(III) + (I)$

$(IV) + (I)$

$(III) - 2(II)$

$(IV) - \frac{5}{3}(II)$

$\underline{A} \mid E$