Expansion By Minors

1. $\begin{vmatrix} 1 & 2 & 1 \\ 3 & 4 & 2 \\ 5 & 6 & 3 \end{vmatrix}$; row 1 $\Rightarrow 0$

2. $\begin{vmatrix} 1 & -1 & 2 \\ 4 & 0 & 1 \\ 2 & 1 & 3 \end{vmatrix}$; column 2 $\Rightarrow 17$

3. $\begin{vmatrix} 3 & 1 & -2 \\ 2 & -1 & 2 \\ 1 & 1 & 0 \end{vmatrix}$; row 3 $\Rightarrow$ -10

4. $\begin{vmatrix} 1 & -1 & 4 \\ 1 & -2 & 5 \\ 1 & -3 & 6 \end{vmatrix}$; column 1 $\Rightarrow 0$

5. $\begin{vmatrix} 0 & -1 & -2 \\ 1 & 3 & 0 \\ 2 & 4 & 1 \end{vmatrix}$; row 2 $\Rightarrow 5$

6. $\begin{vmatrix} 1 & 2 & 0 \\ 3 & 1 & 1 \\ -1 & 4 & 1 \end{vmatrix}$; column 3 $\Rightarrow -11$

7. $\begin{vmatrix} 2 & 1 & 3 \\ -5 & 0 & 2 \\ 6 & 1 & 4 \end{vmatrix} = 13$

8. $\begin{vmatrix} 3 & 2 & 4 \\ -2 & 1 & 6 \\ 0 & 2 & 1 \end{vmatrix} = -45$

9. $\begin{vmatrix} 0 & 2 & 4 \\ 2 & 6 & 3 \\ 0 & 7 & 4 \end{vmatrix} = 40$

10. $\begin{vmatrix} 3 & 2 & 3 \\ 1 & -4 & 2 \\ 0 & 0 & 1 \end{vmatrix} = -14$

Solve for "x"

11. $\begin{vmatrix} 3 & 1 & -2 \\ 0 & x & 1 \\ 4 & -2 & -1 \end{vmatrix} = 0 \Rightarrow -(0)\begin{vmatrix} 1 & -2 \\ -2 & -1 \end{vmatrix} + (x)\begin{vmatrix} 3 & -2 \\ 4 & -1 \end{vmatrix} - (1)\begin{vmatrix} 3 & 1 \\ 4 & -2 \end{vmatrix} = 0 \Rightarrow 5x + 10 = 0 \Rightarrow x = -2$

12. $\begin{vmatrix} x & 2 & 3 \\ 1 & x & 3 \\ 1 & -1 & 1 \end{vmatrix} = 5 \Rightarrow (x)\begin{vmatrix} x & 3 \\ -1 & 1 \end{vmatrix} - (2)\begin{vmatrix} 1 & 3 \\ 1 & 1 \end{vmatrix} + (3)\begin{vmatrix} 1 & x \\ 1 & -1 \end{vmatrix} = 5$

$x(x+3) - 2(1-3) + 3(-1-x) = 5 \Rightarrow x^2 = 4 \Rightarrow x = \pm 2$

Evaluate:

13. $\begin{vmatrix} 1 & 0 & 1 & 0 \\ 3 & -1 & 0 & 2 \\ 1 & 4 & 1 & 1 \\ 3 & 1 & -1 & 2 \end{vmatrix} = -15$

14. $\begin{vmatrix} 1 & -3 & 2 & 1 \\ 2 & -1 & 3 & 0 \\ 3 & 2 & 1 & 0 \\ -1 & 1 & 3 & 1 \end{vmatrix} = -49$