

Determinants

$$1. \begin{bmatrix} -4 & 2 \\ 8 & 0 \end{bmatrix} = (-4)(0) - (8)(2) = \boxed{-16}$$

$$2. \begin{bmatrix} 1 & 4 \\ 5 & 1 \end{bmatrix} = (1)(1) - (5)(4) = 1 - 20 = \boxed{-19}$$

$$3. \begin{bmatrix} -6 & 5 \\ 8 & 10 \end{bmatrix} = (-6)(10) - (8)(5) = -60 - 40 = \boxed{-100}$$

$$4. \begin{bmatrix} 5 & 9 \\ 8 & 1 \end{bmatrix} = (5)(1) - (8)(9) = 5 - 72 = \boxed{-67}$$

$$5. \begin{bmatrix} 7 & -7 \\ 11 & 4 \end{bmatrix} = (7)(4) - (11)(-7) = 28 + 77 = \boxed{105}$$

$$6. \begin{bmatrix} 1 & 3 \\ -2 & -6 \end{bmatrix} = (1)(-6) - (-2)(3) = -6 + 6 = \boxed{0}$$

$$7. \begin{bmatrix} 4 & 6 \\ 9 & 11 \end{bmatrix} = (4)(11) - (9)(6) = 44 - 54 = \boxed{-10}$$

$$8. \begin{bmatrix} 0 & 3 \\ -2 & 9 \end{bmatrix} = (0)(9) - (-2)(3) = \boxed{6}$$

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

$$= [(3 \cdot 0 \cdot 3) + (2 \cdot -1 \cdot 0) + (-5 \cdot 6 \cdot -1)] - [(0 \cdot 0 \cdot 5) + (-1 \cdot -1 \cdot 3) + (3 \cdot 6 \cdot 2)]$$

$$= (0 + 0 + 30) - (0 + 3 + 36) = 30 - 39 = \boxed{-9}$$

$$10. \begin{bmatrix} -1 & 2 & 7 \\ 2 & -1 & -1 \\ 3 & 5 & 2 \end{bmatrix} \begin{matrix} -1 & 2 \\ 2 & -1 \\ 3 & 5 \end{matrix}$$

$$= (2 - 6 + 70) - (-21 + 5 + 8) = 66 - -8 = \boxed{74}$$

$$11. \begin{bmatrix} 1 & 2 & 1 \\ 6 & 5 & 0 \\ 1 & 4 & 2 \end{bmatrix} \begin{matrix} 1 & 2 \\ 6 & 5 \\ 1 & 4 \end{matrix}$$

$$= (-10 + 0 + 24) - (5 + 0 - 24) = 14 - -19 = \boxed{33}$$

$$12. \begin{bmatrix} 3 & 12 & 1 \\ -10 & 9 & 8 \\ -5 & 4 & -1 \end{bmatrix} \begin{matrix} 3 & 12 \\ -10 & 9 \\ -5 & 4 \end{matrix}$$

$$= (-27 - 480 - 40) - (-45 + 96 + 120)$$

$$= -547 - 171 = \boxed{-718}$$

$$13. \begin{bmatrix} -4 & 0 & 1 \\ 0 & 8 & 9 \\ 0 & 3 & 7 \end{bmatrix} \begin{matrix} -4 & 0 \\ 0 & 8 \\ 0 & 3 \end{matrix}$$

$$\begin{aligned} & (-224 + 0 + 0) - (0 - 108 + 0) \\ & = -224 + 108 \\ & = \boxed{-116} \end{aligned}$$

$$14. \begin{bmatrix} 4 & 6 & -3 \\ 0 & 1 & 1 \\ 3 & 9 & 11 \end{bmatrix} \begin{matrix} 4 & 6 \\ 0 & 1 \\ 3 & 9 \end{matrix}$$

$$\begin{aligned} & (44 + 18 + 0) - (-9 + 36 + 0) \\ & = 62 - 27 \\ & = \boxed{35} \end{aligned}$$

$$15. \begin{bmatrix} 5 & -3 & 2 \\ 1 & 6 & -3 \\ -2 & 1 & 4 \end{bmatrix} \begin{matrix} 5 & -3 \\ 1 & 6 \\ -2 & 1 \end{matrix}$$

$$\begin{aligned} & (120 - 18 + 2) - (-24 - 15 - 12) \\ & = 104 - -51 \\ & = \boxed{155} \end{aligned}$$

16.

$$\begin{bmatrix} 8 & 0 & 0 \\ 3 & 2 & 0 \\ 6 & 4 & 2 \end{bmatrix} \begin{matrix} 8 & 0 \\ 3 & 2 \\ 6 & 4 \end{matrix}$$

$$(32 + 0 + 0) - (0 + 0 + 0) \\ = \boxed{32}$$

17.

$$\begin{vmatrix} 2 & 6 \\ 1 & x \end{vmatrix} = 2$$

$$2x - 6 = 2$$

$$2x = 8$$

$$\boxed{x = 4}$$

18.

$$\begin{vmatrix} x & 3 \\ -4 & x \end{vmatrix} = 7x$$

$$x^2 - (-12) = 7x$$

$$x^2 + 12 = 7x$$

$$x^2 - 7x + 12 = 0$$

$$(x-4)(x-3) = 0$$

$$\boxed{x = 4, 3}$$

19.

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

$$(x^2 - 24 - 2) - (-4 - 2x + 6x) = 10$$

$$(x^2 - 26) - (4x - 4) = 10$$

$$x^2 - 26 - 4x + 4 - 10 = 0$$

$$x^2 - 4x - 32 = 0$$

$$(x-8)(x+4) = 0$$

$$\boxed{x = 8, -4}$$

20.

$$\begin{vmatrix} 2x & 0 & 3 \\ 7 & 5 & -1 \\ 4 & 2 & x \end{vmatrix} \begin{vmatrix} 2x & 0 \\ 7 & 5 \\ 4 & 2 \end{vmatrix}$$

$$(10x^2 + 0 + 42) - (60 - 4x + 0)$$

$$10x^2 + 42 - 60 + 4x = 8x^2 - 3x + 12$$

$$2x^2 + 7x - 30 = 0$$

$$(2x-5)(x+6) = 0$$

$$\boxed{x = \frac{5}{2}, -6}$$