B. 1. $\begin{bmatrix} 3 & 10 & 0 & 6 \\ 4 & 1 & -2 & -1 \\ 7 & 4 & 11 & 1 \\ 9 & -3 & 3 & 4 \end{bmatrix}$ Matrix $\mathbf{A}_{(rows,columns)}$; down 3, right 4 = 1

C. 2. $\begin{bmatrix} 1(2)+2(1) & 1(1)+2(6) & 1(0)+2(1) & 1(4)+2(2) \\ 5(2)+4(1) & 5(1)+4(6) & 5(0)+4(1) & 5(4)+4(2) \end{bmatrix} = \begin{bmatrix} 4 & 13 & 2 & 8 \\ 14 & 29 & 4 & 28 \end{bmatrix}$.

B. 3. Area = $\frac{\pm 1}{2}\begin{vmatrix} -2 & 2 & 1 \\ 1 & 5 & 1 \\ 6 & -1 & 1 \end{vmatrix} = \pm\frac{1}{2}\left[-2(5+1)-1(2+1)+6(2-5)\right] = \pm\frac{1}{2}(-33) = 16.5$

C. 4. "transpose" the first column to the first row, the middle column to the second row and the third column becomes the third row.

B. 5. $x+y=3$; $x-y=1$; $2z+t=7$; $z-t=5$

$x=2, y=1, z=4, t=-1$

$2+1+4-1=6$

C. 6. $\mathbf{A}+\mathbf{B} = \begin{bmatrix} 3 & -3 & 4 \\ -4 & -1 & -6 \\ 6 & 8 & 3 \end{bmatrix}$. (A **trace** is the sum of the elements on the main diagonal.)

$3-1+3=5$.

B. 7. (A matrix is **symmetric** if it is a square matrix such that the matrix is equal to the transpose of the matrix.)

$\mathbf{A} = \mathbf{A^T}$; $\begin{bmatrix} 2 & x & 3 \\ 4 & 5 & y \\ z & 1 & 7 \end{bmatrix} = \begin{bmatrix} 2 & 4 & z \\ x & 5 & 1 \\ 3 & y & 7 \end{bmatrix}$; x=4, y=1, z=3; Their product is 12.

B. 8. In order for the inverse to not exist $4x^2-4(x+6)=0$; $x=3, x=-2$.

A. 9. Area = $\dfrac{\pm 1}{2}\begin{vmatrix} 1 & 2 & 1 \\ 3 & 1 & 1 \\ x & 4x+1 & 1 \end{vmatrix} = \dfrac{\pm 1}{2}\left(1(1-(4x+1)-2(3-x)+1(12x+3-x)\right)$

$3 = \pm\dfrac{1}{2}(9x-3)$

$3 = \dfrac{1}{2}(9x-3); 6 = 9x-3; 9 = 9x; x = 1$

$3 = \dfrac{-1}{2}(9x-3); -6 = 9x-3; -3 = 9x; x = \dfrac{-1}{3}$

Since x<0 $x = \dfrac{-1}{3}$; $y = 4x+1; y = 4\left(\dfrac{-1}{3}\right)+1; y = \dfrac{-1}{3}; x+y = \dfrac{-1}{3}+\dfrac{-1}{3} = \dfrac{-2}{3}$

B. 10. If $\mathbf{M} = \begin{bmatrix} a & b \\ c & d \end{bmatrix}$ then adj$\mathbf{M} = \begin{bmatrix} d & -b \\ -c & a \end{bmatrix}$ so the adjoint is $\begin{bmatrix} -3 & 5 \\ -29 & 47 \end{bmatrix}$.

A. 11. $\mathbf{A}^{-1} = \dfrac{1}{\det \mathbf{A}} \cdot adj\mathbf{A}$; $\mathbf{A}^{-1} = \dfrac{1}{-4}\begin{bmatrix} 0 & -1 \\ -4 & 2 \end{bmatrix} = \begin{bmatrix} 0 & \dfrac{1}{4} \\ 1 & \dfrac{-1}{2} \end{bmatrix}$.

D. 12. A rotation of 270^0 may be accomplished by multiplying by the rotation matrix $\begin{bmatrix} 0 & 1 \\ -1 & 0 \end{bmatrix}$.

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

B. 13. $z = \dfrac{\begin{vmatrix} -3 & -5 & -4 \\ -8 & 2 & -91 \\ 6 & 8 & -35 \end{vmatrix}}{\begin{vmatrix} -3 & -5 & 10 \\ -8 & 2 & -3 \\ 6 & 8 & -7 \end{vmatrix}} = \dfrac{2460}{-420} = \dfrac{-41}{7}$

D. 14. First you have to find the inverse of $\begin{bmatrix} 3 & -1 \\ -1 & 2 \end{bmatrix}$ which is $\begin{bmatrix} \frac{2}{5} & \frac{1}{5} \\ \frac{1}{5} & \frac{3}{5} \end{bmatrix}$.

Then you need to multiply both sides by that inverse so that $\begin{bmatrix} a \\ b \end{bmatrix} = \begin{bmatrix} \frac{2}{5} & \frac{1}{5} \\ \frac{1}{5} & \frac{3}{5} \end{bmatrix} \begin{bmatrix} 7 \\ -9 \end{bmatrix} = \begin{bmatrix} 1 \\ -4 \end{bmatrix}$.

$a = 1, b = -4$.

B. 15. det $\begin{vmatrix} 2 & -3 & 1 \\ 1 & 2 & -4 \\ -3 & -2 & 3 \end{vmatrix} = 2\begin{vmatrix} 2 & -4 \\ -2 & 3 \end{vmatrix} - 1\begin{vmatrix} -3 & 1 \\ -2 & 3 \end{vmatrix} - 3\begin{vmatrix} -3 & 1 \\ 2 & -4 \end{vmatrix} = 2(-2) - 1(-7) - 3(10) = -27$

C. 16. $2x = 5, x = 2.5$; $3y = -3, y = -1$.

C. 17. Answers a and d are independent systems. Answer b is an inconsistent system because $0 + 0 = \frac{2}{3}$ is always false. Answer c is a dependent system since $0 + 0 = 0$ is always true.

A. 18. You may not multiply two rows together.

B. 19. $\begin{bmatrix} 5 & 1 \\ 8 & 3 \\ 6 & 2 \end{bmatrix} - 2\begin{bmatrix} 0 & -5 \\ 1 & 4 \\ -2 & 3 \end{bmatrix} = \begin{bmatrix} 5 & 11 \\ 6 & -5 \\ 10 & -4 \end{bmatrix}$

B. 20. $\begin{bmatrix} x \\ y \end{bmatrix} = \frac{1}{17}\begin{bmatrix} 3 & 1 \\ -2 & 5 \end{bmatrix}\begin{bmatrix} 7 \\ -1 \end{bmatrix}$; $\begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} \frac{20}{17} \\ \frac{-19}{17} \end{bmatrix}$; $x = \frac{20}{17}, y = \frac{-19}{17}$.

B. 21. $\begin{bmatrix} (4)(6)+(7)(3) & (4)(8)+(7)(-6) \\ (5)(6)+(3)(3) & (5)(8)+(3)(-6) \\ (2)(6)+(-1)(3) & (2)(8)+(-1)(-6) \end{bmatrix} = \begin{bmatrix} 45 & -10 \\ 39 & 22 \\ 9 & 22 \end{bmatrix}$.

A. 22. Expanding on the first column $\begin{vmatrix} 1 & x & x^2 \\ 1 & y & y^2 \\ 1 & z & z^2 \end{vmatrix} = 1\begin{vmatrix} y & y^2 \\ z & z^2 \end{vmatrix} - 1\begin{vmatrix} x & x^2 \\ z & z^2 \end{vmatrix} + 1\begin{vmatrix} x & x^2 \\ y & y^2 \end{vmatrix}$

$$= xy^2 + x^2z + yz^2 - x^2y - y^2z - xz^2$$
$$\left(xyz + yz^2 - y^2z - xz^2\right) + \left(x^2z + xy^2 - x^2y - xyz\right)$$
$$z\left(xy + yz - y^2 - xz\right) - x\left(-xz - y^2 + xy + yz\right)$$
$$\left(z - x\right)\left(xy + yz - y^2 - xz\right)$$
$$\left(z - x\right)\left(xy - xz\right) + \left(yz - y^2\right)$$
$$\left(z - x\right)x\left(y - z\right) - y\left(-z + y\right)$$
$$\left(z - x\right)\left(x - y\right)\left(y - z\right)$$

C. 23. $\left(\mathbf{A}+\mathbf{B}\right)\left(\mathbf{A}-\mathbf{B}\right) = \begin{bmatrix} 0 & -1 \\ 2 & 3 \end{bmatrix}\begin{bmatrix} -2 & 1 \\ 2 & -1 \end{bmatrix} = \begin{bmatrix} -2 & 1 \\ 2 & -1 \end{bmatrix}$.

A. 24. $x(x+1)(x-6) - 1 + 12 - 2(x+1) - 3x + 2(x-6) = 0$

$x^3 - 5x^2 - 9x - 3 = 0$

$Solutions: x = -1, x = 3 \pm 2\sqrt{3}$

$Integral\ \text{Solution} = -1$

D. 25. $\begin{bmatrix} -2\log_5 x - 3 \\ -4 - 1 \end{bmatrix} = \begin{bmatrix} -7 \\ -5 \end{bmatrix}$**;** $-2\log_5 x - 3 = -7$**;** $-2\log_5 x = -4$**;** $\log_5 x = 2$**;** $5^2 = 25$**.**

D. 26. $\left(-10i^2 - 6i^2\right) - \left(16 - 96\right) = 16 + 80 = 96$.

C. 27. Rotating 90 degrees counterclockwise: $\begin{bmatrix} 0 & -1 \\ 1 & 0 \end{bmatrix}\begin{bmatrix} 3 & 2 & -3 & -2 \\ 2 & -2 & 1 & 5 \end{bmatrix} = \begin{bmatrix} -2 & 2 & -1 & -5 \\ 3 & 2 & -3 & -2 \end{bmatrix}$.

Reflecting over y=x: $\begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix}\begin{bmatrix} -2 & 2 & -1 & -5 \\ 3 & 2 & -3 & -2 \end{bmatrix} = \begin{bmatrix} 3 & 2 & -3 & -2 \\ -2 & 2 & -1 & -5 \end{bmatrix}$.

The x-coordinate of the final image of A is 3.

C. 28. For $n > 4$, the units digit of n! is 0. The units digit of the given sum is therefore affected by only 1! + 2! + 3! + 4! = 1 + 2 + 6 + 24, so x = 3.

$2^3 = 8$, $\begin{vmatrix} 4 & 3 \\ 2 & 5 \end{vmatrix} = 20 - 6 = 14$, ${}_5C_3 = 10$, so the sum is 8 + 14 + 10 = 32.

C. 29. $\begin{vmatrix} x^2 & x \\ 11 & 1 \end{vmatrix} + \begin{vmatrix} x & 5 \\ -1 & x \end{vmatrix} < 0 \quad \Rightarrow \quad x^2 - 11x + x^2 + 5 < 0$

$2x^2 - 11x + 5 < 0 \Rightarrow (2x-1)(x-5) < 0 \Rightarrow \frac{1}{2} < x < 5$

$1 + 2 + 3 + 4 = 10$.

A. 30. $x^2 + y^2 - 4x + 2y - 20 = 0 \quad \Rightarrow (x-2)^2 + \left(y+1\right)^2 = 25 \Rightarrow r = 5$

$\begin{vmatrix} 5 & 0 & 1 \\ 5 & 1 & 2 \\ 2 & 3 & 4 \end{vmatrix} = 5\left(4-6\right) + 1\left(15-2\right) = -10 + 13 = 3$.