14. $\begin{bmatrix} 8 & 1 & 0 & 0 \\ 3 & -4 & 0 & 0 \end{bmatrix}$ is a 2×4 matrix.

16. $[2 \quad 1 \quad -3]$ is a 1×3 row matrix.

17. [2] is a 1×1 matrix. It is a column matrix, a row matrix, and a square matrix.

24. False, to be equal 2 matrices must have the same dimension.

26. True

28. False, the opposite of a matrix is obtained by replacing each entry by its negative.

29. False, to be equal 2 matrices must have the same dimensions. The sum of

$$\begin{bmatrix} 8 \\ 1 \end{bmatrix} + \begin{bmatrix} 2 \\ 9 \end{bmatrix} = \begin{bmatrix} 10 \\ 10 \end{bmatrix}$$

30. False, only matrices with the same dimension can be added.

34. $$-3\begin{bmatrix} 2 & 1 \\ -2 & 1 \\ 0 & 3 \end{bmatrix} = \begin{bmatrix} (-3)\cdot 2 & (-3)\cdot 1 \\ (-3)\cdot(-2) & (-3)\cdot 1 \\ (-3)\cdot 0 & (-3)\cdot 3 \end{bmatrix} = \begin{bmatrix} -6 & -3 \\ 6 & -3 \\ 0 & -9 \end{bmatrix}$$

37. $$3\begin{bmatrix} a & 8 \\ b & 1 \\ c & -2 \end{bmatrix} + 5\begin{bmatrix} 2a & 6 \\ -b & -2 \\ -c & 0 \end{bmatrix} = \begin{bmatrix} 3a & 24 \\ 3b & 3 \\ 3c & -6 \end{bmatrix} + \begin{bmatrix} 10a & 30 \\ -5b & -10 \\ -5c & 0 \end{bmatrix} = \begin{bmatrix} 3a+10a & 24+30 \\ 3b-5b & 3-10 \\ 3c-5c & -6+0 \end{bmatrix} = \begin{bmatrix} 13a & 54 \\ -2b & -7 \\ -2c & -6 \end{bmatrix}$$

46. $$(A+B)+3C = \left(\begin{bmatrix} 2 & -3 & 4 \\ 0 & 2 & 1 \end{bmatrix} + \begin{bmatrix} 1 & -2 & 0 \\ 5 & 1 & 2 \end{bmatrix}\right) + 3\begin{bmatrix} -3 & 0 & 5 \\ 2 & 1 & 3 \end{bmatrix}$$

$$= \begin{bmatrix} 3 & -5 & 4 \\ 5 & 3 & 3 \end{bmatrix} + \begin{bmatrix} -9 & 0 & 15 \\ 6 & 3 & 9 \end{bmatrix} = \begin{bmatrix} 3-9 & -5+0 & 4+15 \\ 5+6 & 3+3 & 3+9 \end{bmatrix} = \begin{bmatrix} -6 & -5 & 19 \\ 11 & 6 & 12 \end{bmatrix}$$

48. $$2A - 5(B+C) = 2\begin{bmatrix} 2 & -3 & 4 \\ 0 & 2 & 1 \end{bmatrix} - 5\left(\begin{bmatrix} 1 & -2 & 0 \\ 5 & 1 & 2 \end{bmatrix} + \begin{bmatrix} -3 & 0 & 5 \\ 2 & 1 & 3 \end{bmatrix}\right)$$

$$= \begin{bmatrix} 4 & -6 & 8 \\ 0 & 4 & 2 \end{bmatrix} - 5\begin{bmatrix} -2 & -2 & 5 \\ 7 & 2 & 5 \end{bmatrix} = \begin{bmatrix} 4+10 & -6+10 & 8-25 \\ 0-35 & 4-10 & 2-25 \end{bmatrix}$$

$$= \begin{bmatrix} 14 & 4 & -17 \\ -35 & -6 & -23 \end{bmatrix}$$

58. Two matrices are equal if they have the same dimension and if corresponding entries are equal. $\begin{bmatrix} x+y & -2 \\ 4 & 10 \end{bmatrix}$ and $\begin{bmatrix} 6 & x-y \\ 4 & z \end{bmatrix}$ have the same dimension so the matrices are equal if $x + y = 6$, $x - y = -2$, and $z = 10$. To find the values of x and y,, solve the system

$$\begin{cases} x + y = 6 & (1) \\ x - y = -2 & (2) \end{cases}$$

Adding equations (1) and (2) gives $2x = 4$ or $x = 2$. Back-substituting into equation (1), we get $2 + y = 6$ or $y = 4$. So the matrices are equal when $x = 2$, $y = 4$, and $z = 10$.