

12-1

Practice

Form K

Adding and Subtracting Matrices

Find each sum or difference.

To start, add or subtract corresponding elements.

1. $\begin{bmatrix} 2 & 4 \\ 5 & -7 \end{bmatrix} + \begin{bmatrix} -4 & -1 \\ 3 & 5 \end{bmatrix}$

$$\begin{bmatrix} 2 + (-4) & 4 + (-1) \\ 5 + 3 & -7 + 5 \end{bmatrix}$$

2. $\begin{bmatrix} 5 & 3 \\ 8 & 2 \end{bmatrix} - \begin{bmatrix} 1 & 7 \\ 4 & -3 \end{bmatrix}$

3. $\begin{bmatrix} -3 & 7 & 1 \\ 4 & 3 & -2 \end{bmatrix} + \begin{bmatrix} 5 & 2 & -6 \\ -4 & 6 & 9 \end{bmatrix}$

4. $\begin{bmatrix} 2 & -2 & 6 \\ -4 & 3 & 8 \end{bmatrix} - \begin{bmatrix} 5 & 3 & 1 \\ 2 & 7 & 4 \end{bmatrix}$

5. $\begin{bmatrix} 9 & -6 \\ -2 & 5 \\ 8 & -1 \end{bmatrix} + \begin{bmatrix} -4 & 7 \\ 5 & 3 \\ 1 & 6 \end{bmatrix}$

6. $\begin{bmatrix} 2 & 4 \\ 8 & 5 \end{bmatrix} - \begin{bmatrix} 6 & 9 \\ 3 & 2 \end{bmatrix}$

Solve each matrix equation.

To start, use the Addition Property of Equality to isolate the variable matrix.

7. $\begin{bmatrix} 7 & -1 \\ 3 & 5 \end{bmatrix} + X = \begin{bmatrix} 4 & 5 \\ 8 & 2 \end{bmatrix}$

8. $\begin{bmatrix} 2 & 7 \\ 9 & -3 \end{bmatrix} - X = \begin{bmatrix} -5 & 1 \\ 3 & 4 \end{bmatrix}$

9. $X - \begin{bmatrix} 2 & 8 \\ -1 & 5 \end{bmatrix} = \begin{bmatrix} 3 & -6 \\ 4 & 2 \end{bmatrix}$

$$X = \begin{bmatrix} 4 - 7 & 5 - (-1) \\ 8 - 3 & 2 - 5 \end{bmatrix}$$

10. **Error Analysis** Maria added $\begin{bmatrix} 5 & 9 \\ 1 & -3 \end{bmatrix} + \begin{bmatrix} -2 & -5 \\ 6 & 3 \end{bmatrix}$ and found a sum of $\begin{bmatrix} 0 & 7 \\ 4 & 3 \end{bmatrix}$. What error did Maria make, and what is the correct sum?

12-1

Practice (continued)

Form K

Adding and Subtracting Matrices

Find each sum.

11. $\begin{bmatrix} 3 & -1 \\ -5 & 8 \end{bmatrix} + \begin{bmatrix} -3 & 1 \\ 5 & -8 \end{bmatrix}$

12. $\begin{bmatrix} -4 & 9 \\ -7 & 5 \end{bmatrix} + \begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix}$

13. $\begin{bmatrix} 7 & 4 \\ 5 & -2 \end{bmatrix} + \begin{bmatrix} -7 & -4 \\ -5 & 2 \end{bmatrix}$

Find the value of each variable.

14. $\begin{bmatrix} 3 & 4 \\ -1 & 6 \end{bmatrix} + \begin{bmatrix} 5 & -5 \\ 7 & -3 \end{bmatrix} = \begin{bmatrix} 8 & x \\ y & z \end{bmatrix}$

$x = 4 + (-5) = \boxed{}$

$y = -1 + 7 = \boxed{}$

$z = 6 + (-3) = \boxed{}$

15. $\begin{bmatrix} 2x & 7 \\ -4 & 3y - 1 \end{bmatrix} = \begin{bmatrix} 18 & 7 \\ -4 & 8 \end{bmatrix}$

16. $\begin{bmatrix} -8 & 3 & -5 \\ 1 & -7 & -6 \end{bmatrix} = \begin{bmatrix} 5x + 2 & 3 & 2 - y \\ 1 & 2z + 1 & -6 \end{bmatrix}$

17. $\begin{bmatrix} 13 & 4b + 3 \\ -5a & -6 \end{bmatrix} = \begin{bmatrix} 3c + 1 & 11 \\ -25 & -2c + 2 \end{bmatrix}$

18. **Writing** Describe the Commutative and Associative Properties of Matrix Addition. How are these properties similar to the Commutative and Associative Properties of Real-Number Addition?

19. **Reasoning** Is it possible to find the value of x in the following equation? Why or why not?

$$\begin{bmatrix} 2x & -1 \\ 4 & -5 \end{bmatrix} = \begin{bmatrix} 5x - 4 & -1 \\ 4 & -5 \end{bmatrix}$$

12-2 Practice

Matrix Multiplication

Form K

Let $A = \begin{bmatrix} 2 & -7 \\ -5 & 3 \end{bmatrix}$ and $B = \begin{bmatrix} -6 & 4 \\ 1 & -11 \end{bmatrix}$. Find each product and each sum.

1. $2A$

$$2 \begin{bmatrix} 2 & -7 \\ -5 & 3 \end{bmatrix} = \begin{bmatrix} 2(2) & 2(-7) \\ 2(-5) & 2(3) \end{bmatrix}$$

2. $5B$ 3. $3A + 4B$

Solve each matrix equation.

To start, use the Addition or Subtraction Property of Equality to isolate the variable matrix.

$$4. \ 2X + \begin{bmatrix} 4 & -5 \\ 1 & -12 \end{bmatrix} = \begin{bmatrix} 10 & 1 \\ -7 & -2 \end{bmatrix}$$

$$5. \ 4 \begin{bmatrix} -2 & 4 \\ 3 & -1 \end{bmatrix} - \frac{1}{2}X = \begin{bmatrix} 3 & 9 \\ -2 & 6 \end{bmatrix}$$

$$2X = \begin{bmatrix} 10 & 1 \\ -7 & -2 \end{bmatrix} - \begin{bmatrix} 4 & -5 \\ 1 & -12 \end{bmatrix}$$

$$6. \ 5 \begin{bmatrix} 1 & 5 \\ 4 & 3 \end{bmatrix} + 3X = \begin{bmatrix} 14 & 22 \\ 8 & 18 \end{bmatrix}$$

$$7. \ \frac{1}{4}X + \begin{bmatrix} 3 & -1 \\ -5 & 7 \end{bmatrix} = \begin{bmatrix} 8 & 5 \\ -8 & 16 \end{bmatrix}$$

8. **Open-Ended** Write an example to demonstrate that the Associative Property applies to scalar multiplication.

12-2 Practice (continued)

Matrix Multiplication

Form K

Find each product.

To start, find the element in the first row and first column of the product matrix.

9. $\begin{bmatrix} 4 & -2 \\ -3 & 7 \end{bmatrix} \begin{bmatrix} 3 & 6 \\ 1 & -5 \end{bmatrix}$

$$4(3) + (-2)(1) = 10 \rightarrow \begin{bmatrix} 10 & \\ & \end{bmatrix}$$

$$4(6) + (-2)(-5) = 34 \rightarrow \begin{bmatrix} 10 & 34 \\ & \end{bmatrix}$$

$$(-3)(3) + 7(1) = -2 \rightarrow \begin{bmatrix} 10 & 34 \\ -2 & \end{bmatrix}$$

$$(-3)(6) + 7(-5) = -53 \rightarrow \begin{bmatrix} \boxed{} & \boxed{} \\ \boxed{} & \boxed{} \end{bmatrix}$$

10. $\begin{bmatrix} 5 & 3 \\ -2 & 0 \end{bmatrix} \begin{bmatrix} 2 & -3 \\ -1 & 4 \end{bmatrix}$

11. $\begin{bmatrix} 2 & 5 \\ & \end{bmatrix} \begin{bmatrix} -1 & 3 \\ 4 & 7 \end{bmatrix}$

12. $\begin{bmatrix} 6 & -2 \\ -3 & 0 \end{bmatrix} \begin{bmatrix} 1 & 5 \\ 8 & 3 \end{bmatrix}$

Determine whether the product exists.

$$A = \begin{bmatrix} 2 & 0 \\ -6 & 9 \end{bmatrix}$$

$$B = \begin{bmatrix} -2 \\ 6 \end{bmatrix}$$

$$C = \begin{bmatrix} 1 & -3 \\ 13 & -5 \end{bmatrix}$$

$$D = \begin{bmatrix} -7 & 5 \end{bmatrix}$$

13. AC

14. BA

15. DC

16. BD

17. The table below shows the number of small, medium, large, and extra-large drinks sold at two snack stands in an hour. The small drinks cost \$1.00, the medium drinks cost \$1.50, the large drinks cost \$2.00, and the extra-large drinks cost \$2.50. Using matrix multiplication, what was the sales total for each snack stand?

	Small	Medium	Large	Extra Large
Stand 1	16	8	10	9
Stand 2	6	12	9	18