

MODEL & DISCUSS

This screen shows the number of Small, Medium, Large, and Extra Large limited-edition silkscreen shirts on sale at an online boutique.

Size	Quantity	Size	Quantity
S	23	S	11
M	53	M	45
L	21	L	25
XL	32	XL	28

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- A. Construct a table to summarize the inventory that is on sale.
- B. At the end of the day, the boutique has sold this many of each T-shirt from the sale items: red: 4 S, 6 M, 3 L, 5 XL; blue: 2 S, 8 M, 4 L, 0 XL. Make two new tables, one showing the merchandise sold and one showing the inventory that is left.
- C. **Use Structure** What relationships did you use in creating the two tables in Part B? © MP.7

HABITS OF MIND

Make Sense and Persevere Edwin summarized the information given in the problem in 2 rows and 4 columns. In Part B, he summarized the information about the number of shirts sold in a table that had 4 rows and 2 columns. Was this organizational strategy helpful? Explain. © MP.1

**EXAMPLE 1** **Try It! Represent Data With a Matrix**

1. In matrix C , the entries are the numbers of students on a committee. Column 1 lists girls, column 2 lists boys, row 1 lists sophomores, and row 2 lists juniors. Find a_{12} , a_{21} , and a_{22} , and tell what each number represents.

$$C = \begin{bmatrix} 7 & 5 \\ 8 & 10 \end{bmatrix}$$

EXAMPLE 2 **Try It! Apply Scalar Multiplication**

2. In this matrix C , the rows represent prices for shirts and khakis. The columns have the same meaning as in Example 2. If the sales tax rate is 6%, use scalar multiplication to find the sales tax for each item.

$$C = \begin{bmatrix} 75 & 40 & 25 \\ 100 & 60 & 30 \end{bmatrix}$$

HABITS OF MIND

Generalize Let the dimensions of matrix Z be 3×4 . After multiplying this matrix by a scalar, what are the dimensions of the product matrix? Explain. © MP.8



EXAMPLE 3  **Try It! Add and Subtract Matrices**

3. Consider matrices M and N .

$$M = \begin{bmatrix} -3 & 5 \\ 2 & 0 \end{bmatrix}, N = \begin{bmatrix} 6 & 5 \\ -8 & 0.2 \end{bmatrix}$$

- What are matrices $M + N$ and $N + M$?
- What are matrices $M - N$ and $N - M$?

EXAMPLE 4  **Try It! Understand Matrix Addition and Subtraction**

4. Consider the matrices below.

$$P = \begin{bmatrix} 5 & 2 & -3 \\ 7 & 0 & -5 \end{bmatrix}, Q = \begin{bmatrix} 2 & -2 \\ 5 & -5 \\ -7 & 7 \end{bmatrix}, R = \begin{bmatrix} 6 & 0.5 \\ -3 & 0 \\ -2 & -2 \end{bmatrix}$$

- Find $R - Q$. What other matrix sums or differences can be calculated?
- Find the additive inverses of P , Q , and R .

HABITS OF MIND

Communicate Precisely What must be true about two matrices for their sum or difference to exist? © MP.6

EXAMPLE 5  **Try It! Use Matrices to Translate and Dilate Figures**

5. A segment has endpoints $M(8, -7)$ and $N(1, 2)$.

- Use matrices to represent a translation of \overline{MN} to \overline{RS} by 6 units left and 3 units down. What are the coordinates of R and S ?
- Use matrices to represent a dilation of \overline{MN} to \overline{DE} by a scale factor of 3, centered at the origin. What are the coordinates of D and E ?

HABITS OF MIND

Model With Mathematics The matrix $T = \begin{bmatrix} 1 & 1 & 4 \\ 2 & 3 & 2 \end{bmatrix}$ represents a triangle. Use matrices to determine whether dilating by a factor of 2 and then translating 5 units right is the same as translating the triangle 5 units right and then dilating by a factor of 2. Does the order of the transformations matter? Explain. © MP.4



Do You UNDERSTAND?

1. **ESSENTIAL QUESTION** How can you interpret matrices and operate with matrices?

2. **Error Analysis** Tonya says $\begin{bmatrix} 3 & 2 \\ -4 & 1 \end{bmatrix} - \begin{bmatrix} 3 & 2 \\ 4 & 1 \end{bmatrix}$ would produce a zero matrix. Explain her error. © MP.3

3. **Communicate Precisely** Explain how you know if two matrices can be added. Then explain how to add them. © MP.6

4. **Vocabulary** What are equal matrices? Give an example of equal matrices.

Do You KNOW HOW?

Identify the element for each matrix.

5. $\begin{bmatrix} 4 & 1 & 0 \\ 7 & 3 & 5 \end{bmatrix}; a_{23}$

6. $\begin{bmatrix} -6 \\ 2 \end{bmatrix}; a_{11}$

Given $A = \begin{bmatrix} 3 & -2 \\ 7 & 1 \end{bmatrix}$ and $B = \begin{bmatrix} 0 & 7 \\ -4 & 12 \end{bmatrix}$, calculate each of the following.

7. $A + B$

8. $B - A$

9. $4A$

10. $A - B$

11. The endpoints of \overline{AB} are represented by the matrix $\begin{bmatrix} 3 & 7 \\ 1 & 5 \end{bmatrix}$. Find the image of the segment after a dilation, centered at the origin, by a scale factor of 2.

