PRACTICE & PROBLEM SOLVING

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UNDERSTAND

9. **Generalize** Suppose square matrices A and B have dimensions $n \times n$, where n is a positive integer greater than or equal to 2. What are the dimensions of their product $A \times B$

10. **Use Structure** If you wanted to find a product of the two matrices shown below, explain why it is necessary to write them in this order.

$$\begin{bmatrix} 10 & 15 & 12 \\ 7 & 11 & 20 \end{bmatrix} \begin{bmatrix} 50 \\ 14 \\ 38 \end{bmatrix}$$

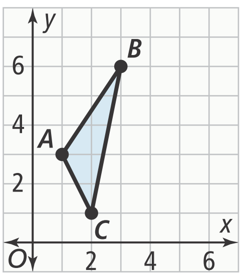
11. **Error Analysis** Describe and correct the error a student made in mulitiplying matrix A by matrix B.

$$\overset{A}{\begin{pmatrix} 6 & 2 \\ -3 & 5 \end{pmatrix}} \overset{B}{\begin{pmatrix} -1 & 0 \\ 4 & -2 \end{pmatrix}}$$

$$\begin{pmatrix} 6 & 2 \\ -3 & 5 \end{pmatrix} \begin{pmatrix} -1 & 0 \\ 4 & -2 \end{pmatrix} = \begin{pmatrix} -6 & 0 \\ -12 & -10 \end{pmatrix}$$

✗

12. **Higher Order Thinking** The triangle shown is transformed using two matrices, $A = \begin{bmatrix} 1 & 0 \\ 0 & -1 \end{bmatrix}$ and $B = \begin{bmatrix} 0 & 1 \\ -1 & 0 \end{bmatrix}$, in that order.



a. What transformation occurs as a result of multiplication by matrix A?

b. What transformation occurs as a result of multiplication by matrix B?

PRACTICE

13. A math teacher assigns final grades based on a weighted system. Matrix W represents the weights of each type of assignment, and matrix G represents the grades for two students, Jacob and Lucy. Use matrix multiplication to find matrix F that represents the final class grades for these two students. SEE EXAMPLE 1

$$W = \overset{\text{hw} \quad \text{tests} \quad \text{exam}}{\begin{bmatrix} 0.20 & 0.50 & 0.30 \end{bmatrix}}$$

$$G = \begin{matrix} \text{hw} \\ \text{tests} \\ \text{exam} \end{matrix} \overset{\text{Jacob} \quad \text{Lucy}}{\begin{bmatrix} 95 & 85 \\ 80 & 90 \\ 75 & 85 \end{bmatrix}}$$

Determine whether each equation is true for the following matrices. SEE EXAMPLE 2

$$A = \begin{bmatrix} 1 & 2 \\ 0 & -2 \end{bmatrix},\ B = \begin{bmatrix} -4 & 0 \\ -1 & 8 \end{bmatrix},\ C = \begin{bmatrix} 5 & 1 \\ 7 & -2 \end{bmatrix}$$

14. $(A + B)C = AC + BC$

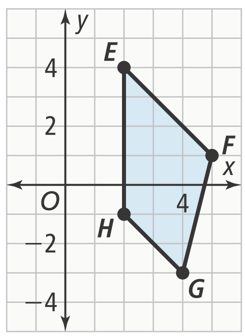
15. $A(BC) = (AB)C$

16. Find IQ, if

$$I = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix} \text{ and } Q = \begin{bmatrix} 1 & -3 & 2 \\ -4 & 5 & -6 \\ 9 & -7 & 8 \end{bmatrix}.$$

SEE EXAMPLE 3

17. Create matrix A to represent the coordinates of quadrilateral $EFGH$.



a. Multiply matrix A by $\begin{bmatrix} 0 & -1 \\ -1 & 0 \end{bmatrix}$

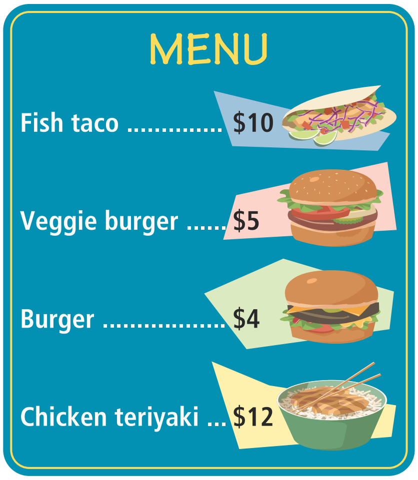
b. Graph the quadrilateral represented by the resulting matrix, and describe the movement of the quadrilateral in the coordinate plane.

PRACTICE & PROBLEM SOLVING

APPLY

18. Reason The following matrix represents the inventory of the three snack bars at a state park.

$$\begin{array}{l} \\ \text{Snack Bar A} \\ \text{Snack Bar B} \\ \text{Snack Bar C} \end{array} \begin{array}{c} \begin{array}{cccc} \text{fish taco} & \text{veggie burger} & \text{burger} & \text{chicken teriyaki} \end{array} \\ \begin{bmatrix} 20 & 15 & 7 & 11 \\ 22 & 18 & 6 & 8 \\ 15 & 19 & 10 & 5 \end{bmatrix} \end{array}$$



Use matrix multiplication to find the total value of the inventory for each snack bar.

19. Model With Mathematics Raul owns and operates two souvenir stands. At his baseball park stand, sweatshirts cost \$45 and T-shirts cost \$20. At his football stadium stand, sweatshirts cost \$50 and T-shirts cost \$15. Today Raul sold 20 sweatshirts and 25 T-shirts at each stand. Use matrix multiplication to find the total amount in daily sales at each souvenir stand.

20. Reason A drama teacher assigns final grades in her class based on the weighted system shown below. The matrix G represents the grades for Kiyo and his two friends, Rachel and Leo.

$$G = \begin{array}{r} \text{tests} \\ \text{proj} \\ \text{part} \end{array} \begin{array}{c} \begin{array}{ccc} \text{Kiyo} & \text{Rachel} & \text{Leo} \end{array} \\ \begin{bmatrix} 90 & 83 & 78 \\ 94 & 88 & 96 \\ 98 & 94 & 89 \end{bmatrix} \end{array}$$

Drama Syllabus
Tests 45%
Projects 30%
Participation 25%

a. Write matrix W as a 1×3 matrix to represent the weighted grading system.

b. Perform matrix multiplication to find the final grades for each of the three students.

ASSESSMENT PRACTICE

21. Find the product of the two matrices.

$$\begin{bmatrix} 1 & 0 \\ 2 & -3 \end{bmatrix} \begin{bmatrix} -3 & 4 \\ 5 & 2 \end{bmatrix} = \begin{bmatrix} \square & \square \\ \square & \square \end{bmatrix}$$

22. SAT/ACT Select the undefined matrix product.

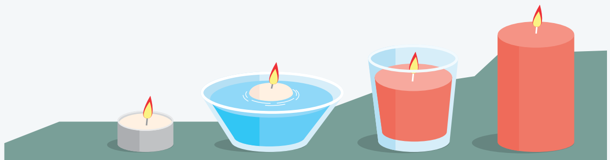
Ⓐ $\begin{bmatrix} 1 & 2 \\ 3 & 6 \end{bmatrix}\begin{bmatrix} 5 & 0 \\ 0 & 2 \end{bmatrix}$

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

Ⓒ $\begin{bmatrix} 2 & -1 \\ 2 & 4 \end{bmatrix}\begin{bmatrix} 1 & 1 & -1 \\ -2 & 0 & -4 \end{bmatrix}$

Ⓓ $\begin{bmatrix} 1 & -2 & -1 \\ -2 & 3 & 0 \end{bmatrix}\begin{bmatrix} 1 & -1 \\ 1 & 0 \end{bmatrix}$

23. Performance Task Paula has a candle-making business. The candles come in four different types. The cost of making each type of candle is \$0.50, \$1, \$5, and \$7, in order of size. Paula's candle sales for her first three years of business are shown in the table below.



	Tea \$1	Floating \$2	Jar \$12	Pillar \$15
Year 1	20	15	40	30
Year 2	25	20	50	35
Year 3	15	20	60	45

Part A Write matrix C as a 4×1 matrix to represent the cost of making each type of candle, write matrix P as a 4×1 matrix to represent the selling price of each candle, and write matrix S as a 3×4 matrix to represent Paula's candle sales for the first three years.

Part B Use matrix subtraction to find a matrix, X, that represents the amount of profit that Paula makes per candle.

Part C Use matrix multiplication to find the product of matrices S and X. Explain what the elements of this product represent.