

# Matrix Multiplier Lab

*Scale every entry, keep the same matrix shape.*

**HIGH SCHOOL • HSN-VM.C.7**

**CCSS.Math.Content.HSN-VM.C.7** "(+) Multiply matrices by scalars to produce new matrices, e.g., as when all of the payoffs in a game are doubled."

NAME \_\_\_\_\_

DATE \_\_\_\_\_

## THE SCALING RULE

To multiply a matrix by a scalar, multiply every entry in the matrix by that scalar. The number of rows and columns stays the same. A negative scalar changes the sign of each entry.

## WORKED EXAMPLE

Multiply -4 by  $\begin{bmatrix} 1 & -2 \\ 3 & 0 \end{bmatrix}$ .

1. Multiply 1 by -4 to get -4, and multiply -2 by -4 to get 8.
2. Multiply 3 by -4 to get -12, and multiply 0 by -4 to get 0.
3. Place the products in the same positions as the original entries.

**Answer:**  $\begin{bmatrix} -4 & 8 \\ -12 & 0 \end{bmatrix}$

## PRACTICE 6 problems

**1** Multiply 5 by  $\begin{bmatrix} 6 & -7 \\ 8 & 9 \end{bmatrix}$ .

**ANSWER** \_\_\_\_\_

**2** Multiply -6 by  $\begin{bmatrix} 7 & 5 \\ -8 \end{bmatrix}$ .

**ANSWER** \_\_\_\_\_

**3** Multiply 7 by  $\begin{bmatrix} 9 \\ -6 \end{bmatrix}$ .

**ANSWER** \_\_\_\_\_

**4** Multiply  $\frac{6}{7}$  by  $\begin{bmatrix} 7 & -5 \\ 8 & 9 \end{bmatrix}$ .

**ANSWER** \_\_\_\_\_

**5** Multiply -8 by  $\begin{bmatrix} 5 & -7 \\ 6 \end{bmatrix}$ .

**ANSWER** \_\_\_\_\_

**6** Multiply 9 by  $\begin{bmatrix} -6 & 8 \\ 7 & -5 \end{bmatrix}$ .

**ANSWER** \_\_\_\_\_

## APPLY IT Show your work

- 1** A music club earns royalty amounts, in dollars, shown by the matrix  $\begin{bmatrix} 7 & 8 \\ 9 & 6 \\ 5 & 7 \end{bmatrix}$ . A sponsor adds 5 dollars for every dollar the club earns, so each original amount becomes 6 times as large. What matrix shows the new royalty amounts?

WORK SPACE

ANSWER \_\_\_\_\_

- 2** In a game design club, a payoff matrix for two strategies is  $\begin{bmatrix} 8 & -5 \\ 7 & 6 \end{bmatrix}$ . The club decides to double every payoff for a final round. What is the new payoff matrix?

WORK SPACE

ANSWER \_\_\_\_\_

## CHALLENGE One step up

### CHALLENGE

Jordan claims that  $-5\begin{bmatrix} x & 7 \\ -6 & y \end{bmatrix} = \begin{bmatrix} 35 & -35 \\ 30 & -45 \end{bmatrix}$ . Find  $x$  and  $y$ . Explain how you used corresponding entries to check your answer.

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## PART 1 • PRACTICE

| # | PROBLEM                               | ANSWER                                       |
|---|---------------------------------------|----------------------------------------------|
| 1 | Multiply 5 by $[6 \ -7; 8 \ 9]$ .     | <b><math>[30 \ -35; 40 \ 45]</math></b>      |
| 2 | Multiply -6 by $[7 \ 5 \ -8]$ .       | <b><math>[-42 \ -30 \ 48]</math></b>         |
| 3 | Multiply 7 by $[9; -6]$ .             | <b><math>[63; -42]</math></b>                |
| 4 | Multiply $6/7$ by $[7 \ -5; 8 \ 9]$ . | <b><math>[6 \ -30/7; 48/7 \ 54/7]</math></b> |
| 5 | Multiply -8 by $[5; -7; 6]$ .         | <b><math>[-40; 56; -48]</math></b>           |
| 6 | Multiply 9 by $[-6 \ 8; 7 \ -5]$ .    | <b><math>[-54 \ 72; 63 \ -45]</math></b>     |

## PART 2 • APPLY IT

1.  **$[42 \ 48; 54 \ 36; 30 \ 42]$**  Multiply every entry in the royalty matrix by 6. Keep the three rows and two columns in the same order.
2.  **$[16 \ -10; 14 \ 12]$**  Multiply each payoff, including the negative payoff, by 2. The matrix shape does not change.

## CHALLENGE

**$x = -7$  and  $y = 9$ . Since  $-5(-7) = 35$  and  $-5(9) = -45$ , the corresponding entries match.**

Accept equivalent matrix notation, as long as entries remain in the correct rows and columns. For fractional entries, accept equivalent fractions such as  $-30/7$  or  $-4 \frac{2}{7}$ .