

## Matrix Operations

**Simplify. Write "undefined" for expressions that are undefined.**

$$1) -4 \begin{bmatrix} 5 & 1 \\ 6 & 0 \end{bmatrix}$$

$$2) \begin{bmatrix} 6 & -5 & 3 & -5 \end{bmatrix} + \begin{bmatrix} 1 & 0 & 1 & 0 \end{bmatrix}$$

$$3) -4w \begin{bmatrix} -w & -4+u & 0 \\ v & 5v & 3wv \end{bmatrix}$$

$$4) \begin{bmatrix} -4 & -5 & 5 \\ 1 & 6 & 3 \\ -2 & 2 & 1 \end{bmatrix} - \begin{bmatrix} -6 & -1 & -6 \\ 6 & -3 & -2 \\ 4 & -1 & -3 \end{bmatrix}$$

$$5) \begin{bmatrix} -5wu \\ 6 \\ v-1 \end{bmatrix} - \left( \begin{bmatrix} -5v \\ 6v \\ 5u+6 \end{bmatrix} - \begin{bmatrix} -3v \\ -5 \\ 3vu \end{bmatrix} \right)$$

$$6) \begin{bmatrix} -3y & 3x \\ -2 & -4x+2 \\ y^2 & 2x \end{bmatrix} - \begin{bmatrix} x & x-2 \\ 4 & y \\ x-1 & xy \end{bmatrix}$$

$$7) \begin{bmatrix} -4b \\ 2b \\ 6b \end{bmatrix} + 2 \begin{bmatrix} 3a \\ ab \\ a+4 \end{bmatrix}$$

$$8) -5 \left( \begin{bmatrix} 1 & 0 \\ -2 & -3 \\ 6 & -6 \end{bmatrix} + \begin{bmatrix} -5 & 4 \\ -6 & 0 \\ 4 & 4 \end{bmatrix} \right)$$

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

$$10) \begin{bmatrix} 3 & 1 \\ -3 & -4 \end{bmatrix} \cdot \begin{bmatrix} 1 & -3 \\ -4 & -1 \end{bmatrix}$$

$$11) \begin{bmatrix} 3 & 2 \\ 2 & 1 \\ 3 & 4 \\ -1 & -1 \end{bmatrix} \cdot \begin{bmatrix} 0 & 0 \\ 2 & -6 \end{bmatrix} \cdot \begin{bmatrix} -2 & 6 \\ 0 & 0 \end{bmatrix}$$

$$12) \begin{bmatrix} 4 & -2 \\ -3 & 6 \end{bmatrix} \cdot \left( \begin{bmatrix} 4 & -5 & 4 & 0 \\ 6 & 3 & 0 & -3 \end{bmatrix} \cdot \begin{bmatrix} 2 & 0 \\ -6 & -1 \end{bmatrix} \right)$$

$$13) \begin{bmatrix} 5ab & -1 & 0 \\ ba & 5b & -1 \end{bmatrix} \cdot \begin{bmatrix} b \\ 4 \\ 2b \end{bmatrix}$$

$$14) \begin{bmatrix} 6u & 2u & u^2 \\ uv & v^2 & -2v^2 \end{bmatrix} \cdot \begin{bmatrix} -3u & 1 \\ 6u & 3v \\ -6u & v \end{bmatrix}$$

**Critical thinking questions:**

15) Give an example of a matrix  $X$  that would make the expression  $AX$  defined where  $A$  is a  $5 \times 7$  matrix.

16) How many multiplications of two numbers would be required to multiply a  $3 \times 5$  matrix by a  $5 \times 10$  matrix?

## Matrix Operations

Date \_\_\_\_\_ Period \_\_\_\_\_

**Simplify. Write "undefined" for expressions that are undefined.**

$$1) -4 \begin{bmatrix} 5 & 1 \\ 6 & 0 \end{bmatrix}$$

$$\begin{bmatrix} -20 & -4 \\ -24 & 0 \end{bmatrix}$$

$$2) \begin{bmatrix} 6 & -5 & 3 & -5 \end{bmatrix} + \begin{bmatrix} 1 & 0 & 1 & 0 \end{bmatrix}$$

$$\begin{bmatrix} 7 & -5 & 4 & -5 \end{bmatrix}$$

$$3) -4w \begin{bmatrix} -w & -4+u & 0 \\ v & 5v & 3wv \end{bmatrix}$$

$$\begin{bmatrix} 4w^2 & 16w - 4wu & 0 \\ -4wv & -20wv & -12w^2v \end{bmatrix}$$

$$4) \begin{bmatrix} -4 & -5 & 5 \\ 1 & 6 & 3 \\ -2 & 2 & 1 \end{bmatrix} - \begin{bmatrix} -6 & -1 & -6 \\ 6 & -3 & -2 \\ 4 & -1 & -3 \end{bmatrix}$$

$$\begin{bmatrix} 2 & -4 & 11 \\ -5 & 9 & 5 \\ -6 & 3 & 4 \end{bmatrix}$$

$$5) \begin{bmatrix} -5wu \\ 6 \\ v-1 \end{bmatrix} - \left( \begin{bmatrix} -5v \\ 6v \\ 5u+6 \end{bmatrix} - \begin{bmatrix} -3v \\ -5 \\ 3vu \end{bmatrix} \right)$$

$$\begin{bmatrix} -5wu + 2v \\ 1 - 6v \\ v - 7 - 5u + 3vu \end{bmatrix}$$

$$6) \begin{bmatrix} -3y & 3x \\ -2 & -4x+2 \\ y^2 & 2x \end{bmatrix} - \begin{bmatrix} x & x-2 \\ 4 & y \\ x-1 & xy \end{bmatrix}$$

$$\begin{bmatrix} -3y - x & 2x + 2 \\ -6 & -4x + 2 - y \\ y^2 - x + 1 & 2x - xy \end{bmatrix}$$

$$7) \begin{bmatrix} -4b \\ 2b \\ 6b \end{bmatrix} + 2 \begin{bmatrix} 3a \\ ab \\ a+4 \end{bmatrix}$$

$$\begin{bmatrix} -4b + 6a \\ 2b + 2ab \\ 6b + 2a + 8 \end{bmatrix}$$

$$8) -5 \left( \begin{bmatrix} 1 & 0 \\ -2 & -3 \\ 6 & -6 \end{bmatrix} + \begin{bmatrix} -5 & 4 \\ -6 & 0 \\ 4 & 4 \end{bmatrix} \right)$$

$$\begin{bmatrix} 20 & -20 \\ 40 & 15 \\ -50 & 10 \end{bmatrix}$$

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

$$\begin{bmatrix} -12 & 33 & -9 \\ 30 & 21 & 18 \end{bmatrix}$$

$$10) \begin{bmatrix} 3 & 1 \\ -3 & -4 \end{bmatrix} \cdot \begin{bmatrix} 1 & -3 \\ -4 & -1 \end{bmatrix}$$

$$\begin{bmatrix} -1 & -10 \\ 13 & 13 \end{bmatrix}$$

$$11) \begin{bmatrix} 3 & 2 \\ 2 & 1 \\ 3 & 4 \\ -1 & -1 \end{bmatrix} \cdot \begin{bmatrix} 0 & 0 \\ 2 & -6 \end{bmatrix} \cdot \begin{bmatrix} -2 & 6 \\ 0 & 0 \end{bmatrix}$$

$$\begin{bmatrix} -8 & 24 \\ -4 & 12 \\ -16 & 48 \\ 4 & -12 \end{bmatrix}$$

$$12) \begin{bmatrix} 4 & -2 \\ -3 & 6 \end{bmatrix} \cdot \left( \begin{bmatrix} 4 & -5 & 4 & 0 \\ 6 & 3 & 0 & -3 \end{bmatrix} \cdot \begin{bmatrix} 2 & 0 \\ -6 & -1 \end{bmatrix} \right)$$

**Undefined**

$$13) \begin{bmatrix} 5ab & -1 & 0 \\ ba & 5b & -1 \end{bmatrix} \cdot \begin{bmatrix} b \\ 4 \\ 2b \end{bmatrix}$$

$$\begin{bmatrix} 5ab^2 - 4 \\ b^2a + 18b \end{bmatrix}$$

$$14) \begin{bmatrix} 6u & 2u & u^2 \\ uv & v^2 & -2v^2 \end{bmatrix} \cdot \begin{bmatrix} -3u & 1 \\ 6u & 3v \\ -6u & v \end{bmatrix}$$

$$\begin{bmatrix} -6u^2 - 6u^3 & 6u + 6uv + u^2v \\ -3u^2v + 18v^2u & uv + v^3 \end{bmatrix}$$

**Critical thinking questions:**

15) Give an example of a matrix  $X$  that would make the expression  $AX$  defined where  $A$  is a  $5 \times 7$  matrix.

**Any  $7 \times$  Anything matrix**

16) How many multiplications of two numbers would be required to multiply a  $3 \times 5$  matrix by a  $5 \times 10$  matrix?

**$5 \cdot 3 \cdot 10 = 150$  multiplications**