

# Matrix

EX. 1 solving for variables that represent a number  
"lower case variables"

$$2 \begin{bmatrix} 3 & a \\ -1 & b \end{bmatrix} - \begin{bmatrix} c & -3 \\ 5 & 8 \end{bmatrix} = \begin{bmatrix} 9 & 11 \\ -7 & 16 \end{bmatrix}$$

Note: Using PENCILS & LOCATIONS we can create 4 equations and solve for the variables

$$\begin{bmatrix} 6 & 2a \\ -2 & 2b \end{bmatrix} - \begin{bmatrix} c & -3 \\ 5 & 8 \end{bmatrix} = \begin{bmatrix} 9 & 11 \\ -7 & 16 \end{bmatrix}$$

Top Left:  $6 - c = 9 \rightarrow c = -3$

Top Right:  $2a - 3 = 11 \rightarrow a = 4$

Bottom Left:  $-2 - 5 = -7 \rightarrow$  no variable

Bottom Right:  $2b - 8 = 16 \rightarrow b = 3$

# Equations

EX. 2 solving for variables that represent a Matrix  
"UPPER CASE VARIABLES"

$$2X + \begin{bmatrix} 7 & 3 \\ -5 & 4 \end{bmatrix} = \begin{bmatrix} 5 & 9 \\ -15 & 8 \end{bmatrix}$$

Note: using opposite/inverse operations & "what ever you do to one side... rule"

$$2X + \begin{bmatrix} 7 & 3 \\ -5 & 4 \end{bmatrix} = \begin{bmatrix} 5 & 9 \\ -15 & 8 \end{bmatrix}$$

$$- \begin{bmatrix} 7 & 3 \\ -5 & 4 \end{bmatrix} = \begin{bmatrix} 7 & 3 \\ -5 & 4 \end{bmatrix}$$


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$$2X = \begin{bmatrix} -2 & 6 \\ -10 & 4 \end{bmatrix}$$

we don't divide matrices. so we multiply by  $\frac{1}{2}$  and the

$\frac{1}{2} 2X = \frac{1}{2} \begin{bmatrix} -2 & 6 \\ -10 & 4 \end{bmatrix}$   
away

$$X = \begin{bmatrix} -1 & 3 \\ -5 & 2 \end{bmatrix}$$

## Solving for Variables in Matrix Equations

$$1. \begin{bmatrix} 2 & 6 \\ x & 5 \end{bmatrix} + \begin{bmatrix} y & -1 \\ 3 & 0 \end{bmatrix} = \begin{bmatrix} 2 & 5 \\ 8 & 5 \end{bmatrix}$$

$$2. 2 \begin{bmatrix} 4 & z \\ x & -1 \end{bmatrix} - \begin{bmatrix} y & -8 \\ 3 & -7 \end{bmatrix} = \begin{bmatrix} 2 & 6 \\ 13 & a \end{bmatrix}$$

$$3. -3 \begin{bmatrix} 4 & z \\ x & -2 \end{bmatrix} + 2 \begin{bmatrix} y & 0 \\ 1 & 4 \end{bmatrix} = \begin{bmatrix} 2 & 6 \\ 17 & a \end{bmatrix}$$

$$4. 2Y - \begin{bmatrix} 9 & 8 \\ 3 & -7 \end{bmatrix} = \begin{bmatrix} 5 & 7 \\ 15 & 9 \end{bmatrix}$$

$$5. \begin{bmatrix} 1 & 2 \\ 3 & -9 \end{bmatrix} + 2X = \begin{bmatrix} 7 & 0 \\ -3 & -7 \end{bmatrix}$$

# Matrix Expressions

Ex. 1

$$3 \begin{bmatrix} 2 & 3 \\ -1 & -4 \end{bmatrix} + \begin{bmatrix} 5 & 0 \\ -1 & 0 \end{bmatrix} - 2 \begin{bmatrix} 2 & -3 \\ 6 & -4 \end{bmatrix}$$

Remember: In order to add/subtract matrices:  
All matrices must have the same dimension (shape size).

When simplifying Matrix expression we use PEMDAS

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

$$\begin{bmatrix} 6 & 9 \\ -3 & -12 \end{bmatrix} + \begin{bmatrix} 5 & 0 \\ -1 & 0 \end{bmatrix} - \begin{bmatrix} 4 & -6 \\ 12 & -8 \end{bmatrix}$$

$$\begin{bmatrix} 11 & 9 \\ -4 & -12 \end{bmatrix} - \begin{bmatrix} 4 & -6 \\ 12 & -8 \end{bmatrix}$$

$$\begin{bmatrix} 7 & 15 \\ -16 & -4 \end{bmatrix}$$

## Assignment

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

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

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

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

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

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

5)  $\begin{bmatrix} 4 & -4 & 0 \end{bmatrix} + \begin{bmatrix} -5 & 4 & 0 \end{bmatrix} + \begin{bmatrix} -5 & 3 & -4 \end{bmatrix}$

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

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

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

9)  $2\left(\begin{bmatrix} 4 \\ -4 \\ 4 \end{bmatrix} - \begin{bmatrix} -5 \\ -5 \\ 2 \end{bmatrix}\right)$

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

# Scalar Multiplication

EX. 1

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

$$\begin{bmatrix} 5 \cdot 3 & 5 \cdot (-2) \\ 5 \cdot 2 & 5 \cdot 4 \end{bmatrix} = \begin{bmatrix} 15 & -10 \\ 10 & 20 \end{bmatrix}$$

NOTE: Scalar multiplication is like  $2(x+3)$   
we distribute

EX. 2

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

$$\begin{bmatrix} -2 \cdot 4 & -2 \cdot (-1) & -2 \cdot 5 \\ -2 \cdot 3 & -2 \cdot 0 & -2 \cdot (-2) \end{bmatrix} = \begin{bmatrix} -8 & 2 & -10 \\ -6 & 0 & 4 \end{bmatrix}$$

## Assignment

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

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

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

$$3) -5 [4 \quad 4 \quad -1]$$

$$4) 5 [6 \quad -2 \quad 3 \quad -4]$$

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

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

$$7) 4 \begin{bmatrix} -6 & 1 \\ 4 & 0 \\ 6 & 1 \\ -3 & 1 \end{bmatrix}$$

$$8) -3 [6 \quad 3 \quad 1]$$

$$9) -4 [-2 \quad 5 \quad -6 \quad 4]$$

$$10) -5 \begin{bmatrix} 5 & 6 \\ 6 & -6 \end{bmatrix}$$

# Adding / Subtracting Matrices

Ex. 1

$$\begin{bmatrix} \underline{1} & \triangle 2 & 3 \\ \underline{5} & 0 & 7 \end{bmatrix} + \begin{bmatrix} \underline{5} & \triangle 6 & 2 \\ -3 & 0 & -4 \end{bmatrix}$$

Note: we can only add if the two/more matrices are the same shape.

To add/subtract matrices you just combine "like" locations

$$\begin{bmatrix} \underline{1+5} & \triangle 2+6 & 3+2 \\ \underline{5+3} & 0+0 & 7+4 \end{bmatrix} = \begin{bmatrix} \underline{6} & \triangle 8 & 5 \\ \underline{2} & 0 & 3 \end{bmatrix}$$

Ex. 2

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

## Assignment

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

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

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

$$3) \begin{bmatrix} 3 & 1 & -4 \end{bmatrix} + \begin{bmatrix} 1 & -2 & 0 \end{bmatrix}$$

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

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

$$6) \begin{bmatrix} 5 & 3 & 2 \\ -5 & 4 & 2 \end{bmatrix} - \begin{bmatrix} 0 & 2 & 1 \\ 0 & 6 & -2 \end{bmatrix}$$

$$7) \begin{bmatrix} 6 & -2 & -6 & 5 \end{bmatrix} - \begin{bmatrix} 2 & -2 & -2 & 6 \end{bmatrix}$$

$$8) \begin{bmatrix} -4 & 0 & 4 & 6 \end{bmatrix} + \begin{bmatrix} -6 & 0 & 0 & 4 \end{bmatrix}$$

$$9) \begin{bmatrix} -2 & -3 & 3 \\ 0 & -1 & -2 \end{bmatrix} + \begin{bmatrix} -3 & 0 \\ -4 & 5 \\ 2 & 3 \\ 0 & -3 \end{bmatrix}$$

$$10) \begin{bmatrix} 0 & -5 \\ 1 & 0 \\ 5 & 5 \end{bmatrix} + \begin{bmatrix} 4 & 6 & 2 & 6 \end{bmatrix}$$