Matrix Addition:

Two add two matrices they must have the same dimensions.

The resulting matrix has the same dimensions as the two being added.

The elements in the resulting matrix are just the sum of the corresponding elements.

Definition **Matrix Addition**

To add matrices A and B with the same dimensions, add corresponding elements.

$$A = \begin{bmatrix} a & b & c \\ d & e & f \end{bmatrix} \qquad B = \begin{bmatrix} r & s & t \\ u & v & w \end{bmatrix}$$

$$A + B = \begin{bmatrix} a & b & c \\ d & e & f \end{bmatrix} + \begin{bmatrix} r & s & t \\ u & v & w \end{bmatrix} = \begin{bmatrix} a+r & b+s & c+t \\ d+u & e+v & f+w \end{bmatrix}$$

The Identity Matrix:

What matrix can be added to any matrix to end up with the identical matrix in return?

$$\begin{bmatrix} 5 & 8 \\ 7 & -6 \end{bmatrix} + \begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix} = \begin{bmatrix} 5 & 8 \\ 7 & -6 \end{bmatrix}$$

The Identity Matrix is called the Zero Matrix *0*

The additive inverse of any number is its OPPOSITE

Inverse Matrix : The additive inverse matrix of A is -A.

-A is a matrix with the same dimensions as A but whose elements are all the opposites of the corresponding elements in A

$$A + (-A) = 0$$

$$\begin{bmatrix} 5 & 8 \\ 7 & -6 \end{bmatrix} + \begin{bmatrix} -5 & -8 \\ -7 & 6 \end{bmatrix} = \begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix}$$

Properties **Matrix Addition**

If A, B, and C are $m \times n$ matrices, then

$A + B$ is an $m \times n$ matrix.	Closure Property
$A + B = B + A$	Commutative Property of Addition
$(A + B) + C = A + (B + C)$	Associative Property of Addition
There exists a unique $m \times n$ matrix O such that $O + A = A + O = A$.	Additive Identity Property
For each A, there exists a unique opposite, $-A$. $A + (-A) = O$	Additive Inverse Property

Property **Matrix Subtraction**

If two matrices, A and B, have the same dimensions, then $A - B = A + (-B)$.

Use these matrices to find each sum and/or difference.

$$A = \begin{bmatrix} 2 & -10 \\ -4 & 1 \end{bmatrix} \quad B = \begin{bmatrix} -9 & 3 \\ 4 & 20 \end{bmatrix} \quad C = \begin{bmatrix} 7 & -13 \\ 8 & 100 \end{bmatrix}$$

1. $A + B = \begin{bmatrix} -7 & -7 \\ 0 & 21 \end{bmatrix}$

2. $C - B = \begin{bmatrix} 16 & -16 \\ 4 & 80 \end{bmatrix}$

3. $B - A + C = \begin{bmatrix} -11 & 13 \\ 8 & 19 \end{bmatrix} + \begin{bmatrix} 7 & -13 \\ 8 & 100 \end{bmatrix} = \begin{bmatrix} -4 & 0 \\ 16 & 119 \end{bmatrix}$

Find B-A first then add C to that resultant matrix.

Solve this equation for matrix X.

$$X + \begin{bmatrix} 12 & 5 \\ 57 & -8 \\ -19 & 6 \end{bmatrix} = \begin{bmatrix} 3 & 16 \\ -21 & 40 \\ -23 & 1 \end{bmatrix}$$

subtract $\begin{bmatrix} 12 & 5 \\ 57 & -8 \\ -19 & 6 \end{bmatrix}$ from both sides.

$$X + \begin{bmatrix} 12 & 5 \\ 57 & -8 \\ -19 & 6 \end{bmatrix} - \begin{bmatrix} 12 & 5 \\ 57 & -8 \\ -19 & 6 \end{bmatrix} = \begin{bmatrix} 3 & 16 \\ -21 & 40 \\ -23 & 1 \end{bmatrix} - \begin{bmatrix} 12 & 5 \\ 57 & -8 \\ -19 & 6 \end{bmatrix}$$

$$X = \begin{bmatrix} -12 & 11 \\ -78 & 48 \\ -4 & -5 \end{bmatrix}$$

find the resulting matrix

Solve this equation for matrix X.

$$\begin{bmatrix} 47 & 51 \\ -78 & 104 \end{bmatrix} - X = \begin{bmatrix} 18 & -33 \\ 9 & 85 \end{bmatrix}$$

1st: add matrix X to both sides

$$\begin{bmatrix} 47 & 51 \\ -78 & 104 \end{bmatrix} + X = \begin{bmatrix} 18 & -33 \\ 9 & 85 \end{bmatrix} + X$$

2nd: subtract $\begin{bmatrix} 18 & -33 \\ 9 & 85 \end{bmatrix}$ from both sides

$$\begin{bmatrix} 47 & 51 \\ -78 & 104 \end{bmatrix} - \begin{bmatrix} 18 & -33 \\ 9 & 85 \end{bmatrix} = X + X - \begin{bmatrix} 18 & -33 \\ 9 & 85 \end{bmatrix} - \begin{bmatrix} 18 & -33 \\ 9 & 85 \end{bmatrix}$$

$$\begin{bmatrix} 29 & 84 \\ -87 & 19 \end{bmatrix} = X$$

find the resulting matrix

Find the value of each variable.

$$\begin{bmatrix} 40 & 33 & x+5 \\ 4y-7 & 100 & -75 \end{bmatrix} = \begin{bmatrix} 3z+4 & 33 & 84 \\ 30 & 8-4w & -75 \end{bmatrix}$$

$3z+4=40$

$z=12$

$4y-7=30$

$y=37/4$

$8-4w=100$

$w=-23$

$x+5=84$

$x=79$

Find the value of each variable.

$$\begin{bmatrix} 7 & 4 \\ -10 & y \end{bmatrix} + \begin{bmatrix} x & -13 \\ -6 & 4 \end{bmatrix} = \begin{bmatrix} 23 & z \\ w & 44 \end{bmatrix}$$

$7+x=23$

$x=16$

$y+4=44$

$y=40$

$4+73=z$

$-9=z$

$-10+-6=w$

$-16=w$

You can now finish Hwk #22 Sec 4-2

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Problems 3, 5, 7, 10, 11, 16, 19, 20, 32