Mean SAT Scores				
	Verbal		Math	
Year	Male	Female	Male	Female
2000	507	504	533	498
2001	509	502	533	498
2002	507	502	534	500
2003	512	503	537	503

SOURCE: College Entrance Examination Board

Organize this data using matrices.

Mean SAT Scores				
	Verbal		Math	
Year	Male	Female	Male	Female
2000	507	504	533	498
2001	509	502	533	498
2002	507	502	534	500
2003	512	503	537	503

SOURCE: College Entrance Examination Board

Male

$$\begin{array}{c|cc} & \text{Verbal} & \text{Math} \\ \hline 2000 & 507 & 533 \\ 2001 & 509 & 533 \\ 2002 & 507 & 534 \\ 2003 & 512 & 537 \end{array}$$

Female

$$\begin{array}{c|cc} & \text{Verbal} & \text{Math} \\ \hline 2000 & 504 & 498 \\ 2001 & 502 & 498 \\ 2002 & 502 & 500 \\ 2003 & 503 & 503 \end{array}$$

Mean SAT Scores				
	Verbal		Math	
Year	Male	Female	Male	Female
2000	507	504	533	498
2001	509	502	533	498
2002	507	502	534	500
2003	512	503	537	503

SOURCE: College Entrance Examination Board

Verbal

$$\begin{array}{c} \\ 2000 \\ 2001 \\ 2002 \\ 2003 \end{array} \begin{array}{c} \begin{array}{cc} \text{Male} & \text{Female} \end{array} \\ \begin{bmatrix} 507 & 504 \\ 509 & 502 \\ 507 & 502 \\ 512 & 503 \end{bmatrix} \end{array}$$

Math

$$\begin{array}{c} \\ 2000 \\ 2001 \\ 2002 \\ 2003 \end{array} \begin{array}{c} \begin{array}{cc} \text{Male} & \text{Female} \end{array} \\ \begin{bmatrix} 533 & 498 \\ 533 & 498 \\ 534 & 500 \\ 537 & 503 \end{bmatrix} \end{array}$$

An electronics store has two locations: Downtown & at the mall. Sales for May and June of digital cameras is shown below. Model this data with two matrices.

May	Downtown sales:	31 of model A, 42 of model B, 18 of model C
	Mall sales:	22 of model A, 25 of model B, 11 of model C
June	Downtown sales:	25 of model A, 36 of model B, 12 of model C
	Mall sales:	38 of model A, 32 of model B, 15 of model C

MAY

$$\begin{array}{c} \\ \text{DOWNTOWN} \\ \text{MALL} \end{array} \begin{array}{c} \begin{array}{ccc} A & B & C \end{array} \\ \begin{bmatrix} 31 & 42 & 18 \\ 22 & 25 & 11 \end{bmatrix} \end{array}$$

JUNE

$$\begin{array}{c} \\ \text{DOWNTOWN} \\ \text{MALL} \end{array} \begin{array}{c} \begin{array}{ccc} A & B & C \end{array} \\ \begin{bmatrix} 25 & 36 & 12 \\ 38 & 32 & 15 \end{bmatrix} \end{array}$$

Add the two matrices together to create a new matrix.

$$\begin{array}{c|c} & \begin{matrix} A & B & C \end{matrix} \\ \begin{matrix} \text{DOWNTOWN} \\ \text{MALL} \end{matrix} & \begin{bmatrix} 56 & 78 & 30 \\ 60 & 57 & 26 \end{bmatrix} \end{array}$$

What are the dimensions of this new matrix?

2x3

What do the elements in this new matrix represent?

TOTAL SALES FOR MAY & JUNE BY MODEL & LOCATION

You can now finish Hwk #21. Sec 4-1

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Problems 20-28

On Saturday the store sold the following t-shirts
10 Large Girls, 13 Medium Girls, 8 Small Girls, 15 Large Boys, 7 Medium Boys, and 5 Small Boys.

On Sunday the same store sold the following amounts of the same t-shirt:
5 Large Girls, 19 Medium Girls, 12 Small Girls, 10 Large Boys, 21 Medium Boys, and 4 Small Boys.

Model this data using two matrices.

SAT

$$\begin{array}{c|c} & \begin{matrix} G & B \end{matrix} \\ \begin{matrix} \text{LG} \\ \text{Med} \\ \text{Sm} \end{matrix} & \begin{bmatrix} 10 & 15 \\ 13 & 7 \\ 8 & 5 \end{bmatrix} \end{array}$$

SUN

$$\begin{array}{c|c} & \begin{matrix} G & B \end{matrix} \\ \begin{matrix} \text{LG} \\ \text{m} \\ \text{Sm} \end{matrix} & \begin{bmatrix} 5 & 10 \\ 19 & 21 \\ 12 & 4 \end{bmatrix} \end{array}$$

Write a new matrix which is the sum of the two matrices you created on the previous page.

$$\begin{array}{c|c} & \begin{matrix} G & B \end{matrix} \\ \begin{matrix} \text{LG} \\ \text{MED} \\ \text{Sm} \end{matrix} & \begin{bmatrix} 15 & 25 \\ 32 & 28 \\ 20 & 9 \end{bmatrix} \end{array}$$

What does this resulting matrix represent?

TOTAL WEEKEND SALES of T-SHIRTS by size and gender

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

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

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.

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

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

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

3. $B - A + C = \begin{bmatrix} -4 & 0 \\ 16 & 119 \end{bmatrix}$

Solve this equation for matrix X.

$x + A = B$

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

$X = B - A$

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

$$X = \begin{bmatrix} -9 & 11 \\ -78 & 48 \\ -4 & -5 \end{bmatrix}$$