Algebra 2 Notes — Name: Key
Section 3.5 – Matrices and Data

The table shows the top scores for girls in barrel racing at the 2004 National High School Rodeo finals. The data can be presented in a table or a spreadsheet as rows and columns of numbers. You can also use a matrix to show table data. A matrix is a rectangular array of numbers enclosed in brackets.

2004 National H.S. Rodeo Finals – Barrel Racing Scores			
Participant	1st Ride	2nd Ride	3rd Ride
Sierra Thomas (UT)	16.781	16.29	17.318
Kelly Allen (TX)	16.206	16.606	17.668

The data can be rewritten into matrix A.

$$A=\begin{array}{c} \begin{bmatrix} 16.781 & 16.29 & 17.318 \\ 16.206 & 16.606 & 17.668 \end{bmatrix} \begin{array}{l} \leftarrow \text{Row 1} \\ \leftarrow \text{Row 2} \end{array} \\ \begin{array}{ccc} \uparrow & \uparrow & \uparrow \\ \text{Column 1} & \text{Column 2} & \text{Column 3} \end{array} \end{array}$$

Matrix A has 2 rows and 3 columns. A matrix with m rows and n columns has dimensions $m \times n$, read "m by n," and is called an $m \times n$ matrix. A has dimensions 2 × 3. Each value in a matrix is called an entry of the matrix. The address of an entry is its location in a matrix, expressed by using the lowercase matrix letter with the row and column number as subscripts. The score 16.206 is located in row 2 column 1, so a_{21} is its address.

Example 1: Displaying Data in Matrix Form

Use the packaging data for the costs of the packages given.

Cost of 4-Inch Cubic Box ($)		
	Plastic	Paper
Total Cost	0.48	0.72
Cost per in^2	0.005	0.0075
Cost per in^3	0.0075	0.01125

(a) Display the data as matrix C.

$$C=\begin{bmatrix} 0.48 & 0.72 \\ 0.005 & 0.0075 \\ 0.0075 & 0.01125 \end{bmatrix}$$

(b) What are the dimensions of C? 3 × 2

(c) What is the entry at c_{12}? 0.72 row 1 column 2

What does it represent? Total cost of a 4-Inch cubic PAPER box

(d) What is the address of the entry 0.005? c_{21}

Adding and Subtracting Matrices

Words	Numbers	Algebra
To add or subtract matrices, add or subtract the corresponding entries.	$[1 \quad 2]+[5 \quad 10]=[1+5 \quad 2+10]$ $=[6 \quad 12]$	$[a_{11} \quad a_{12}]+[b_{11} \quad b_{12}]$ $=[a_{11}+b_{11} \quad a_{12}+b_{12}]$

Corresponding entries in two or more matrices are entries with the same address, such as a_{32} and b_{32} in matrices A and B.

You can add or subtract matrices ONLY IF they have the same dimensions.
You can also multiply a matrix by a number called a Scalar. To find the product of a scalar and a matrix, or the Scalar product, multiply each entry by the scalar.

Example 2: Use the given matrices to find simplify the matrix expressions, if possible.

$$A=\begin{bmatrix}4 & -2\\ -3 & 10\\ 2 & 6\end{bmatrix} \qquad B=\begin{bmatrix}4 & -1 & -5\\ 3 & 2 & 8\end{bmatrix} \qquad C=\begin{bmatrix}3 & 2\\ 0 & -9\\ -5 & 14\end{bmatrix} \qquad D=\begin{bmatrix}0 & 1 & -3\\ 3 & 0 & 10\end{bmatrix}$$

a. $A+C$

$$\begin{bmatrix}4 & -2\\ -3 & 10\\ 2 & 6\end{bmatrix}+\begin{bmatrix}3 & 2\\ 0 & -9\\ -5 & 14\end{bmatrix}$$

$$=\begin{bmatrix}4+3 & -2+2\\ -3+0 & 10+-9\\ 2+-5 & 6+14\end{bmatrix}=\boxed{\begin{bmatrix}7 & 0\\ -3 & 1\\ -3 & 20\end{bmatrix}}$$

b. $B-2D$

$$\begin{bmatrix}4 & -1 & -5\\ 3 & 2 & 8\end{bmatrix} + {}^-2\begin{bmatrix}0 & 1 & -3\\ 3 & 0 & 10\end{bmatrix}$$

$$\begin{bmatrix}4 & -1 & -5\\ 3 & 2 & 8\end{bmatrix}+\begin{bmatrix}0 & -2 & 6\\ -6 & 0 & -20\end{bmatrix}$$

$$\boxed{\begin{bmatrix}4 & -3 & 1\\ -3 & 2 & -12\end{bmatrix}}$$

c. $3C+B$

$$3\begin{bmatrix}3 & 2\\ 0 & -9\\ -5 & 14\end{bmatrix}+\begin{bmatrix}4 & -1 & -5\\ 3 & 2 & 8\end{bmatrix}$$

$\boxed{\text{not possible}}$

Commutative Property - Matrix addition is commutative, so $A+B=$ B + A.

Associative Property - Matrix addition is associative, so $(A+B)+C=$ A + (B + C).

Additive Identity - The zero matrix is the additive identity matrix 0, so $A+0=$ A.

Additive Inverse - The additive inverse of matrix A contains the opposite of each entry in matrix A, so if $A+B=0$, then A and B are additive inverses.

Matrices are equal if and only if their dimensions are equal AND every corresponding element is equal.

Example 3:

a. Solve for x and y.

$$\begin{bmatrix}2x-5 & 4\\ 3 & 3y+12\end{bmatrix}=\begin{bmatrix}25 & 4\\ 3 & y+18\end{bmatrix}$$

$2x-5=25$

$2x=30$

$\boxed{x=15}$

$3y+12=y+18$

$2y+12=18$

$2y=6$

$\boxed{y=3}$

b. Solve for matrix X.

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

$+X$

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

$$X=\begin{bmatrix}1 & -1\\ 3 & 2\end{bmatrix}+\begin{bmatrix}+5 & 0\\ +2 & {}^-1\end{bmatrix}=\boxed{\begin{bmatrix}6 & -1\\ 5 & 1\end{bmatrix}}$$

Example 4:

Mean SAT Scores				
	Verbal		Math	
Year	Male	Female	Male	Female
1992	428	419	490	456
1993	428	420	502	457
1994	425	421	501	460
1995	429	426	503	463

(a) Write a matrix to represent the mean verbal SAT scores for males and females and another for the mean math SAT scores.

verbal $\begin{bmatrix}428 & 419\\ 428 & 420\\ 425 & 421\\ 429 & 426\end{bmatrix}$ math $\begin{bmatrix}490 & 456\\ 502 & 457\\ 501 & 460\\ 503 & 463\end{bmatrix}$

(b) Write a matrix for the combined math and verbal scores for males and females.

add matrices from A

$$\begin{bmatrix}918 & 875\\ 927 & 877\\ 926 & 881\\ 932 & 889\end{bmatrix}$$