Accelerated Pre-Calculus
January 2023
Unit 5 – Matrices

Monday	Tuesday	Wednesday	Thursday	Friday
2 **Last Day of Winter Break**	3 **Teacher Work Day**	4 5.01 Introduction to Matrices • Vocabulary • Add, Subtract, & Scalar • Properties HW: 5.01 Practice	5 5.02 Matrix Multiplication • Multiply Matrices • Properties • Multiplicative Identity • Verifying Inverses HW: 5.02 Practice	6 5.02 Cont'd More Practice with Matrix Multiplication HW: 5.02 Extra Practice
9 5.03 Matrix Inverses • 2x2 matrices only • Determinant • Multiplicative Inverse • Singular Matrix HW: 5.03 Practice	10 5.04 Matrix Operations Review	11 5.04 Matrix Operations Review	12 **5.05 Matrix Ops Quiz**	13 5.06 Solving a 2X2 System of Equations • Review of Elimination • Using a Matrix Equation to Solve HW: 5.06 Practice
16 **MLK Holiday**	17 5.07 Matrix Inverses • 3x3 matrices only • Determinant • Multiplicative Inverse on calculator HW: 5.07 Practice	18 5.08 Solving a 3X3 System of Equations • Review of Elimination • Using a Matrix Equation to Solve HW: 5.08 Practice	19 5.09 Applications with Matrices HW: 5.09 Practice	20 5.10 Applications with Matrices Cont'd Finish 5.10
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Homework Keys:

tinyurl.com/MiltonAPC

Matrices

Properties of Matrix Addition

Given matrices A, B, C with the same dimensions

Commutative Property: A + B = B + A

Associative Property: A + (B + C) = (A + B) + C

Scalar Distributive Property: k (A + B) = kA + kB

Properties of Matrix Multiplication

Given matrices A and B with the same inner dimensions

<u>Matrix Multiplication is not commutative</u>

Associative Property: (AB)C = A(BC)

Associative Property of Scalar Multiplication: k(AB) = (kA)B = A(kB)

Identity matrix (I)

2 x 2

$$\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$$

3 x 3

$$\begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

A * I = I * A = A

The product of two inverse matrices is equal to the identity matrix.

$(A)(A^{-1}) = (A^{-1})(A) = I$

<u>Addition and Subtraction:</u> matrices <u>must</u> have the same dimensions

A + B = A + B

$$\begin{bmatrix} a & b \\ c & d \end{bmatrix} + \begin{bmatrix} e & f \\ g & h \end{bmatrix} = \begin{bmatrix} a+e & b+f \\ c+g & d+h \end{bmatrix}$$

A − B = A – B

$$\begin{bmatrix} a & b \\ c & d \end{bmatrix} - \begin{bmatrix} e & f \\ g & h \end{bmatrix} = \begin{bmatrix} a-e & b-f \\ c-g & d-h \end{bmatrix}$$

<u>Scalar Multiplication:</u> for matrices of <u>any</u> dimension

Given matrix M = $\begin{bmatrix} a & b & c \\ d & e & f \end{bmatrix}$ then kM = $\begin{bmatrix} ka & kb & kc \\ kd & ke & kf \end{bmatrix}$

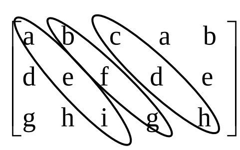
<u>Determinant:</u> <u>must</u> be a square matrix

2 x 2 $A = \begin{bmatrix} a & b \\ c & d \end{bmatrix}$

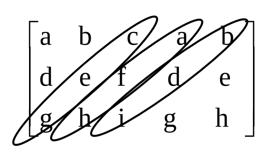
det(A) = $|\,A\,| = ad - bc$

3 x 3 B = $\begin{bmatrix} a & b & c \\ d & e & f \\ g & h & i \end{bmatrix}$ **repeat columns 1 and 2** $\begin{bmatrix} a & b & c & a & b \\ d & e & f & d & e \\ g & h & i & g & h \end{bmatrix}$

Now multiply and combine products according to the pattern.



and



$$det(B) = |B| = (aei + bfg + cdh) - (ceg + afh + bdi)$$

<u>Inverse:</u> <u>must</u> be a square matrix. If det(A) = 0, then A is a singular matrix (non-invertible).
For 2x2 find the inverse without a calculator. For matrices larger than 2x2 – find the inverse with an app.

Given matrix $A = \begin{bmatrix} a & b \\ c & d \end{bmatrix}$ then $A^{-1} = \frac{1}{det}\begin{bmatrix} d & -b \\ -c & a \end{bmatrix} = \frac{1}{ad-bc}\begin{bmatrix} d & -b \\ -c & a \end{bmatrix}$

<u>Solving a System of Equations:</u>

C x V = A

$\begin{cases} ax + by = c \\ dx + ey = f \end{cases}$ written as a **Matrix Equation**: $\begin{bmatrix} a & b \\ d & e \end{bmatrix} \text{x} \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} c \\ f \end{bmatrix}$ **Can be solved by: $V = C^{-1}A$**

where **C** is the **C**oefficient matrix, **V** is the **V**ariable matrix, and **A** is the **A**nswer matrix.