## Core Content

| **Cluster Title: Solve systems of equations.** |
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| **Standard (Honors) A.REI.8:** Represent a system of linear equations as a single matrix equation in a vector variable. |
| **Concepts and Skills to Master** |
| • Rewrite a system of linear equations in matrix form as AX = B, where X is the vector of variables.<br>• Solve a system of linear equations using matrices. |

## Supports for Teachers

| **Critical Background Knowledge** | |
|---|---|
| • Element of the matrix<br>• Order of the matrix | |
| **Academic Vocabulary** | |
| matrix equation, vector | |
| **Suggested Instructional Strategies** | **Resources** |
| • Work with systems arising from contextual situations, including those where the equation must be rewritten to create the matrix.<br>• Compare the process of solving a system using equations to the process of solving a system using matrices. | |
| **Sample Formative Assessment Tasks** | |
| **Skill-Based Task:**<br>Represent and solve:<br>$2x+y=3$<br>$y-z=1$<br>$x+2w=0$<br>$3z=w$ | **Problem Task:**<br>When asked to represent the following linear equations as a matrix equation, a student produced the following. Will the student's process result in a correct answer? Justify your answer.<br>$\begin{matrix} 7x-y+z=2 \\ 2x+2y-3z=-3 \\ 4x+y+5z=6 \end{matrix} \rightarrow \begin{bmatrix} 7 & 2 & 4 \\ -1 & 2 & 1 \\ 1 & -3 & 5 \end{bmatrix}\begin{bmatrix} x \\ y \\ z \end{bmatrix}=\begin{bmatrix} 2 \\ -3 \\ 6 \end{bmatrix}$ |

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# Core Content

| **Cluster Title: Solve systems of equations.** |
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| **Standard (Honors) A.REI.9:** Find the inverse of a matrix if it exists and use it to solve systems of linear equations (using technology for matrices of dimension 3 x 3 or greater). |
| **Concepts and Skills to Master** |
| • Use the determinant to determine whether an inverse exists.<br>• For 2 x 2 matrices, apply the following to find the inverse: For $A=\begin{bmatrix} a & b \\ c & d \end{bmatrix}$, $A^{-1}=\frac{1}{\det(A)}\begin{bmatrix} d & -b \\ -c & a \end{bmatrix}=\frac{1}{ad-bc}\begin{bmatrix} d & -b \\ -c & a \end{bmatrix}$.<br>• Apply the augmented matrix method, by hand for 2 x 2 matrices and using technology for 3 x 3 or greater, to find $A^{-1}$.<br>• Use matrix algebra to solve *AX* = *B* as the unique solution $X = A^{-1}B$. |

# Supports for Teachers

| **Critical Background Knowledge** | |
|---|---|
| • Represent systems of equations as matrices.<br>• Find the determinant of a matrix. | |
| **Academic Vocabulary** | |
| inverse of a matrix, identity matrix, invertible, nonsingular, determinant, $A^{-1}$, I, augmented matrix | |
| **Suggested Instructional Strategies** | **Resources** |
| • Investigate how to solve the matrix equation AX = B without using division. Use the definition of the inverse of a square matrix, $AA^{-1}=I_n$ or $A^{-1}A=I_n$, to develop the idea of the identity matrix and why it is necessary.<br>• Use matrices to create and crack codes. | |

| **Sample Formative Assessment Tasks** | |
|---|---|
| **Skill-Based Task:**<br>Use the following system to answer the following:<br>a) Set up a matrix equation *AX*=*B*.<br>b) Find $A^{-1}$.<br>c) Solve for *x*.<br>d) State the solutions to the system of equations.<br>$x+y+z=2$<br>$x+z=1$<br>$x-y-z=-4$ | **Problem Task:**<br>As a professional code cracker, you receive an encoded two-digit ATM pin $E=\begin{bmatrix} 2 & 5 \end{bmatrix}$ that was encoded by multiplying the original pin number by the matrix $K=\begin{bmatrix} 2 & 3 \\ 5 & 8 \end{bmatrix}$. Find the decoding key and use it to find the original pin number *P*.<br><br>Teacher Hint: *PK* = *E* |

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