Fall 2021 Precalc
Lesson 3.2

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Herbert H. Lehman High School
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Do Now

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Be sure to…Get out your notebook/binder. Answer the questions below. Write a complete sentence for each question!

1. Convert this linear system to augmented matrix form
2. Why do you think it's useful to represent linear systems in matrix form?

$$\begin{cases} x - y + 2z = 4 \\ x + z = 6 \\ 2x - 3y + 5z = 4 \\ 3x + 2y - z = 1 \end{cases}$$

class: precalc **goal:** HDW use Gauss-Jordan elimination to convert matrix to reduced row echelon form?

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2. because teh variables equal signs, and so on don't really matter when we're doing gaussian elimination.

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B24 rules

Welcome to our new room, B24! Please read the information below:

1. When you come in, please find a seat at a desk (if one's available) or one of the six closest desks to the screen. ***Do not sit in the back of the classroom***. We'll conduct the do now and mini lesson from here.
2. When I dismiss you for independent work, find a sit at one of the computer workstations.
3. ***No food or drink by the computers.***
4. At the end of the period, you'll be directed to assemble for the exit ticket/debrief. Log out of your computer, and ***quietly*** return to a seat near the front.

class: precalc **goal:** HDW use Gauss-Jordan elimination to convert matrix to reduced row echelon form?

framing

- **what:** use Gauss-Jordan elimination to convert matrices to reduced row echelon form?
- **why:** Gauss Jordan elimination is an easy way to solve for a linear system
- **where to:** Review for Thursday quiz!

Matrices

An $m \times n$ matrix is an array with m rows and n columns:

$$\begin{array}{c} \\ \text{Row 1} \\ \text{Row 2} \\ \text{Row 3} \\ \vdots \\ \text{Row } m \end{array} \begin{array}{c} \begin{array}{cccccc} \text{Column 1} & \text{Column 2} & \text{Column 3} & & \cdots & \text{Column } n \end{array} \\ \begin{bmatrix} a_{11} & a_{12} & a_{13} & \cdots & a_{1n} \\ a_{21} & a_{22} & a_{23} & \cdots & a_{2n} \\ a_{31} & a_{32} & a_{33} & \cdots & a_{3n} \\ \vdots & \vdots & \vdots & & \vdots \\ a_{m1} & a_{m2} & a_{m3} & \cdots & a_{mn} \end{bmatrix} \end{array}$$

where each entry $a_{i,j}$ is a real number.

Matrix vocabulary

Reduced row echelon form
A matrix in row echelon form where all pivots are 1 and all values above and below the pivots are 0.

Gauss-Jordan elimination
Extension of Gaussian elimination that converts a matrix to reduced row echelon form.

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Gauss-Jordan Elimination

Yesterday we converted this system to row echelon form.

Reduced row echelon form
A matrix in row echelon form where all pivots are 1 and all values above and below the pivots are 0.

$$\begin{cases} x - 2y + 3z = 9 \\ -x + 3y + z = -2 \\ 2x - 5y + 5z = 17 \end{cases} \rightarrow \left[\begin{array}{ccc|c} 1 & -2 & 3 & 9 \\ 0 & 1 & 4 & 7 \\ 0 & 0 & 1 & 2 \end{array}\right]$$

Gauss-Jordan elimination
Extension of Gaussian elimination that converts a matrix to reduced row echelon form.

Today we'll convert it to reduced row echelon form with Gauss-Jordan elimination!

class: precalc **goal:** HDW use Gauss-Jordan elimination to convert matrix to reduced row echelon form?

See pg. 511 of textbook for solution

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Independent work

1. Solve the nonsquare system below:

$$\begin{cases} 2x - 3y + z = -2 \\ -4x + 9y = 7 \end{cases}$$

2. (i) convert the linear system below to an augmented matrix.
(ii) Identify the dimensions of this matrix
(iii) Convert the matrix to row echelon form:
(iv) Use back-substitution or Gauss Jordan elimination to solve.

a. $\begin{cases} x - 3z = -2 \\ 3x + y - 2z = 5 \\ 2x + 2y + z = 4 \end{cases}$

b. $\begin{cases} x + y - 5z = 3 \\ x - 2z = 1 \\ 2x - y - z = 0 \end{cases}$

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1.
pivot: 2, elimination coefficient: -4, multiplier: 2

$$\begin{array}{r} 4x - 6y + 2z = -4 \\ -4x + 9y = 7 \\ \hline 3y + 2z = 3 \end{array}$$

$y + 2/3\, z = 1$

$y = 1 - 2/3z$

$4x - 6(1 - 2/3z) + 2z = -4$

$4x. \ -6 + 4z + 2z = -4$

$4x + 6z. = 2$

$2x + 3z = 1$

$x = 0.5 - 1.5z$

z = a, where a is any real.

2. see ipad notes for solution.

wrapping up!

be sure to: read the directions below!

1. Make sure there isn't any litter near your workstation.
2. If you borrowed headphones, sign them back in.
3. **Make sure you are logged out of your computer!**
4. Remain in your seat until the bell rings.

class: precalc **goal:** HDW use Gauss-Jordan elimination to convert matrix to reduced row echelon form?