Announcements: August 28

- Office Hours today 1-2, Skiles 234
- Bharat’s Office Hours Tue 1:45-2:45, Skiles 230
- WebWorK due date pushed back to Friday (only this week)
- Quiz in recitation on Friday (covers material up to today’s class)
- Join our Piazza group: 1553 E1 through E5
Section 1.1
Systems of Linear Equations
Is it possible for a system of linear equations to have exactly two solutions?
Systems of Linear Equations

The solution to a single linear equation can be...

The solution to system of linear equations is...

For example, consider this system.

\[ x - 3y = -3 \]
\[ 2x + y = 8 \]
Example

Solve:

\[ x + 2y + 3z = 6 \]
\[ 2x - 3y + 2z = 14 \]
\[ 3x + y - z = -2 \]

How many ways can you do it?
Example

Solve:

\[ x + 2y + 3z = 6 \]
\[ 2x - 3y + 2z = 14 \]
\[ 3x + y - z = -2 \]

It is redundant to write \( x, y, z \) again and again, so we rewrite using (augmented) matrices:
Row operations

Our manipulations of matrices are called row operations.

Which operations did we use?

We call these: row swap, row scale, and row replacement

Goal: we want our elimination method to eventually produce a system of equations like

\[
\begin{align*}
x &= A \\
y &= B \\
z &= C
\end{align*}
\]

or in matrix form:

\[
\begin{bmatrix}
1 & 0 & 0 & \vdots & 0 \\
0 & 1 & 0 & \vdots & 0 \\
0 & 0 & 1 & \vdots & 0
\end{bmatrix} \begin{bmatrix}
A \\
B \\
C
\end{bmatrix}
\]
Row operations

Why do row operations not change the solution?
Solve:

\[
\begin{align*}
    x + y &= 2 \\
    -2x + y &= -1
\end{align*}
\]

System has one solution, \( x = 1, y = 1 \).

What happens to the two lines as you do row operations?

\[
\begin{pmatrix}
    1 & 1 & 2 \\
    -2 & 1 & -1
\end{pmatrix}
\]
A New Kind of Example

Solve:

\[
\begin{align*}
    x + y &= 2 \\
    3x + 4y &= 5 \\
    4x + 5y &= 9
\end{align*}
\]

\[
\begin{pmatrix}
    1 & 1 & | & 2 \\
    3 & 4 & | & 5 \\
    4 & 5 & | & 9
\end{pmatrix}
\]

We say the system is...