system of linear equations

substitution

elimination

matrix inversion

Cramer's rule

system of linear equations

- Matrices are particularly useful when solving systems of equations
- Consider following system:

$$
\begin{aligned}
2x - y + 3z &= 9 \\
x + 4y - 5z &= -6 \\
x - y + z &= 2
\end{aligned}
$$

- This system of equations can be represented in matrix form as follows:

$$
A = \begin{bmatrix} 2 & -1 & 3 \\ 1 & 4 & -5 \\ 1 & -1 & 1 \end{bmatrix} \quad \vec{x} = \begin{bmatrix} x \\ y \\ z \end{bmatrix} \quad \vec{b} = \begin{bmatrix} 9 \\ -6 \\ 2 \end{bmatrix} \implies A\vec{x} = \vec{b}
$$

- Techniques for solving:
  - substitution
  - elimination
  - matrix inversion
  - Cramer's rule

we use this example in the following to illustrate each

substitution

- Choose the easiest variable to solve for and plug this expression for the variable into the other two equations you did not yet use
- Three things can happen:

1. There is the same number of equations as unknowns $\Longrightarrow$ uniquely determined
2. There are more unknowns than equations i.e. infinite number of solutions $\Longrightarrow$ underdetermined
3. There are more equations than unknowns (equations are contradictory) $\Longrightarrow$ overdetermined