2.1 System of Linear Equations - Introduction

Example 1: From section 1.4

Solve the system of linear equations

\[
x - 4y = 20
\]
\[
\frac{-27}{4} x + 3y = 9
\]

Substitution Method

1. **Pick an equation and solve for a variable**
   \[ x - 4y = 20 \rightarrow x = 4y + 20 \]

2. **Plug \( x = 4y + 20 \) into other equation**
   \[
   \frac{-27}{4} (4y + 20) + 3y = 9
   \]

3. **Solve for \( y \)**
   \[
   -27y + 135 + 3y = 9
   -24y = 144
   y = -6
   \]

4. **Plug \( y = -6 \) into \( x = 4y + 20 \) to find \( x \)**
   \[
   x = 4(-6) + 20
   x = -24 + 20
   x = -4
   \]

\((-4, -6)\)
Addition Method

\[
x - 4y = 20
\]
\[
-\frac{27}{4}x + 3y = 9
\]

MULT each row by a ≠ so when added, a variable cancels

\[
3x - 12y = 60
\]
\[
-27x + 12y = 36
\]

ADD \[ -24x = 96 \]
\[ x = -4 \]

PLU6 \[ x = -4 \] n10 \[ x - 4y = 20 \] \[ -y - 4y = 20 \] \[ -4y = 24 \] \[ y = -6 \]

Definition 1: Types of Solutions

**UNIQUE (ONE SOLUTION)**

**NO SOLUTION**

**PARALLEL**

**INFINITELY MANY**

**SAME LINE**
Example 2

\[ 2x - y = 1 \]
\[ 6x - 3y = 3 \]

Substitution: \[ 2x - y = 1 \Rightarrow y = 2x - 1 \]

Plug in: \[ 6x - 3(2x - 1) = 3 \]
\[ 6x - 6x + 3 = 3 \]
\[ 3 = 3 \]

True for any value for x

Example 3

\[ 2x - y = 1 \]
\[ 6x - 3y = 12 \]

\[ \frac{2x - y = 1}{-6x + 3y = -3} \]

Add \[ 0 = 9 \]

Not true (no solution)
LET $x$ = # of acres of corn
$y$ = # of acres of wheat

$x + y = 500$  
$42x + \frac{30}{y} = 18600$  

Total cost of corn  
Total cost of wheat

3% interest for account A  
$x$ = amount of money in A

Return $0.03x$