

# MATH 210 FINITE MATHEMATICS

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## 2.1 System of Linear Equations - Introduction

Example 1: From section 1.4

Solve the system of linear equations

$$\begin{aligned}x - 4y &= 20 \\ -\frac{27}{4}x + 3y &= 9\end{aligned}$$

### 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  $x$

$$x = 4(-6) + 20$$

$$x = -4$$

$$(-4, -6)$$

### Addition Method

$$\begin{aligned} x - 4y &= 20 \\ -\frac{27}{4}x + 3y &= 9 \end{aligned}$$

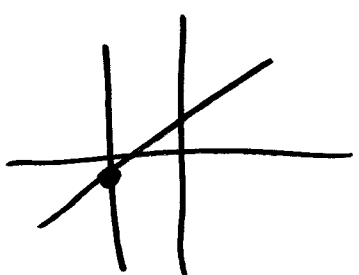
MULT EACH ROW BY A #  
SO WHEN ADDED, A VARIABLE  
CANCELS

$$\begin{aligned} 3x - 12y &= 60 \\ -27x + 12y &= 36 \\ \hline \text{ADD } -24x &= 96 \\ x &= -4 \end{aligned}$$

PLUG  $x = -4$  INTO  $x - 4y = 20 \rightarrow -4 - 4y = 20$   
 $-4 - 4y = 20 \rightarrow -4y = 24$   
 $y = -6$

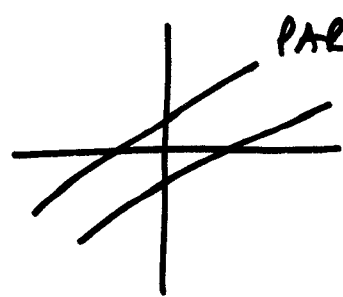
**Definition 1: Types of Solutions**

UNIQUE (ONE SOLUTION)



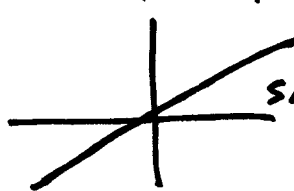
NO SOLUTION

PARALLEL



INFINITELY MANY

SAME LINE



## Example 2

$$\begin{aligned}2x - y &= 1 \\6x - 3y &= 3\end{aligned}$$

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

$$\begin{aligned}2x - y &= 1 \\6x - 3y &= 12\end{aligned}$$

MULT BY  
-3

$$\begin{aligned}2x - y &= 1 \\6x - 3y &= 12\end{aligned}$$

$$\begin{aligned}-6x + 3y &= -3 \\6x - 3y &= 12\end{aligned}$$

ADD

$$0 = 9$$

NOT TRUE (NO SOLUTION)

LET  $x = \#$  OF ACRES OF CORN  
 $y = \#$  OF ACRES OF WHEAT

#23

$$\begin{cases} x + y = 500 \\ 42x + \underline{30y} = 18600 \end{cases}$$

TOTAL COST  
OF CORN

TOTAL COST OF  
WHEAT

3% INTEREST FOR ACCOUNT A

$x =$  AMOUNT OF MONEY IN A

RETURN  $.03x$