Algebra 2/Trig Notes **Name** Key

3.2 Solve Linear Systems Algebraically

Substitution Method	Elimination Method
1. Solve one equation for one variable. (look for a coefficient of 1)	1. Pick a variable to eliminate. +3x −3x
2. Substitute this expression into the OTHER equation.	2. GOAL: to create opposite terms ➢ May only have to change one equation ➢ May have to change both equations by multiplying each by the other's coefficient
3. Solve for the remaining variable.	3. ADD the 2 equations. One variable should be eliminated.
4. Substitute this value into EITHER equation to solve for the remaining variable.	4. Solve for the remaining variable.
5. State the final answer. ➢ Ordered pair (alphabetically) ➢ Slope-intercept form ➢ No Solution	5. Substitute this value into EITHER equation to solve for the remaining variable.
✱ look for a coefficient of 1 or −1 that is easy to solve for	6. State the final answer. ➢ Ordered pair (alphabetically) ➢ Slope-intercept form ➢ No Solution

Substitution Examples:

1. $3x - 2y = -3$ solve for y

$3x + y = 3$

$y = 3 - 3x$ substitute in for y

$3x - 2(3 - 3x) = 3$

$3x - 6 + 6x = -3$

$9x - 6 = -3$

$9x = 3$

$x = 1/3$

plug in to other equation: $y = 3 - 3x$, $y = 3 - 3(1/3)$, $y = 3 - 1$, $y = 2$

$(1/3, 2)$

Write answer as ordered pair

2. $3x - 2y = 10$

$x + 4y = -6$

$x = -6 - 4y$

$3(-6 - 4y) - 2y = 10$

$-18 - 12y - 2y = 10$

$-14y = 28$

$y = -2$

$x = -6 - 4(-2)$

$x = -6 + 8 = 2$

$(2, -2)$

Elimination Examples:

opposites so add equations

3. $2x + 3y = 2$
$x - 3y = -17$

$3x = -15$

$x = -5$

$-5 - 3y = -17$ ← plug in to either equation to get y

$-3y = -12$

$y = 4$

$(-5, 4)$

multiply

4. $(5x + 3y = 0)(-4)$
$(4x + 5y = 13)(5)$

$-20x - 12y = 0$
$20x + 25y = 65$

$13y = 65$

$y = 5$

$5x + 3(5) = 0$
$5x + 15 = 0$
$5x = -15$
$x = -3$

$(-3, 5)$

Special Cases:

5. $2x + 6y = 16$
$\left(\frac{2}{3}x + 2y = 18\right)(-3)$

$-2x - 6y = -54$
$2x + 6y = 16$

$0 = -38$

not true
so no solution

lines would be parallel!

6. $\left(\frac{1}{2}x - \frac{2}{3}y = 2\right)6$
$\left(\frac{4}{3}x - \frac{16}{9}y = \frac{16}{3}\right)(-9)$

clear fractions First

$(3x - 4y = 12)4$
$-12x - 16y = 48$

$12x - 16y = 48$

$0 = 0$

true
so lines coincide
answer is
$3x - 4y = 12$
or $y = 3/4x - 3$

Word Problems.

Example 1. x = shorts cost y = shirts cost

Morgan and Amy found a special on shorts and shirts at American Eagle. Morgan bought 5 pairs of shorts and 7 shirts for $145. Amy bought 3 shorts and 6 shirts for $105. Find the cost of each pair of shorts and each shirt.

$5x + 7y = 145 \quad \cdot -3$

$3x + 6y = 105 \quad \cdot 5$

$-15x - 21y = -435$

$15x + 30y = 525$

$9y = 90$

$y = 10$

$5x + 70 = 145$

$5x = 75$

$x = 15$

shorts cost $15

shirts cost $10

You try. The Bike shop owns three times as many mountain bikes as racing bikes. There are 60 more mountain bikes than racing bikes. How many of each does the company own?

x = mountain bikes y = racing

$x = 3y$

$x = y + 60$

$3y = y + 60$

$2y = 60$

$y = 30$

$x = 90$

90 mountain bikes

30 racing bikes

Example 2. There were 166 people at the booster club bingo. The price was $2 for adults and $0.75 for students. The booster club raised $293.25. How many adults and how many students attended?

x = # adults y = # students

$x + y = 166$ total people

$2x + .75y = 293.25$ total money

$x = 166 - y$

$2(166 - y) + .75y = 293.25$

$332 - 2y + .75y = 293.25$

$-1.25y = -38.75$

$y = 31$

$x = 166 - 31 = 135$

135 adults

31 students