4.1.Systems of linear equations in 2 variables

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Goals: ① Solve systems of linear equations by the method of substitution.

② Solve systems of linear equations by the method of elimination.

③ Solve by the method of graphing

④ Solve some application problems.

Method of Substitution:

$$\begin{cases} 3x + 5y = -9 \\ x + 4y = -10 \end{cases}$$

Solve this system.

Key: pick an equation. Solve for one variable in terms of the other. Substitute that expression we get for that variable to the remaining equation. This turns that equation into an equation in one variable.

Done!

→ $x = -10 - 4y$.

Substitute this into the first equation

$$3(-10-4y)+5y=-9.$$

$$-30-12y+5y=-9$$

$$-30-7y=-9$$

$$-7y=21$$

$$\boxed{y=-3}$$

$$x=-10-4\cdot(-3)=-10+12=2.$$

Solution for this system: $\boxed{(2,-3)}$

Method of Elimination

$$\begin{cases} 3x+5y=-9 \\ x+4y=-10 \end{cases}$$

→ Multiply both sides by -3

Add side by side:

$$\begin{cases} \cancel{3x}+5y=-9 \\ \cancel{-3x}-12y=30 \end{cases}$$

$$-7y=21 \longrightarrow \boxed{y=-3}$$

$x+4\cdot(-3)=-10$

$\boxed{x=2}$

Key: Multiply either one or both equations by a number on both sides and add the equations so that one variable disappears. Then we can solve for the other variable.

An application:

Animals in a clinic need to be kept in a very strict diet.

Each animal should receive exactly 35 grams of protein and 5 grams of fat.

Lab technician are able to obtain 2 types of food mixes:

Mix A has 20% of protein and 8% of fat.

Mix B has 40% of protein and 4% of fat.

Q: How many grams of each mix should be used to obtain the correct diet for an animal.

Amount of mix A to be used: x

Amount of mix B to be used: y

Amount of protein in x grams of A: $0.2x$

_____ fat in _____: $0.08x$

Amount of protein in y gram of B: $0.4y$

_____ fat _____: $0.04y$

So, $0.2x + 0.4y = 35$ → Multiply by 2

$0.08x + 0.04y = 5$ → Multiply by -5

→ Solve for x and y.

$$+\begin{cases} 0.4x + 0.8y = 70 \\ -0.4x - 0.2y = -25 \end{cases}$$

$$0.6y = 45$$

$y = 75$

$x = 25$