Math 1201

7.6B Solve a System of Linear Equations Algebraically

Example 1:
A test has twenty questions worth 100 points. The test consists of selected response questions worth 3 points each and constructed response worth 11 points each. How many selected response questions are on the test?

x: Selected respose
y: constructed response

① $3x + 11y = 100$
② $x + y = 20$

Solve ② for x:
$x = -y + 20$
Sub into ①

$3(-y+20) + 11y = 100$
$-3y + 60 + 11y = 100$
$8y = 100 - 60$
$\frac{8y}{8} = \frac{40}{8}$
$y = 5$

Sub into ②
$x = -5 + 20$
$x = 15$

Example 2:
The cost of a buffet dinner for a family of six was $48.50; $11.75 per adult, $6.25 per child. How many members paid each price?

x: children
y: adults

① $x + y = 6$
② $6.25x + 11.75y = 48.50$

6.25① − ②

$$
\begin{array}{rl}
① & \cancel{6.25x} + 6.25y = 37.5 \\
- & \cancel{6.25x} + 11.75y = 48.50 \\
\hline
 & -5.5y = -11
\end{array}
$$

$\frac{-5.5y}{-5.5} = \frac{-11}{-5.5}$
$y = 2$

Sub y into ①
$x + 2 = 6$
$x = 6 - 2$
$x = 4$

Example 3:
Describe a real-life situation in which the graphs of the lines in the linear system are not parallel but the linear system has no solution. This could involve situations where the domain is restricted. For example, the cellular phone plans modeled in the table below would never have the same cost.

Plan	Base Monthly Fee ($)	Cost per Minute (¢)
A	30	5 $0.05
B	10	2 $0.02

A: $y = 30 + 0.05x$

B: $y = 10 + 0.02x$

Some times solutions are constrained by real world situations.

Example 4:
Write a linear system that has an infinite number of solutions. Explain what happens when you try to solve the system using elimination.

① $3x - 2y = 5$
② $15x - 10y = 25$

There will be no solution to this system of equations.

Example 5:

(A) Solve the linear system using elimination.

$$\begin{cases} ① \ 2x - 5y = 10 \\ ② \ 4x - 10y = 20 \end{cases}$$

2① − ②

$$\begin{array}{rrcr} & 4x - 10y & = & 20 \\ - & 4x - 10y & = & 20 \\ \hline & 0 \quad\quad 0 & & 0 \end{array}$$

(B) What does the solution tell you about the nature of the lines of the equations?

There are an infinite number of solutions because one line is a multiple of the other.

(C) Convert the equations to slope-intercept form to confirm this conclusion.

① $2x - 5y = 10$

$-5y = -2x + 10$

$\frac{-5y}{-5} = \frac{-2x}{-5} + \frac{10}{-5}$

$y = \frac{2}{5}x - 2$

② $4x - 10y = 20$

$-10y = -4x + 20$

$\frac{-10y}{-10} = \frac{-4x}{-10} + \frac{20}{-10}$

$y = \frac{2}{5}x - 2$

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