DO NOW…. Solve:

$$\begin{cases} 3x - 2y = 3 \\ -2x + y = -2 \end{cases}$$

homework answers

3) inconsistent

4) consistent

7) (2, -1)

8) (-2,4)

17) (6,2)

18) (1,-4)

22) (-5.75, 4)

46) 0=-2... no solution

Homework Due Today!

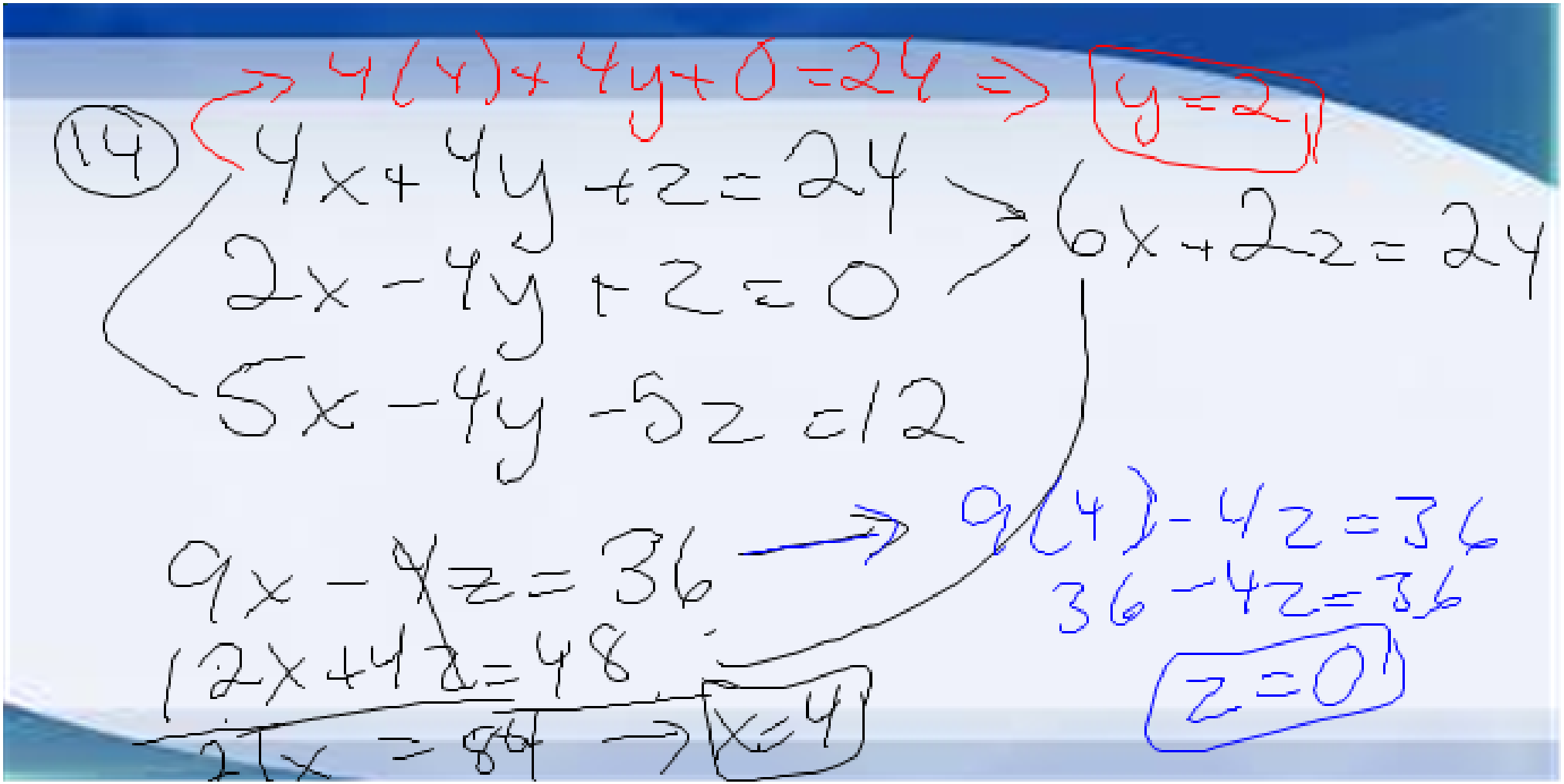
WS

④ $-2x+6y=6$ → $x=3y-3$

$-7x+8y=-5$

$-7(3y-3)+8y=-5$

$-21y+21+8y=-5$


(14)
4x + 4y + 2 = 24
2x − 4y + 2 = 0
5x − 4y − 5z = 12
9x − 4z = 36
12x + 4z = 48
21x = 84
x = 4
6x + 2z = 24
4(4) + 4y + 0 = 24
y = 2
9(4) − 4z = 36
36 − 4z = 36
z = 0

DO NOW.... Solve:

$$\begin{cases} 3x - 2y = 3 \\ -2x + y = -2 \end{cases}$$

$-2x + y = -2 \rightarrow y = 2x - 2$

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

$3x - 4x + 4 = 3$

$-x = -1$

$\boxed{x = 1}$

$3(1) - 2y = 3$

$3 - 2y = 3$

$-2y = 0$

$\boxed{y = 0}$

SECTION 11.2

SYSTEM MATRICES

(ROW OPERATIONS)

A **matrix** is defined as a rectangular array of numbers,

	Column 1	Column 2	⋯	Column j	⋯	Column n
Row 1	a_{11}	a_{12}	⋯	a_{1j}	⋯	a_{1n}
Row 2	a_{21}	a_{22}	⋯	a_{2j}	⋯	a_{2n}
⋮	⋮	⋮		⋮		⋮
Row i	a_{i1}	a_{i2}	⋯	a_{ij}	⋯	a_{in}
⋮	⋮	⋮		⋮		⋮
Row m	a_{m1}	a_{m2}	⋯	a_{mj}	⋯	a_{mn}

Augmented Matrices

The matrix used to represent a system of linear equations.

$$\begin{cases} x + 4y = 14 \\ 3x - 2y = 0 \end{cases}$$

$$\left[\begin{array}{cc|c} 1 & 4 & 14 \\ 3 & -2 & 0 \end{array}\right]$$

EXAMPLE

Writing the Augmented Matrix of a System of Linear Equations

Write the augmented matrix of each system of equations.

(a) $\begin{cases} 3x - 2y = 3 \\ -2x + y = -2 \end{cases}$

$$\left[\begin{array}{cc|c} 3 & -2 & 3 \\ -2 & 1 & -2 \end{array}\right]$$

(b) $\begin{cases} 3x - 2y + 5 = 0 \\ -2x + 4z + 2 = 0 \\ x + 4y - 7z = 0 \end{cases}$

$$\left[\begin{array}{ccc|c} x & y & z & \\ 3 & -2 & 0 & -5 \\ -2 & 0 & 4 & -2 \\ 1 & 4 & -7 & 0 \end{array}\right]$$

EXAMPLE Writing the System of Linear Equations from the Augmented Matrix

Write the system of linear equations corresponding to each augmented matrix.

(a) $\left[\begin{array}{cc|c} -2 & 1 & 3 \\ 1 & 1 & -2 \end{array}\right]$

$x \quad y = ?$

$-2x + y = 3$

$x + y = -2$

(b) $\left[\begin{array}{ccc|c} 3 & -2 & 5 & 3 \\ -2 & 1 & 4 & -2 \\ 1 & 4 & -7 & 1 \end{array}\right]$

$x \quad y \quad z = ?$

$3x - 2y + 5z = 3$

$-2x + y + 4z = -2$

$x + 4y - 7z = 1$

Row Operations

1. Interchange any two rows.
2. Replace a row by a nonzero multiple of that row.
3. Replace a row by the sum of that row and a constant nonzero multiple of some other row.

EXAMPLE

Applying a Row Operation to an Augmented Matrix

Apply the row operation $R_2 = 2r_1 + r_2$ to the augmented matrix

$$\begin{bmatrix} 1 & 3 & -4 \\ -2 & -5 & 3 \end{bmatrix}$$

$$\begin{bmatrix} 1 & 3 & -4 \\ 0 & 1 & -5 \end{bmatrix}$$

$$\begin{array}{rrr} 2 & 6 & -8 \\ -2 & -5 & 3 \\ \hline 0 & 1 & -5 \end{array}$$

Conduct the following Row Operations:

$$\begin{bmatrix} 1 & 2 & 1 \\ -2 & 3 & 5 \end{bmatrix} \xrightarrow{2R_1 + R_2 = R_2}$$

$$\begin{array}{rrr} 2 & 4 & 2 \\ +\,-2 & 3 & 5 \\ \hline 0 & 7 & 7 \end{array} \qquad \begin{bmatrix} 1 & 2 & 1 \\ 0 & 7 & 7 \end{bmatrix}$$

$$\begin{bmatrix} 1 & 2 & 1 \\ 0 & 1 & 1 \end{bmatrix} \xrightarrow{-2R_2 + R_1 = R_1}$$

$$\begin{array}{rrr} 0 & -2 & -2 \\ +\,1 & 2 & 1 \\ \hline 1 & 0 & -1 \end{array} \qquad \begin{bmatrix} 1 & 0 & -1 \\ 0 & 1 & 1 \end{bmatrix}$$

$$\begin{bmatrix} 1 & 2 & 1 \\ 0 & 7 & 7 \end{bmatrix} \xrightarrow{\frac{1}{7}R_2 = R_2}$$

$$\begin{array}{rrr} 0 & 1 & 1 \end{array} \qquad \begin{bmatrix} 1 & 2 & 1 \\ 0 & 1 & 1 \end{bmatrix}$$

EXAMPLE

Finding a Particular Row Operation

Find a row operation that will result in the augmented matrix

$$\left[\begin{array}{cc|c} 1 & 3 & -4 \\ 0 & 1 & -5 \end{array}\right]$$

$-3R_2 + R_1 = R_1$

having a 0 in row 1, column 2.

$$\begin{array}{rr|r} 0 & -3 & 15 \\ +1 & 3 & -4 \\ \hline 1 & 0 & 11 \end{array}$$

$$\left[\begin{array}{cc|c} 1 & 0 & 11 \\ 0 & 1 & -5 \end{array}\right]$$

Things you can do:

Add two rows

Manipulate a single equation by multiplying or dividing by a #

Switch rows

Find a row operation that will result in the augmented matrix having a 0 in row 3, column 3.

$$\begin{bmatrix} 1 & 0 & 0 & -3 \\ 0 & 1 & 0 & 2 \\ 0 & 0 & -2 & 4 \end{bmatrix}$$

$R_1 \leftrightarrow R_3$

$$\begin{bmatrix} 0 & 0 & -2 & 4 \\ 0 & 1 & 0 & 2 \\ 1 & 0 & 0 & -3 \end{bmatrix}$$

Things you can do:

Add two rows

Manipulate a single equation by multiplying or dividing by a #

Switch rows