

Sept 13th Class Notes

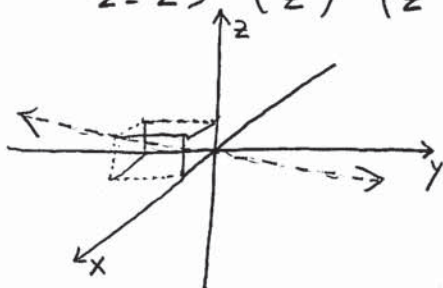
Simplify to Reduced Row Echelon Form:

$$\left(\begin{array}{cc|c} 5 & 13 & 2 \\ 2 & 5 & -7 \end{array}\right) \xrightarrow{5R_1 - 2R_2} \left(\begin{array}{cc|c} 5 & 13 & 2 \\ 0 & -1 & 31 \end{array}\right) \xrightarrow{-1 \cdot R_2} \left(\begin{array}{cc|c} 5 & 13 & 2 \\ 0 & 1 & -31 \end{array}\right) \xrightarrow{R_1 - 13R_2} \left(\begin{array}{cc|c} 5 & 0 & 405 \\ 0 & 1 & -31 \end{array}\right) \xrightarrow{\frac{1}{5} \cdot R_1} \left(\begin{array}{cc|c} 1 & 0 & 81 \\ 0 & 1 & -31 \end{array}\right)$$

$$\left(\begin{array}{ccc|c} 3 & 2 & 1 & 0 \\ 0 & 5 & 10 & 0 \end{array}\right) \xrightarrow{\frac{1}{5} \cdot R_2} \left(\begin{array}{ccc|c} 3 & 2 & 1 & 0 \\ 0 & 1 & 2 & 0 \end{array}\right) \xrightarrow{R_1 - 2R_2} \left(\begin{array}{ccc|c} 3 & 0 & -3 & 0 \\ 0 & 1 & 2 & 0 \end{array}\right) \xrightarrow{\frac{1}{3} \cdot R_1} \left(\begin{array}{ccc|c} 1 & 0 & -1 & 0 \\ 0 & 1 & 2 & 0 \end{array}\right)$$

↑ These are free variables

$$\begin{cases} 1x + 0y + -1z = 0 \\ 0x + 1y + 2z = 0 \\ z = z \end{cases} \begin{cases} x = z \\ y = -2z \\ z = z \end{cases} \begin{pmatrix} x \\ y \\ z \end{pmatrix} = \begin{pmatrix} z \\ -2z \\ z \end{pmatrix} = z \begin{pmatrix} 1 \\ -2 \\ 1 \end{pmatrix}$$



Slope

Slope-Intercept: $y = mx + b$

Point Slope: $(y - y_0) = m(x - x_0)$

$y = m(x - x_0) + y_0$

Standard: $Ax + By = C$

$2x + 3y = 0$

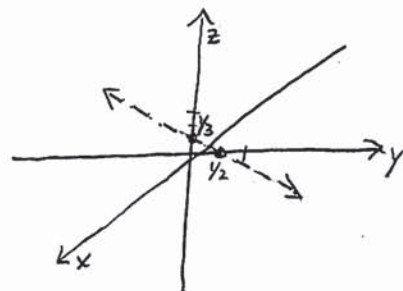
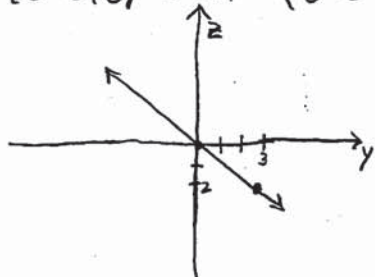
$$\left(\begin{array}{cc|c} 2 & 3 & 0 \\ 6 & 9 & 0 \end{array}\right) \xrightarrow{R_2 - 3R_1} \left(\begin{array}{cc|c} 2 & 3 & 0 \\ 0 & 0 & 0 \end{array}\right) \xrightarrow{\frac{1}{2} \cdot R_1} \left(\begin{array}{cc|c} 1 & 3/2 & 0 \\ 0 & 0 & 0 \end{array}\right)$$

We have a free variable

$$x = -\frac{3}{2}y$$

$$y = \frac{2}{3}x$$

$$2x + 3y = 0$$



$$\left(\begin{array}{cc|c} 2 & 3 & 1 \\ 6 & 9 & 3 \end{array}\right) \xrightarrow{R_2 - 3R_1} \left(\begin{array}{cc|c} 2 & 3 & 1 \\ 0 & 0 & 0 \end{array}\right)$$

$$2x + 3y = 1 \rightarrow 2x = 1 - 3y \rightarrow x = (1 - 3y)/2$$

$$y = y \quad y = y$$

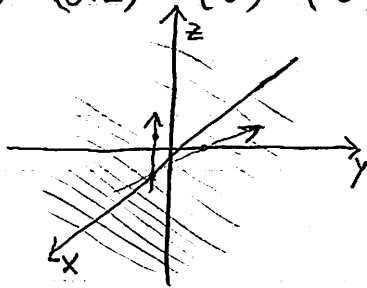
$$2 \cdot \frac{1}{2} + 3 \cdot 0 = 1$$

$$\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} (1 - 3y)/2 \\ y \end{pmatrix} = \begin{pmatrix} \frac{1}{2} - \frac{3}{2}y \\ 0 + y \end{pmatrix} = \begin{pmatrix} \frac{1}{2} \\ 0 \end{pmatrix} + \begin{pmatrix} -\frac{3}{2}y \\ y \end{pmatrix} = \begin{pmatrix} \frac{1}{2} \\ 0 \end{pmatrix} + \begin{pmatrix} -\frac{3}{2} \\ 1 \end{pmatrix} y$$

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$$\left(\begin{array}{ccc|c} 1 & 2 & 0 & 1 \\ 3 & 6 & 0 & 3 \\ -2 & -4 & 0 & -2 \end{array} \right) \xrightarrow{\substack{R_2 - 3R_1 \\ R_3 - 2R_1}} \left(\begin{array}{ccc|c} 1 & 2 & 0 & 1 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \end{array} \right)$$

$$\left. \begin{array}{l} X = 1 - 2y \\ Y = y \\ Z = z \end{array} \right\} \begin{pmatrix} X \\ Y \\ Z \end{pmatrix} = \begin{pmatrix} 1 - 2y \\ 0 + y \\ 0 + z \end{pmatrix} = \begin{pmatrix} 1 \\ 0 \\ 0 \end{pmatrix} + \begin{pmatrix} -2y \\ y \\ 0 \end{pmatrix} + \begin{pmatrix} 0 \\ 0 \\ z \end{pmatrix} = \begin{pmatrix} 1 \\ 0 \\ 0 \end{pmatrix} + \begin{pmatrix} -2 \\ 1 \\ 0 \end{pmatrix} y + \begin{pmatrix} 0 \\ 0 \\ 1 \end{pmatrix} z$$



Creates a plane

Being a point on this plane means being a solution to this system of equations.