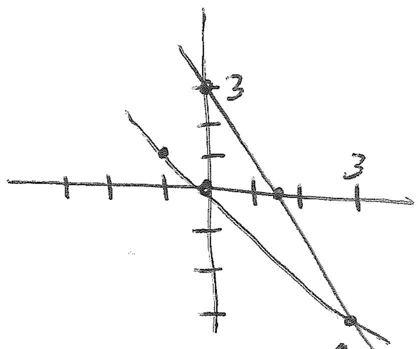
Section 2.1

(1) linear

(3) nonlinear due to x^{-1}

(5) nonlinear due to $\cos x$

(15)



Find 2 points on each line

$x+y=0$	$2x+y=3$
$(0,0)$	$(\frac{3}{2},0)$
$(-1,1)$	$(0,3)$

Solution is $\begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 3 \\ -3 \end{bmatrix}$

Unique Solution

$$\begin{array}{c} \begin{array}{cc} x & y \end{array} \\ \left[\begin{array}{cc|c} 1 & 1 & 0 \\ 2 & 1 & 3 \end{array}\right] \end{array}$$

$$R_2 - 2R_1 \quad \left[\begin{array}{cc|c} 1 & 1 & 0 \\ 0 & -1 & 3 \end{array}\right]$$

$$\frac{R_2}{(-1)} \quad \left[\begin{array}{cc|c} 1 & 1 & 0 \\ 0 & 1 & -3 \end{array}\right]$$

$$R_1 - R_2 \quad \left[\begin{array}{cc|c} 1 & 0 & 3 \\ 0 & 1 & -3 \end{array}\right]$$

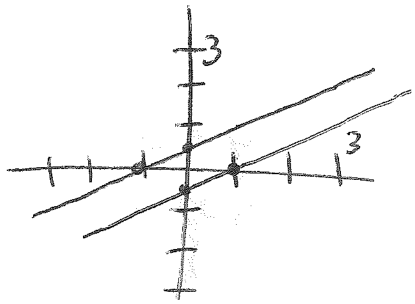
$$\begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 3 \\ -3 \end{bmatrix}$$

(17) Find 2 points on each line

$3x - 6y = 3$ $\qquad\qquad$ $-x + 2y = 1$

$(1, 0)$ $\qquad\qquad$ $(-1, 0)$

$(0, -\frac{1}{2})$ $\qquad\qquad$ $(0, \frac{1}{2})$



no solution

$$\left[\begin{array}{cc|c} 3 & -6 & 3 \\ -1 & 2 & 1 \end{array}\right]$$

$$\frac{R_1}{3} \quad \left[\begin{array}{cc|c} 1 & -2 & 1 \\ -1 & 2 & 1 \end{array}\right]$$

$$R_2 + R_1 \quad \left[\begin{array}{cc|c} 1 & -2 & 1 \\ 0 & 0 & 2 \end{array}\right]$$

The system has no solution.

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(21)

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

$$3z = -1 \rightarrow z = \frac{-1}{3}$$

$$2y - z = 1 \rightarrow 2y + \frac{1}{3} = 1 \rightarrow 2y = \frac{2}{3}$$
$$y = \frac{1}{3}$$

$$x - y + z = 0 \rightarrow x - \frac{1}{3} - \frac{1}{3} = 0 \rightarrow x = \frac{2}{3}$$

$$\begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 2/3 \\ 1/3 \\ -1/3 \end{bmatrix}$$

(23)

$$\begin{array}{cccc} x_1 & x_2 & x_3 & x_4 \\ \end{array}$$
$$\left[\begin{array}{cccc|c} 1 & 1 & -1 & -1 & 1 \\ 0 & 1 & 1 & 1 & 0 \\ 0 & 0 & 1 & -1 & 0 \\ 0 & 0 & 0 & 1 & 1 \end{array}\right]$$

$$x_4 = 1$$

$$x_3 - x_4 = 0 \rightarrow x_3 - 1 = 0 \rightarrow x_3 = 1$$

$$x_2 + x_3 + x_4 = 0 \rightarrow x_2 + 1 + 1 = 0 \rightarrow x_2 = -2$$

$$x_1 + x_2 - x_3 - x_4 = 1 \rightarrow x_1 - 2 - 1 - 1 = 1 \rightarrow x_1 = 5$$

$$\begin{bmatrix} x_1 \\ x_2 \\ x_3 \\ x_4 \end{bmatrix} = \begin{bmatrix} 5 \\ -2 \\ 1 \\ 1 \end{bmatrix}$$

(27)

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

(29)

$$\begin{array}{cc} x & y \\ \end{array}$$
$$\left[\begin{array}{cc|c} 1 & 5 & -1 \\ -1 & 1 & -5 \\ 2 & 4 & 4 \end{array}\right]$$

(33)

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

$R_2 - 2R_1$ $$\left[\begin{array}{cc|c} 1 & -1 & 0 \\ 0 & 3 & 3 \end{array}\right]$$

$\frac{R_2}{3}$ $$\left[\begin{array}{cc|c} 1 & -1 & 0 \\ 0 & 1 & 1 \end{array}\right]$$

$R_1 + R_2$ $$\left[\begin{array}{cc|c} 1 & 0 & 1 \\ 0 & 1 & 1 \end{array}\right]$$

$$\begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 1 \\ 1 \end{bmatrix}$$

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$$\begin{array}{cc} x & y \\ \end{array}$$
$$\left[\begin{array}{cc|c} 1 & 5 & -1 \\ -1 & 1 & -5 \\ 2 & 4 & 4 \end{array}\right]$$

$$\begin{array}{l} \\ R_2+R_1 \\ R_3-2R_1 \end{array} \left[\begin{array}{cc|c} 1 & 5 & -1 \\ 0 & 6 & -6 \\ 0 & -6 & 6 \end{array}\right]$$

$$\frac{R_2}{6} \left[\begin{array}{cc|c} 1 & 5 & -1 \\ 0 & 1 & -1 \\ 0 & -6 & 6 \end{array}\right]$$

$$\begin{array}{l} R_1-5R_2 \\ \\ R_3+6R_2 \end{array} \left[\begin{array}{cc|c} 1 & 0 & 4 \\ 0 & 1 & -1 \\ 0 & 0 & 0 \end{array}\right] \leftarrow \text{no info}$$

$x = 4$
$y = -1$

$$\begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 4 \\ -1 \end{bmatrix}$$