## 4-3: Cramer's Rule

June 8

The solution ( x, y, z ) for a system of 3 linear equations is $\left( \frac{D_x}{D}, \frac{D_y}{D}, \frac{D_z}{D} \right)$

$D$ = coefficients determinant

$D_x$ , $D_y$ , and $D_z$ are determinants formed by replacing coefficients in x, y, and z columns in $D$ with the constants

**1** Solve by Cramer's Rule: $3x - 5y = 11$, $4x + 6y = -8$

$$D = \begin{vmatrix} 3 & -5 \\ 4 & 6 \end{vmatrix} = 18 + 20 = 38$$

$$D_x = \begin{vmatrix} 11 & -5 \\ -8 & 6 \end{vmatrix}$$

$66 - 40 = 26$

$$D_y = \begin{vmatrix} 3 & 11 \\ 4 & -8 \end{vmatrix}$$

$-24 - 44 = -68$

$$\left(\frac{26}{38}, \frac{-68}{38}\right) = \left(\frac{13}{19}, \frac{-34}{19}\right)$$

You must find both

**2** Solve by Cramer's Rule:

$$x + 2y - z = 4$$
$$3x - 2y = 6$$
$$-4x + 3z = -5$$

$$D = \begin{vmatrix} 1 & 2 & -1 \\ 3 & -2 & 0 \\ -4 & 0 & 3 \end{vmatrix} \begin{matrix} 1 & 2 \\ 3 & -2 \\ -4 & 0 \end{matrix} = -6 + 8 - 18$$

$$D_x = \begin{vmatrix} 4 & 2 & -1 \\ 6 & -2 & 0 \\ -5 & 0 & 3 \end{vmatrix} \begin{matrix} 4 & 2 \\ 6 & -2 \\ -5 & 0 \end{matrix} = -24 + 10 - 36 = -50$$

$$3\left(\frac{25}{8}\right) - 2y = 6$$

For 3x3 system, you may use substitution or Cramer's Rule to solve for remaining variables

$$\left(\frac{-50}{-16}\right) = \left(+\frac{25}{8}, \frac{27}{16}, \frac{5}{2}\right)$$