

Mar. 22, 2017

Sect. 6-5b

Using Matrix Determinants

Cramer's Rule

Area of a Triangle (Extra)

$$4x - 2y = 10$$

$$3x - 5y = 11$$

$$D = \begin{vmatrix} 4 & -2 \\ 3 & -5 \end{vmatrix} = -20 - (-6) = -14$$

$$D_x = \begin{vmatrix} 10 & -2 \\ 11 & -5 \end{vmatrix} = -50 - (-22) = -28$$

$$D_y = \begin{vmatrix} 4 & 10 \\ 3 & 11 \end{vmatrix} \begin{matrix} 30 \\ 44 \end{matrix} = 44 - 30 = 14$$

$$x = \frac{D_x}{D} = \frac{-28}{-14} = 2$$

$$y = \frac{D_y}{D} = \frac{14}{-14} = -1$$

(2, -1)

$$-x + 2y - 3z = 1$$

$$2x + z = 0$$

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

$$D = \left| \begin{array}{ccc|cc} -1 & 2 & -3 & -1 & 2 \\ 2 & 0 & 1 & 2 & 0 \\ 3 & -4 & 4 & 3 & -4 \end{array} \right.$$

$0 + 4 + 16 = 20$

$30 - 20 = 10$

$0 + 6 + 24 = 30$

$$D_x = \begin{array}{ccc|cc} & & & 0 & -4 & +0 & = & -4 \\ 1 & 2 & -3 & 1 & 2 & & & \\ 0 & 0 & 1 & 0 & 0 & & 4 - (-4) & = 8 \\ 2 & -4 & 4 & 2 & -4 & & & \\ & & & 0 & +4 & +0 & = & 4 \end{array}$$

$$D_y = \begin{array}{ccc|cc} & & & 0 & -2 & +8 & = & 6 \\ -1 & 1 & -3 & -1 & 1 & & & \\ 2 & 0 & 1 & 2 & 0 & & -9 - 6 & = -15 \\ 3 & 2 & 4 & 3 & 2 & & & \\ & & & 0 & +3 & -12 & = & -9 \end{array}$$

$$D_2 = \begin{vmatrix} -1 & 2 & 1 \\ 2 & 0 & 0 \\ 3 & -4 & 2 \end{vmatrix} \begin{matrix} 0+0+8 \\ -1 & 2 \\ 2 & 0 \\ 3 & -4 \end{matrix} = -8-8 = -16$$

$$0 + 0 - 8 = -8$$

$$x = \frac{D_x}{D} = \frac{8}{10} = \frac{4}{5}$$

$$y = \frac{D_y}{D} = \frac{-15}{10} = -\frac{3}{2}$$

$$z = \frac{D_z}{D} = \frac{-16}{10} = -\frac{8}{5}$$

$$\left(\frac{4}{5}, -\frac{3}{2}, -\frac{8}{5} \right)$$

Area of a Triangle

$$(2, -1) \quad (5, 6) \quad (-1, 3)$$

$$A = \pm \frac{1}{2} \begin{vmatrix} x_1 & y_1 & 1 \\ x_2 & y_2 & 1 \\ x_3 & y_3 & 1 \end{vmatrix}$$

$$A = \pm \frac{1}{2} \left(\begin{array}{cc|cc} 2 & -1 & 1 & 2 & -1 \\ 5 & 6 & 1 & 5 & 6 \\ -1 & 3 & 1 & -1 & 3 \end{array} \right) \quad \begin{array}{l} -6 + 6 - 5 = -5 \\ 28 - (-5) \\ = 33 \\ 12 + 1 + 15 = 28 \end{array}$$

$$A = \frac{1}{2} (33) = \frac{33}{2} = 16\frac{1}{2}$$