**Activity 8.5.3 Solving a 3×3 Contextual Application using Cofactors and Inverses**

Continuing with our problem from activity 8.5.1

$$x=number of aluminum cans collected$$

$$y=number of plastic bottles collected$$

$$z=pounds of newspaper collected$$

The equation for the value in dollars of the collected items is: $0.05x+0.05y+0.5z$ (1)

The equation for the weight in pounds of the collected items is: $0.04x+0.045y+z$ (2)

The equation for the reduction in pounds of CO2 emissions is: $0.4x+0.0765y+2.5z$ (3)

Suppose we wished to know what combination of aluminum cans, plastic bottles and newsprint collected would result in $1000 gained, 1000 pounds collected, and a 5000 pound reduction in carbon dioxide emissions into the atmosphere?

Let us now complete the solution.

1. We need to find the inverse matrix in order to find the solution of the system of three equations with three variables.

Write the matrix of cofactors for the matrix$\left[\begin{matrix}.05&.05&.5\\.04&.045&1\\.4&.0765&2.5\end{matrix}\right]$

1. Evaluate each of the nine entries. Verify your work with the result below:
2. Now, move the entries across the diagonal:
3. What additional information will you need to find the inverse of the matrix?
4. Find the additional information.
5. Multiply the matrix you found in 3 above by $\frac{1}{detA}=\frac{1}{.00933}=107.18$ and check your result:
6. Finally, you can now multiply the original matrix equation by this inverse matrix to solve the original equation. First multiply the left side below:
7. Now multiply the right side of the equation and simplify:

$$\left[\begin{matrix}3.858&-9.298&2.947\\32.154&-8.039&-3.215\\-1.601&1.734&.0268\end{matrix}\right]\left[\begin{matrix}1000\\1000\\5000\end{matrix}\right]=$$

1. If you wish to have collections that are valued at $1000, weigh 1000 lbs. and result in a reduction in CO2 emission of 5000 lbs, you will need to collect:
2. Check your solution.

$0.05x+0.05y+0.5z$ = 1000

$0.04x+0.045y+z$ = 1000

 $0.4x+0.0765y+2.5z=5000$

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