Finding Atomic Weight with Matrices

Activity overview

Students are introduced to the key concepts of solving Linear Systems through the use of matrices. They will also look at the relationship between one equation and another equation. Later they will be exposed to multiple methods for using matrices to solve complex systems.

Concepts: Equations, System of equations, matrices, inverse matrices and solving systems of equations. This is a great cross curricular activity Algebra II and AP Chemistry.

Teacher preparations:

This investigation offers many possible extensions depending on the level of the students. This investigation is most appropriate for Algebra II and pre-Calculus students. The investigation has a direct application to chemistry.

Teacher should spend some time practicing this investigation with the calculator in advance of presenting it themselves.

Classroom Management

This investigation is intended to be ***teacher-led***. This lesson is best presented after the students have a general understanding of matrices and matrix operations.

Problem:

The atomic weights of three compounds are shown in the table below. Use a matrix equation and your knowledge of inverse operations to determine the atomic weights of carbon (c), hydrogen (H) and oxygen (O).

Atomic Weight of Specific Compounds

Compound	Formula	Atomic weight
Methane	CH_4	16
Glycerol	$C_3H_8O_3$	92
Water	H_2O	18

Your goal is to set-up matrices that describes each compound. Let C, H and O represent the atomic weights of carbon, hydrogen and oxygen respectively.

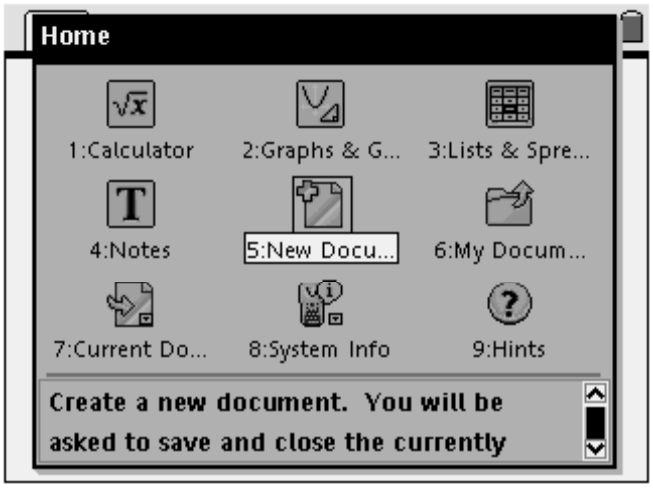
C+4H+ (no oxygens)=16

3C+8H+3"O"=92

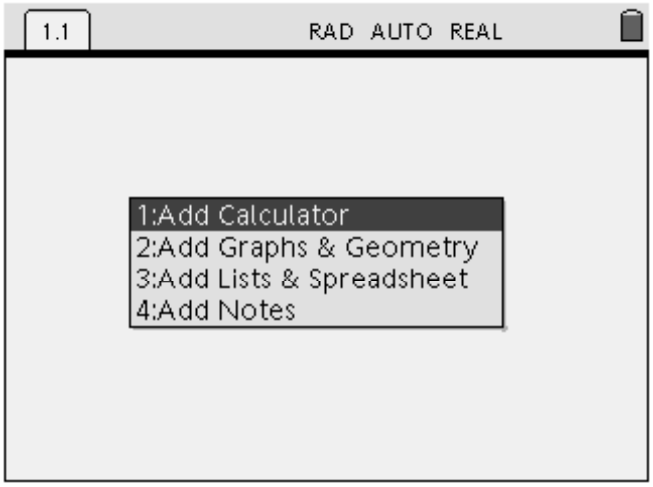
(no carbons)+2H+"O"=18

Step 1:

From the Home screen of your Nspire choose “New Document”.

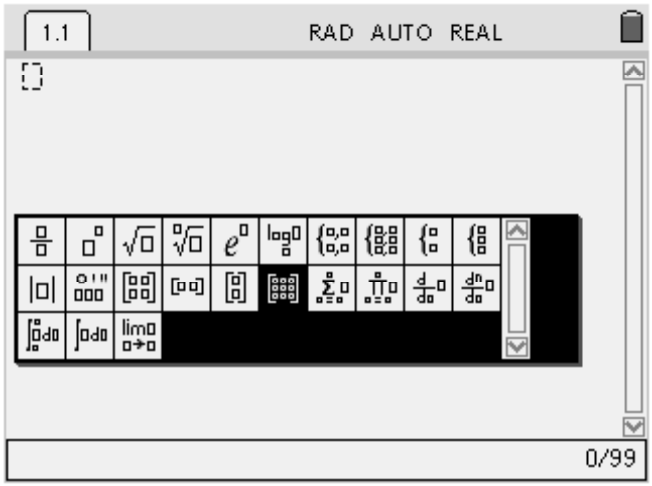


Step 2 Choose “add calculator”

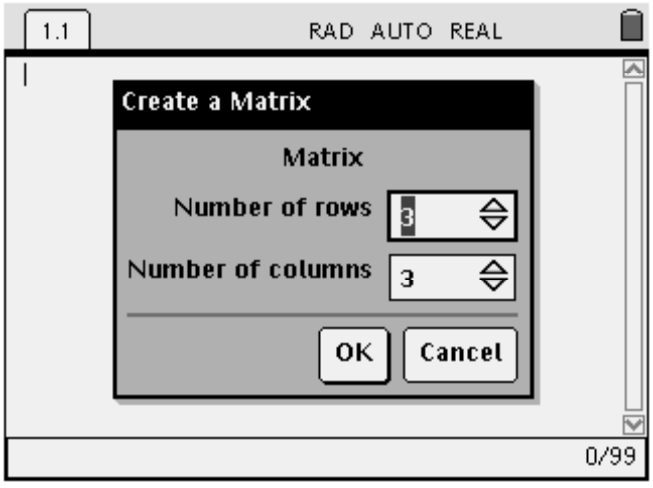


Step 3

Press the “control” button and then the multiplication button. Use the cursor to select the matrix icon.

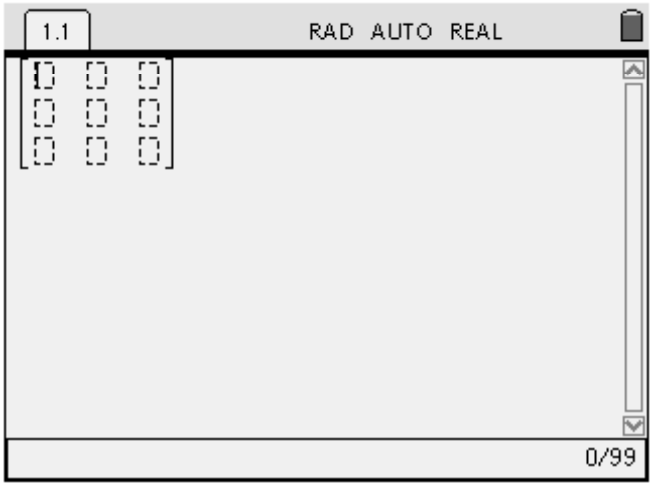


Step 4 Use the “tab” key fill in 3 rows and 3 columns. Tab to move from “rows” to “columns”

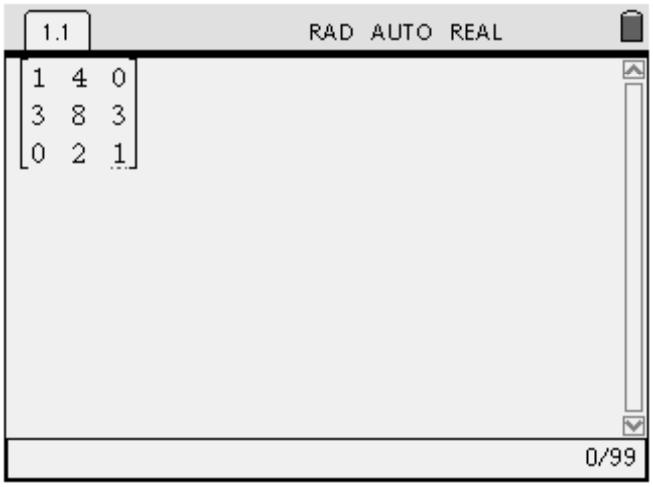


Step 5

A blank 3x3 matrix will appear on the screen. Fill in each cell moving to the next cell through the use of the “tab” button.

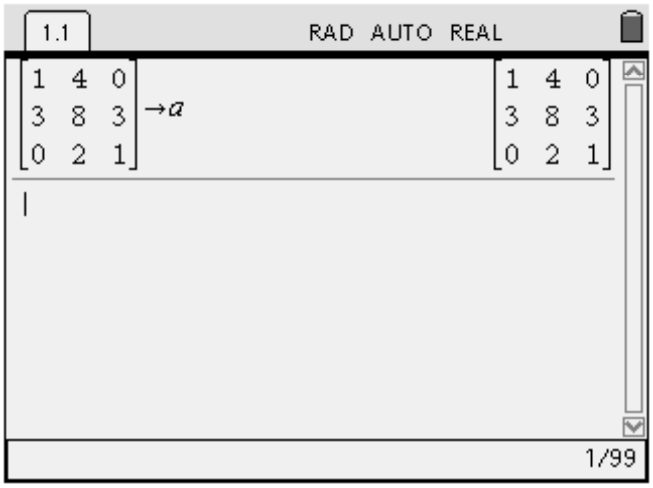


Your completed matrix should resemble the one shown below.



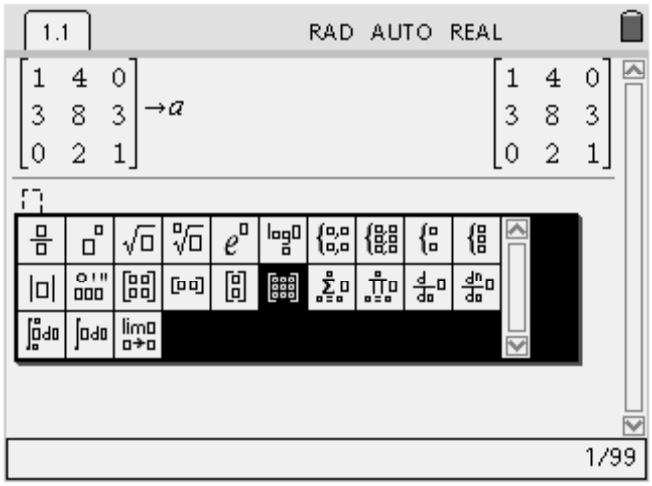
Step 6

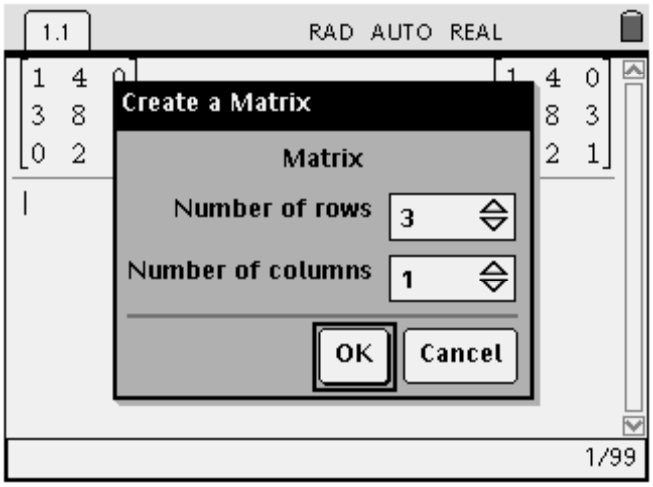
Store your matrix by pushing the control key and the “sto” key. Name your matrix “a”.

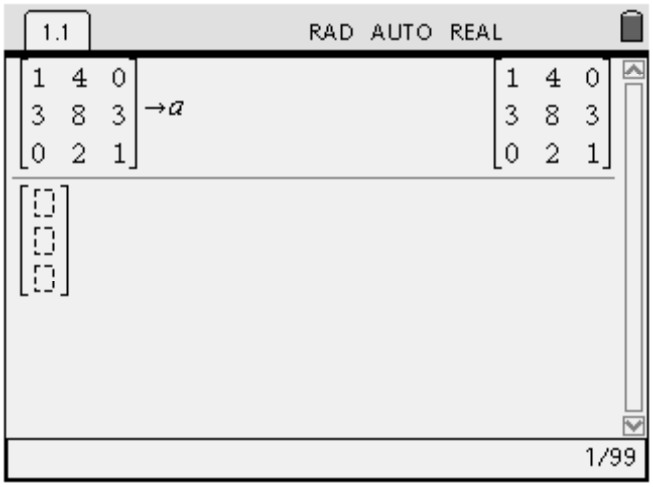


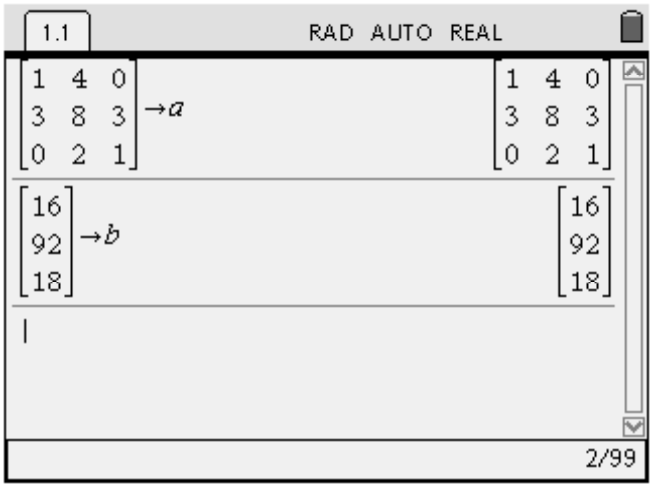
Step 7

Repeat steps 3 through 6 to create your constant matrix.



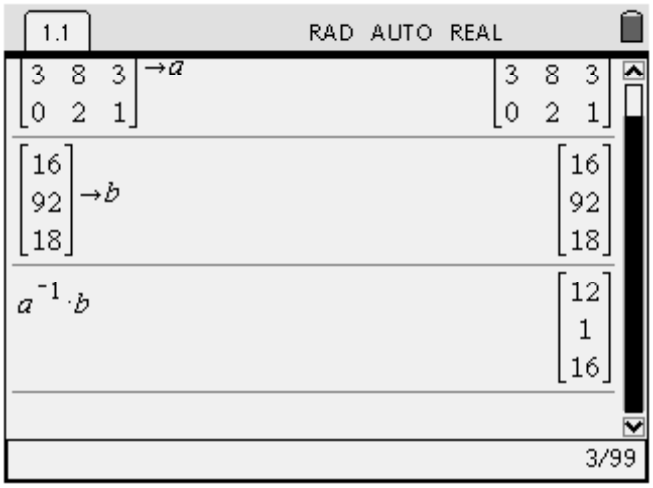

1.1
RAD AUTO REAL
Create a Matrix
Matrix
Number of rows
3
Number of columns
1
OK
Cancel
1/99


1.1
RAD AUTO REAL
1/99


1.1
RAD AUTO REAL
2/99

Step 8

Solve the matrix equation by entering a^{-1}. b The solution will appear on the screen.



Solution:

The Atomic weight of carbon, hydrogen and oxygen are 12, 1 and 16 respectively.

Step 9

Discuss additional ways that the system could have been solved! This lesson problem can be solved through the use of determinants. It is a great way to link 2 matrix operations.