

Problem set: Using the adjugate and determinant of a matrix to solve real world problems

Name: _____

Precalculus

Herbert H. Lehman High School

March 24, 2022

Be sure to... Do all work in your notebook. If you don't complete work in class, finish at home. Submit on Google Classroom.

1. For the matrices below, **be sure to** (i) find the determinant and adjugate for each, then (ii) use these to find the inverse of the matrix (if possible). If an inverse can't be found, explain why not:

(a) $A = \begin{bmatrix} 6 & -7 \\ -3 & 4 \end{bmatrix}$

(b) $A = \begin{bmatrix} 6 & 12 \\ 2 & 4 \end{bmatrix}$

2. For the system of linear equations below, **be sure to**:

- i. Convert into a matrix equation $AX = B$
- ii. Find the determinant and adjugate for A
- iii. Find the inverse of A
- iv. Use the inverse of A to solve the system of equations

$$\begin{cases} 5x + 4y = 3 \\ 2x + 2y = 4 \end{cases}$$

3. Dr. Galvez and Dr. Guillermo are testing a new experimental medicine (Precalodine) at Montefiore Hospital. The medicine is being given to a total of 100 patients. Patients take the medicine in a 1 liter solution, meaning that some percent of the solution is the medicine, and the rest is water. If patients are being given 2% or 4% solutions, and 2.5 liters of the medicine are on hand, how many patients will be given the 2% solution and how many should be given the 4%, with all the medicine used up?

Be sure to:

- (a) Create a system of linear equations corresponding to this problem
 - (b) Rewrite your system of equations as $AX = B$
 - (c) Use your knowledge of matrix adjugate and determinant to figure out how many patients can be given the 4% solution.
4. **Challenge!!!!** Now Dr. Galvez and Dr. Guillermo want to add a third 6% solution. They still have 100 patients and now have 3.5 liters of Precalodine on hand. They want to give the 2% solution to twice as many patients as the 6% solution. How many patients should be given each dose?

Hint: You'll be dealing with a 3×3 matrix. Use the adjugate and determinant **calculator** on Google Classroom!