Sample of an assignment for students. (You can of course construct a number of other interesting investigations to suit your students and your course.)

For each of the following answer the result of the expression involving reversal matrices. Some answers require a matrix (M), others require a verbal description (V) of the type of matrix. Write the expression and answer on a sheet of paper. (Don't say it is a n by n matrix as an answer.)

1. $\mathbf{J_4^T} =$ ______________$\mathbf{(M)}$

2. $\mathbf{J_4^T} =$ $\mathbf{is\ a}$______________ $\mathbf{type\ of\ matrix.(V)}$

3. $\mathbf{J_4^2} =$ $\mathbf{is}$ ______________ $\mathbf{(M)}$

4. $\mathbf{J_4^{-1}} =$ $\mathbf{is\ a}$______________ $\mathbf{type\ of\ matrix.\ (V)}$

5. $\mathbf{J_4^T * J_4} =$ $\mathbf{is}$ ______________ $\mathbf{(M)}$

6. $\mathbf{J_4} =$ $\mathbf{is\ a}$______________ $\mathbf{type\ of\ matrix.\ (V) Hint : use\ answer\ to\ 5}$

7. $\mathbf{J_4 + I_4} =$ $\mathbf{is}$ ______________ $\mathbf{(M)}$

8. $\mathbf{Let\ W = J_4 + I_4.\ Find\ \ rref(W)} =$ __________________$\mathbf{(M)}$

9. Use the answer of #8 to find a basis for the null space of $\mathbf{W = J_4 + I_4}$.

The basis will be a set of vectors. Answer: ____________________

10. Given that $\mathbf{v} = \begin{bmatrix} 0 \\ 1 \\ 1 \\ 0 \end{bmatrix}$ is an eigenvector of $\mathbf{J_4}$. Find the corresponding eigenvalue.

$\lambda =$ ________. Hint, just recall $\mathbf{J_4 * v} = \lambda * \mathbf{v}$.

11. In linear algebra, the **trace** of a square matrix **A**,
denoted tr(**A**), is the sum of the elements on its main diagonal, $a_{11} + a_{22} + \cdots + a_{nn}$.
It is only defined for a square matrix (n × n).
Use the table below to conjecture a formula for $tr(\mathbf{J_n})$, n a positive interger.

n	3	4	5	6	7
tr(J_n)	1	0	1	0	1

Answer:____

12. Use the table below to conjecture a formula for $det(\mathbf{J_n})$, n a positive interger.

n	2	3	4	5	6	7	8	9
det(J_n)	-1	-1	1	1	-1	-1	1	1

Answer:______________________________________

13. Use the table below to conjecture a formula for $tr(\mathbf{W_n} = \mathbf{J_n} + \mathbf{I_n})$, n a positive interger.

n	3	4	5	6	7	8	9	10
tr(W_n)	4	4	6	6	8	8	10	10

Answer:______________________________________

14. The $det(\mathbf{W_n} = \mathbf{J_n} + \mathbf{I_n})$ for n a positive interger is zero.

Construct $\mathbf{W_n}$ for n = 3, 4, 5, and 6. Then conjecture why $det(\mathbf{W_n}) = 0)$ for all n.

Answer:______________________________________