Test 2: + 2.1-2.3, 1.8 (62, 65, 67-68), 1.9 (70-75), 2.7, apps

- Formatted same as test 1. Test 2 is majority new material.
- hw, problem sets, & clicker questions [solutions online]
- computations, definitions, critical reasoning & "big picture"

- 1.1, 1.2 & 1.5: Gaussian elimination, algebra and geometry of solutions of systems of equations...
- 1.4: connects everything together
- 1.3 and 1.7: algebra and geometry of vectors (linear combinations/mixing, span, li...)
- 2.1 and 2.2 : matrix algebra: $A + B$, cA, A^T, AB, $A^{-1}_{2\times 2}$, $\det(A_{2\times 2})$
- 2.3: theorem 8: what makes a matrix invertible [connects 2.2 to 1.1, 1.2, 1.3 and 1.7] & condition #
- 1.8 (62, 65, 67-68), 1.9 (70-75), 2.7: linear transformations
- apps: Hill cipher, computer graphics/animations, computer speed and reliability

If A is invertible:
Multiply both sides by the inverse
Reorder parenthesis by associativity
Cancel A by its inverse
Identity reduces

Pivots:

$A_{n\times n}$ invertible $\rightsquigarrow$ I so full pivots & all of thm 8 works $\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$

$A_{n\times n}$ not invertible $\rightsquigarrow$ row of 0s & all of thm 8 fails $\begin{bmatrix} 1 & 4 & 7 \\ 2 & 5 & 8 \\ 3 & 6 & 9 \end{bmatrix}$

A not square then no inverse, but can't negate other thm 8 statements $\begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \end{bmatrix}$, $\begin{bmatrix} 1 & 0 \\ 0 & 1 \\ 0 & 0 \end{bmatrix}$

Rotation: $\begin{bmatrix} \cos(\theta) & -\sin(\theta) \\ \sin(\theta) & \cos(\theta) \end{bmatrix}$ Dilation: $\begin{bmatrix} c & 0 \\ 0 & c \end{bmatrix}$ Horizontal Shear: $\begin{bmatrix} 1 & k \\ 0 & 1 \end{bmatrix}$

Projections: y=x line: $\begin{bmatrix} \frac{1}{2} & \frac{1}{2} \\ \frac{1}{2} & \frac{1}{2} \end{bmatrix}$ x-axis: $\begin{bmatrix} 1 & 0 \\ 0 & 0 \end{bmatrix}$ y-axis: $\begin{bmatrix} 0 & 0 \\ 0 & 1 \end{bmatrix}$

Reflections: y=x line: $\begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix}$ x-axis: $\begin{bmatrix} 1 & 0 \\ 0 & -1 \end{bmatrix}$ y-axis: $\begin{bmatrix} -1 & 0 \\ 0 & 1 \end{bmatrix}$

Translation: $\begin{bmatrix} 1 & 0 & h \\ 0 & 1 & k \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} x \\ y \\ 1 \end{bmatrix} = \begin{bmatrix} x+h \\ y+k \\ 1 \end{bmatrix}$ Others: $\begin{bmatrix} a & b & 0 \\ c & d & 0 \\ 0 & 0 & 1 \end{bmatrix}$

Rotate a Figure about the point $\begin{bmatrix} 4 \\ 9 \end{bmatrix}$:

$$\begin{bmatrix} 1 & 0 & 4 \\ 0 & 1 & 9 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} \cos(\theta) & -\sin(\theta) & 0 \\ \sin(\theta) & \cos(\theta) & 0 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} 1 & 0 & -4 \\ 0 & 1 & -9 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} x_1 & \dots & x_p \\ y_1 & \dots & y_p \\ 1 & \dots & 1 \end{bmatrix}$$