PRINT NAME:____________________

Math 102 — Lab 8

Throughout this lab we consider a subset of the vector space of all 3×3 matrices defined as follows:

$$G = \{A \in \mathcal{M}_{3,3}(\mathbb{R}) : AA^T = I\}$$

1. Use the determinant operation to prove that every matrix in G is invertible. [5]

Clues: • A is invertible $\iff \det(A) \neq 0$

• $\det(XY) = \det(X) \cdot \det(Y)$

• $\det(A^T) = \det(A)$

• $\det(I) = 1$

2. If $A \in G$ compute A^{-1}. [2]

Clue: Multiply both sides of the equation $AA^T = I$ on the left by A^{-1}.

3. What does the identity $AA^T = I$ tell us about the row vectors of A? [3]

Clue: Vectors $\vec{a}_1, \dots, \vec{a}_n$ are orthonormal if $\vec{a}_i \cdot \vec{a}_j = 0$ if $i \neq j$ and $\vec{a}_i \cdot \vec{a}_i = 1$.