

## Midterm 3 Lecture Review Activity, Math 1554

1. Indicate **true** if the statement is true, otherwise, indicate **false**.

	true	false
a) If $S$ is a two-dimensional subspace of $\mathbb{R}^{50}$ , then the dimension of $S^\perp$ is 48.	<input type="radio"/>	<input type="radio"/>
b) An eigenspace is a subspace spanned by a single eigenvector.	<input type="radio"/>	<input type="radio"/>
c) The $n \times n$ zero matrix can be diagonalized.	<input type="radio"/>	<input type="radio"/>
d) A least-squares line that best fits the data points $(0, y_1), (1, y_2), (2, y_3)$ is unique for any values $y_1, y_2, y_3$ .	<input type="radio"/>	<input type="radio"/>

2. If possible, give an example of the following.

2.1) A matrix,  $A$ , that is in echelon form, and  $\dim((\text{Row } A)^\perp) = 2$ ,  $\dim((\text{Col } A)^\perp) = 1$

2.2) A singular  $2 \times 2$  matrix whose eigenspace corresponding to eigenvalue  $\lambda = 2$  is the line  $x_1 = 2x_2$ . The other eigenspace of the matrix is the  $x_2$  axis.

2.3) A subspace  $S$ , of  $\mathbb{R}^4$ , that satisfies  $\dim(S) = \dim(S^\perp) = 3$ .

2.4) A  $2 \times 3$  matrix,  $A$ , that is in RREF.  $(\text{Row } A)^\perp$  is spanned by  $\begin{pmatrix} 2 \\ 3 \\ 1 \end{pmatrix}$ .

3. Circle **possible** if the set of conditions are create a situation that is possible, otherwise, circle **impossible**. For the situations that are possible give an example.

3.1)  $A$  is  $n \times n$ ,  $A\vec{x} = A\vec{y}$  for a particular  $\vec{x} \neq \vec{y}$ ,  $\vec{x}$  and  $\vec{y}$  are in  $\mathbb{R}^n$ , and  $\dim((\text{Row } A)^\perp) \neq 0$ .

**possible**                      **impossible**

3.2)  $A$  is  $n \times n$ ,  $\lambda \in \mathbb{R}$  is an eigenvalue of  $A$ , and  $\dim((\text{Col}(A - \lambda I))^\perp) = 0$ .

**possible**                      **impossible**

3.3)  $\text{proj}_{\vec{v}}\vec{u} = \text{proj}_{\vec{u}}\vec{v}$ ,  $\vec{v} \neq \vec{u}$ , and  $\vec{u} \neq \vec{0}$ ,  $\vec{v} \neq \vec{0}$ .

**possible**                      **impossible**

4. Consider the matrix  $A$ .

$$A = \begin{pmatrix} 1 & -3 & 0 & 2 \\ 0 & 0 & 1 & -3 \\ 0 & 0 & 0 & 0 \end{pmatrix}$$

Construct a basis for the following subspaces and state the dimension of each space.

4.1)  $(\text{Row } A)^\perp$

4.2)  $\text{Col } A$

4.3)  $(\text{Col } A)^\perp$