

Last name \_\_\_\_\_

First name \_\_\_\_\_

**LARSON—MATH 601—CLASSROOM WORKSHEET 17**  
**Linear Transformation.**

**Concepts & Notation**

- (Sec. 2.4) *ordered basis, coordinates, coordinate matrix,  $[\alpha]_{\mathcal{B}}$ .*
- (Sec. 2.5) *row rank.*
- (Sec. 3.1) *linear transformation, rank, nullity.*

1. What is the *row space* of a matrix? Why is it a vector space? Describe the row space

of 
$$\begin{bmatrix} 1 & 2 & 3 & 4 \\ 2 & 4 & 6 & 8 \\ 0 & 0 & 1 & 1 \end{bmatrix}.$$

2. What is the *row rank* of a matrix? Find the row rank of 
$$\begin{bmatrix} 1 & 2 & 3 & 4 \\ 2 & 4 & 6 & 8 \\ 0 & 0 & 1 & 1 \end{bmatrix}.$$

3. **Claim:** Row-equivalent matrices have the same row-space.

4. **Claim:** If matrix  $A$  is equivalent to row-reduced echelon  $R$  and to  $\begin{bmatrix} 1 & 2 & 0 \\ 0 & 0 & 1 \end{bmatrix}$  then

$$R = \begin{bmatrix} 1 & 2 & 0 \\ 0 & 0 & 1 \end{bmatrix}.$$

5. What is a *linear transformation* from a vector space  $V$  into a vector space  $W$ ?
6. What is the zero transformation  $0$  from a vector space  $V$  to a vector space  $W$ ? Show it is a linear transformation.
7. What are the *rank* and *nullity* of a linear transformation? Assume  $V$  and  $W$  are finite dimensional vector spaces. What is the rank and nullity of the zero transformation?
8. What is the identity transformation  $I$  from a vector space  $V$  to itself? Show it is a linear transformation.
9. Assume  $V$  is finite dimensional vector spaces. What is the rank and nullity of the identity transformation?