

## Linear Transformations and Group Representations

### Homework #1 (2010-2011)

Q1: Eigenvectors of some linear operators in matrix form (also see Homework from “Algebraic Overview” (2008-2009))

In each case, find the eigenvalues, the eigenvectors, the dimensions of the eigenspaces, and whether a basis can be chosen from the eigenvectors.

A.  $A = \begin{pmatrix} 1 & r \\ 0 & 1 \end{pmatrix}$ .

B.  $B = \begin{pmatrix} q & r \\ r & q \end{pmatrix}$  (assume  $q > r > 0$ ).

Q2: Eigenvectors of some linear operators in a continuous space

$V$  is a vector space of functions of time. In each case, find the eigenvalues and eigenvectors of the indicated operator, and determine whether the operator is time-translation invariant

A.  $Lv(t) = tv(t)$ .

B.  $Rv(t) = v(-t)$ .

C.  $Mv(t) = \frac{d}{dt}v(t)$ .

D.  $Nv(t) = t \frac{d}{dt}v(t)$ .