

1. Let  $A = \begin{bmatrix} 3 & 0 & 0 \\ 5 & 8 & -10 \\ 5 & 5 & -7 \end{bmatrix}$ .

1A. Find the characteristic polynomial of  $A$  in factored form.

1B. One of the eigenvalues of  $A$  is an odd number, the other is even. Find a basis for the eigenspace of the odd one. Show all your work.

2. Let  $M = \begin{bmatrix} 1 & -1 & -3 & 5 & 5 \\ 2 & 1 & 15 & 2 & 1 \\ 1 & 1 & 11 & 0 & -1 \\ -1 & 1 & 3 & -4 & -5 \end{bmatrix}$ ; then  $\text{RREF}([M|I_4])$  is  $\left[ \begin{array}{ccccc|cccc} 1 & 0 & 4 & 0 & 2 & -2 & 0 & 1/2 & -5/2 \\ 0 & 1 & 7 & 0 & -3 & 2 & 0 & 1/2 & 5/2 \\ 0 & 0 & 0 & 1 & 0 & 1 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 & -3/2 & 1/2 \end{array} \right]$

Find bases for each of the following; use correct notation. You may write “*same as*” if appropriate; for example, if the basis in (2G) were the same as for (2A) then “*same as 2A*” would be acceptable as the answer to 2G.

2A.  $\text{Col}(M)$

2B.  $\text{Nul}(M)$

2C.  $\text{Col}(\text{RREF}(M))$

2D.  $\text{Nul}(\text{RREF}(M))$

2E.  $\text{Row}(M)$

2F.  $\text{Row}(\text{RREF}(M))$