

1) Use Gaussian elimination to put the following system into row echelon form. Find the solution set. [If there are free variables, use  $\alpha$  notation in your answer.]

$$2x_1 + x_2 + x_3 = 4$$

$$x_1 + x_2 + 2x_3 = 4$$

2) Which of these are in reduced row echelon form? Circle the ones that are in RREF.

$$\begin{pmatrix} 0 & 0 & 1 \\ 0 & 1 & 0 \\ 1 & 0 & 0 \end{pmatrix} \quad \begin{pmatrix} 1 & -2 & 0 \\ 0 & 0 & 1 \end{pmatrix} \quad \begin{pmatrix} 1 & 1 & 0 & -1 \\ 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 0 \end{pmatrix}$$

3) Answer each part with “True” or “False”.

- a) Every underdetermined homogeneous linear system has a nontrivial solution.
- b) If an  $m \times n$  system has a unique solution, then  $m = n$  and it can be reduced to triangular form.
- c) A system has the trivial solution if and only if it is homogeneous.
- d) Multiplying a row by  $-1/2$  is an example of an elementary operation.
- e) If two different systems lead to the same RREF, then they are equivalent.

**Remarks and Answers:** This quiz was a bit on the easy side, even for a Quiz 1. The average of the top 11 grades, out of 17, was about 53/60, almost 90 per cent. The unofficial scale is: A's = 55-60, B's = 49-54, C's = 43-48, D's = 37-42.

The material gets harder, and the grades usually come down later. So, I still expect to use a scale like the one on the syllabus at the end of the term. But probably the True-False questions will not get much harder, and the grades often rise on those, especially if you practice them. In my opinion, that also helps with logic and proof-writing.

1) There are many possible REF's (the RREF is included below, without the vertical line). The solution set is  $S = \{(\alpha, 4 - 3\alpha, \alpha)\}$ . You should use this same notation, or something pretty close. I suggest quickly checking your answer (eg set  $\alpha = 0$  and check that  $(0, 4, 0)$  works, then maybe try  $\alpha = 1$ ).

$$\begin{pmatrix} 1 & 0 & -1 & 0 \\ 0 & 1 & 3 & 4 \end{pmatrix}$$

2) The second and third are in RREF.

3) TFTTT