

Math 54 Discussion Section Problems

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You should work on the following problems in groups of 3 or 4. Try to get through as many as you can, but you aren't expected to finish everything. In fact, the answers are largely unimportant; making sure **everyone** in your group knows **how** to solve all the problems is what really matters.

1. Suppose you find that the solution set to some system of equations is
$$\begin{cases} x_1 = 5 + 4x_2 + 6x_4 \\ x_2 \text{ is free} \\ x_3 = -2 - 7x_2 + 8x_4 \\ x_4 \text{ is free} \end{cases} .$$

Re-write this solution set in parametric vector form.

2. Find the solution set to
$$\begin{cases} x_1 + 3x_2 + x_3 = 10 \\ -4x_1 - 9x_2 + 2x_3 = -16 \\ -3x_2 - 6x_3 = -24 \end{cases} .$$

Write your answer in parametric vector form.

3. For each of the following properties of A , determine a) whether it is possible to have such a matrix and if so, if b) the system $Ax = 0$ has some non-trivial solution, and c) whether $Ax = b$ has a solution for every possible choice of b .
- (a) A is 3×3 with 3 pivot positions
 - (b) A is 3×3 with 2 pivot positions
 - (c) A is 3×2 with 3 pivot positions
 - (d) A is 3×2 with 2 pivot positions
 - (e) A is 2×3 with 3 pivot positions
 - (f) A is 2×3 with 2 pivot positions
4. We know that any solution to $Ax = b$ is **some** solution to the equation, plus a solution to $Ax = 0$. Given that, is it true that $Ax = 0$ and $Ax = b$ always have the same number of solutions? If yes, explain why. If not, give an example of an A and a b where these two equations have differing numbers of solutions.