

- 10** Which of the following subsets of $\mathbf{R}^3$ are actually subspaces?
- (a) The plane of vectors (b_1, b_2, b_3) with $b_1 = b_2$.
 - (b) The plane of vectors with $b_1 = 1$.
 - (c) The vectors with $b_1 b_2 b_3 = 0$.
 - (d) All linear combinations of $v = (1, 4, 0)$ and $w = (2, 2, 2)$.
 - (e) All vectors that satisfy $b_1 + b_2 + b_3 = 0$.
 - (f) All vectors with $b_1 \leq b_2 \leq b_3$.
- 20** For which right sides (find a condition on b_1, b_2, b_3) are these systems solvable?
- (a)
$$\begin{bmatrix} 1 & 4 & 2 \\ 2 & 8 & 4 \\ -1 & -4 & -2 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} = \begin{bmatrix} b_1 \\ b_2 \\ b_3 \end{bmatrix}$$
- (b)
$$\begin{bmatrix} 1 & 4 \\ 2 & 9 \\ -1 & -4 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} = \begin{bmatrix} b_1 \\ b_2 \\ b_3 \end{bmatrix}.$$
- 24** The columns of AB are combinations of the columns of A . This means: *The column space of AB is contained in (possibly equal to) the column space of A .* Give an example where the column spaces of A and AB are not equal.
- 26** If A is any 5 by 5 invertible matrix, then its column space is _____. Why?