B13.

136.130: Test #5
Solutions

[7] **1.** Which of the following is a subspace of the vector space $\mathbf{M}_{2,2}$ of all 2×2 matrices (with the usual addition and scalar multiplication)? Do **NOT** justify your answer.

(a) All matrices of type $\begin{bmatrix} a & a \\ a & a \end{bmatrix}$ (a ranging through all real numbers).

(b) All matrices of type $\begin{bmatrix} 1 & a \\ a & 0 \end{bmatrix}$ (a ranging through all real numbers).

(c) All matrices of type $\begin{bmatrix} 0 & -a \\ a & 0 \end{bmatrix}$ (a ranging through all real numbers).

Solution. **(a) Yes,**
(b) No
(c) Yes.

[6] **2.** **(a)** Is $(2,3,1)$ in Span({(-1, 3, 1), (3, 0,0)})? Justify your answer.
(b) Is (1, 0, 0) in Span({(0, 3, 1), (0, 1,0)})? Justify your answer.

Solution. **(a)** Yes: $(2,3,1) = (-1,3,1) + (3,0,0)$
(b) No: $(1,0,0) \neq k_1(0,3,1) + k_2(0,1,0)$ since the first coordinates are never equal.

[6] **3.** Is the set {(1,0,0), (2,3,0), (4, 5, 6)} linearly independent? Justify your answer.

Solution. Yes. Solving $k_1(1,0,0) + k_2(2,3,0) + k_3(4,5,6) = 0$ gives $k_1 = k_2 = k_3 = 0$.

[6] **4.** Find the point of intersection of the line $x = 2,\ y = 2t,\ z = 2 + 2t$ and the plane $x + y + z = 4$.