B01.

136.130: Test #5 Solutions

1. Suppose $\mathbf{u} = (1, -2, 3, 0, -1)$ and $\mathbf{v} = (-2, 1, 0, 1, 0)$.

- **(a)** Compute $2\mathbf{u} - 3\mathbf{v}$ and $\|\mathbf{u}\|$.
- **(b)** Are **u** and **v** orthogonal? Justify your answer.

Solution. **(a)** $2\mathbf{u} - 3\mathbf{v} = (2, -4, 6, 0, -2) - (-6, 3, 0, 3, 0) = (8, -7, 6, -3, -2)$, and $\|\mathbf{u}\| = \sqrt{1^2 + (-2)^2 + 3^2 + 0^2 + (-1)^2} = \sqrt{15}$.

(b) $\mathbf{u} \cdot \mathbf{v} = (-2) + (-2) + 0 + 0 + 0 = -4$ and since this is not 0, the vectors are not orthogonal.

2. Consider the set **W** containing only the vectors (0,0,0) and (1,2,3). Is **W** is a subspace of the vector space $\mathbb{R}^3$? Justify your answer.

Solution. Since, say, (1,2,3)+(1,2,3)=(2,4,6) is obviously not in **W**, the set **W** is not closed under addition, and so it is not a subspace of $\mathbb{R}^3$.

3. Show that the set $\{(1,2,0), (-1,0,1), (0,2,1)\}$ of vectors in $\mathbb{R}^3$ is linearly dependent.

Solution. Notice that the third vector is the sum of the first two. So, the set is indeed linearly dependent.