The test

- The second test is scheduled for Nov. 14 at 10:30 am (that is class time). The test will be 50 minutes.
- If your surname is in the range A - O then you will write the test in T28/001; P - Z will write in T29/101.
- The test will be multiple choice and you will need to bring an HB pencil. You will be allowed to have the McMaster approved Casio fx-991 MS but no other aids. Please bring your ID card with you to the test.
- The test will cover sections 5.1 - 5.2, 5.5, 3.1 - 3.5 and 10.1 - 10.3 from the 9th edition. I will post additional problems.
- There is a practice test for Test 2. Please try the practice test once you have studied for the test; I will post the solutions on Monday.
- There is a review class which will be run by Matt on Thursday, Nov. 13, 5:30 - 7:30 in HH 302; the class Wed. Nov. 12 will also be review.

Vector spaces

Definition

Suppose that V is a non-empty set, $+$ is function on pairs from V and for every $k \in \mathbb{R}$ and $u \in V$, ku is defined. We say that V together with these operations defines a vector space if the following axioms are satisfied for all $u, v, w \in V$ and $k, m \in \mathbb{R}$:

Vector spaces, cont'd

1. $u + v \in V$.
2. $u + v = v + u$
3. $u + (v + w) = (u + v) + w$
4. there is a $0 \in V$ such that $u + 0 = u$ for all $u \in V$
5. there is a $-u \in V$ such that $u + (-u) = 0$
6. $ku \in V$
7. $k(u + v) = ku + kv$
8. $(k + m)u = ku + mu$
9. $k(mu) = (km)u$
10. $1u = u$

Some general

Theorem (4.1.1)

Suppose that V is a vector space, $v \in V$ and k is a scalar. Then

1. $0v = 0$;
2. $k0 = 0$;
3. $(-1)v = -v$; *and*
4. *if* $kv = 0$ *then either* $k = 0$ *or* $v = 0$.

Subspaces

Definition

Suppose that V is a vector space and W is a non-empty subset of V. We say that W is a subspace of V if with respect to the $+$ and scalar multiplication restricted to W from V, W is a vector space in its own right.

Theorem

If V is a vector space and W is a non-empty subset of V then W is a subspace iff W is closed under $+$ and scalar multiplication.

Span

Theorem

If V is a vector space and X is a subset of V then there is a subspace W containing X with the property that if any other subspace W' contains X then $W \subseteq W'$.

Definition

1. We call the W in the previous theorem the subspace spanned by X and write span(X).
2. If $x_1, \ldots, x_n \in X$ and $k_1, \ldots, k_n \in \mathbb{R}$ then we call $k_1 x_1 + \ldots + k_n x_n$ a linear combination of elements of X.

Fact

If X is a subset of a vector space V then the set of all linear combinations of elements of X is the subspace spanned by X.