January 8

2.1 Vectors

A vector is a list of number with addition and scalar multiplication defined. Given vectors $u = (u_1, u_2, \ldots, u_n) \in \mathbb{R}^n$, $v = (v_1, v_2, \ldots, v_n) \in \mathbb{R}^n$ of equal dimension and a scalar $c \in \mathbb{R}$, we define * addition: $u + v = (u_1 + v_1, u_2 + v_2, \ldots, u_n + v_n)$, * scalar multiplication: $cu = (cu_1, cu_2, \ldots, cu_n)$.

go over the geometry in class. tail to tip, parallelogram

Let a, b be scalars and $u, v, w \in \mathbb{R}^n$. Then

- $u + v = v + u$,
- $a(u + v) = au + av$,
- $(a + b)u = au + bu$,
- $(u + v) + w = u + (v + w)$,
- $a(bu) = (ab)u$,
- $u + (-u) = 0$,
- $u + 0 = 0 + u = u$,
- $1u = u$.

Definition: The If $u_1, u_2, \ldots, u_m$ are vectors and $c_1, c_2, \ldots, c_m$ are scalars, then

$$c_1u_1 + c_2u_2 + \ldots + c_mu_m$$

is a *linear combination* of $u_1, \ldots, u_m$. Note that the constants can be negative or zero.