

## October 2

### Announcements

- Watch 2nd and 3rd 3blue1brown videos
- Section 1.1, 1.2 due this Thursday
- Worksheet 1 due Friday
- Section 2.1, 2.2 due next Thursday
- Office hours in Padelford C-8D
  - Wednesday 4:30 - 5:30
  - Thursday 12:00 - 1:00

### Continue from last class

Justify the elementary row operations in class.

### Gaussian elimination

**Definition:** The *pivot positions* are positions that contain a leading term. The *pivot columns* are columns that contain a pivot position. A *pivot* is the value of a *pivot position*.

**Algorithm:** *Gaussian elimination* is performed as follows: \* find the pivot position in the first row \* use elementary row operators to eliminate all value under the pivot position \* continue

work out example in class

### Reduced echelon form

**Definition:** A matrix is in *reduced echelon form* if \* it is in echelon form \* all pivot positions contain a 1 \* the only nonzero term in a pivot column is in the pivot position

**Algorithm:** *Gauss-Jordan elimination* is performed as follows: \* do Gaussian elimination \* divide each row by the value of its pivot \* eliminate all other values in pivot column.

work out example in class.

### Homogenous linear systems

A linear system is homogenous if the numbers to the right of the equal sign are all zero. They always have the trivial solution

## 2.1 Vectors

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

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  $u_1, u_2, \dots, u_m$  are vectors and  $c_1, c_2, \dots, c_m$  are scalars, then

$$c_1 u_1 + c_2 u_2 + \dots + c_m u_m$$

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

give examples in class.