# Study guide for midterm

Also see all homework problems ("to hand in" and "not to hand in") and see the text.

- Spaces and maps
  - $\mathbb{R}^n$, $\mathbb{E}^n$
  - parametric lines
  - linear combinations
    - barycentric
  - translations
  - linear maps
    - relation to matrices
    - rotations in 2 dimension
    - reflections
    - meaning of determinant
  - affine maps
    - compatibility with barycentric
  - 3-step problems
    - plane rotations about any center
    - plane reflections using any mirror line
- Curves
  - ways to represent
    - graph of function
    - graph of relation
    - parametric
  - Bézier curves
    - Bernstein polynomials
    - basic properties
    - applications
      - loop
      - arc, arrow

            - S-curve
            - Hermite interpolation
        * de Casteljau algorithm
            - idea of repeated weighted averages
            - geometrically
            - recursion formula
            - table version for computation
        * derivatives
            - at ends; anywhere
        * Bézier of any degree
    - polynomial parametric curves in general
        * basic properties of polynomials
        * Lagrange interpolation
            - theorem
            - proof of uniqueness
            - Lagrange basis functions (blending functions)
            - constructive proof of existence
            - parametric polynomial interpolation

- Surfaces
    - ways to represent
        * graph of function
        * graph of relation
        * parametric
    - examples of surfaces
        * inventing surfaces step-by-step
            - sphere
            - cylinder
            - Möbius strip
            - etc.
        * linear blending of two curves
        * tensor-product surfaces
            - Lagrange
            - Bézier
        * bilinear patch
        * Coons patch
        * normals