

CMSC427

Geometry and Vectors: Intro



NVIDIA Marbles



You know most of this

- Points, vectors, coordinate systems, shapes, transformations
- From geometry, algebra, calculus, linear algebra, physics (and MATH431, math for graphics)
- But ... some unique graphics approaches



- Represent basic shapes

Lines, planes, triangles

- Move and transform these shapes

Translations, rotations, scalings

- Interact with these shapes

Shape to shape collisions

Light bouncing off and through



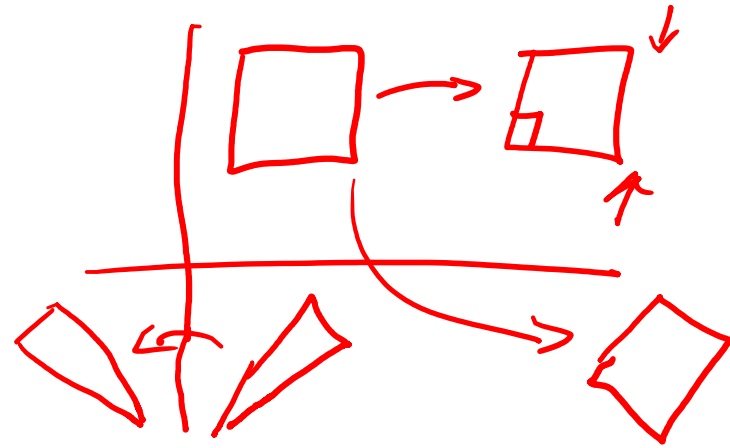
Transformations

- Rigid body: Preserves shapes, lengths, angles

- Translations

- Rotations

- Reflections

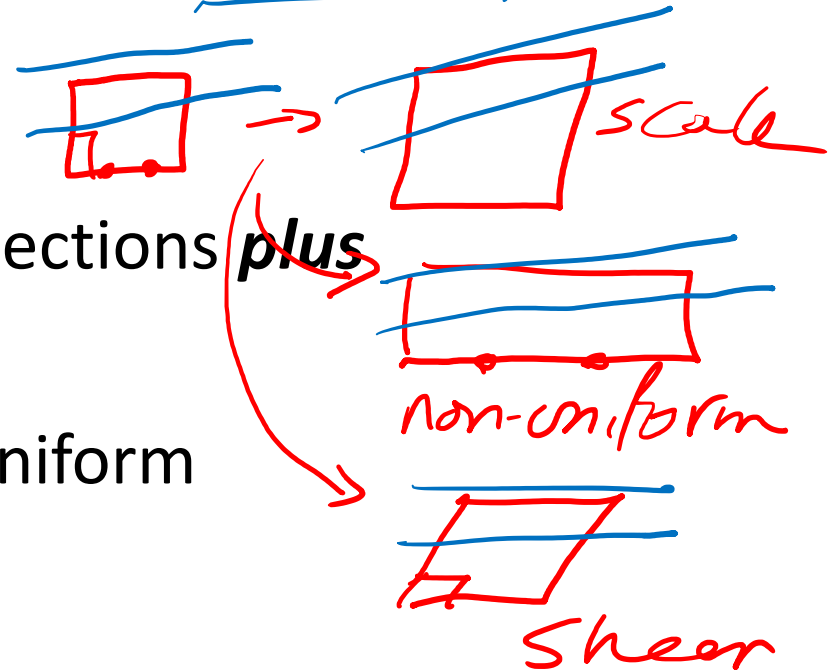


- **Euclidean Geometry**



Transformations

- Linear stretching: preserves lines (collinearity), parallelism



- Translations/Rotations/Reflections **plus**
- Scaling, uniform and non-uniform
- Shears

- **Affine Geometry**

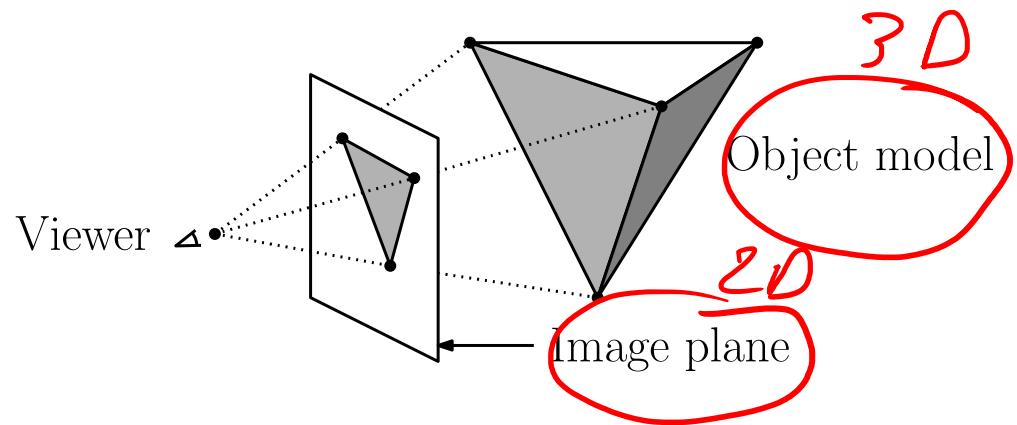


Transformations

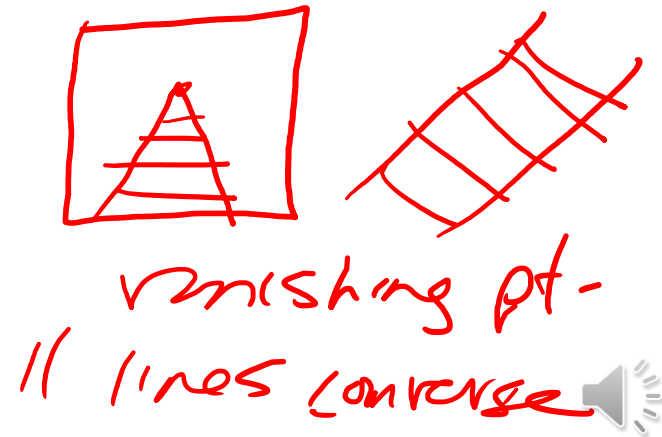
- Projections: preserves lines (collinearity) but **not** parallelism

Light sources 

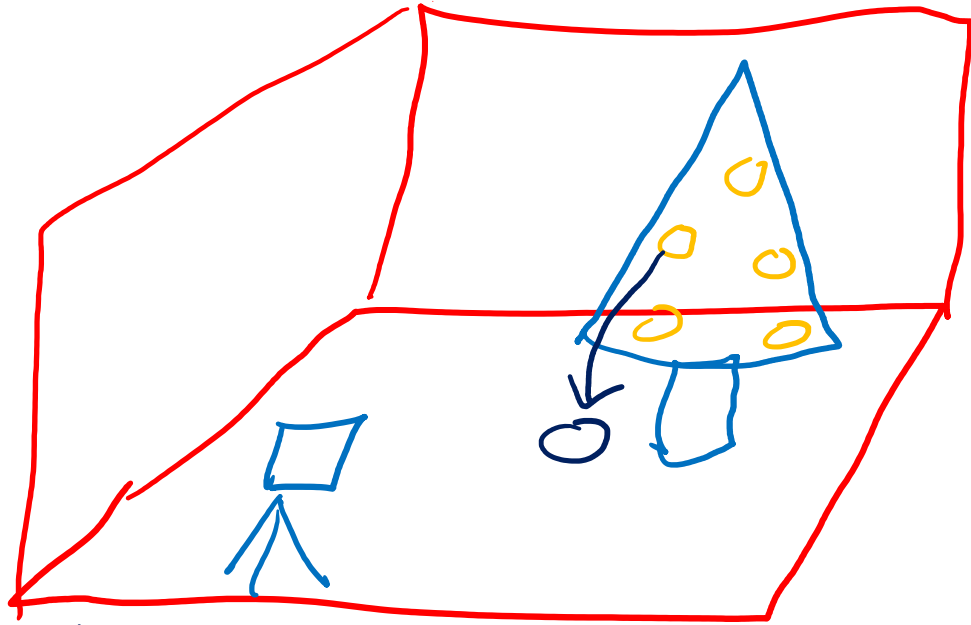
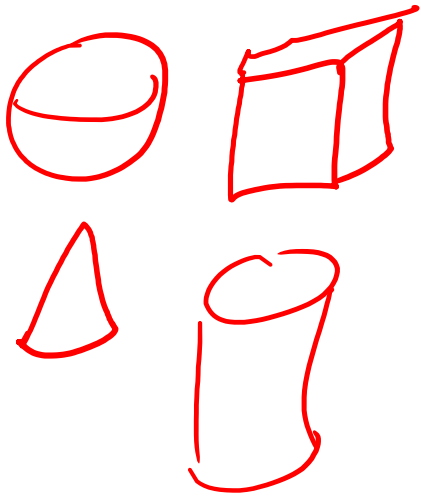
- Projections (3d to 2d)



- **Projective Geometry**



Use all three



affine \Rightarrow model shapes

Euclidean \Rightarrow model motion

Projective \Rightarrow picture



Open source version of Matlab

Prototype vector operations

<https://octave-online.net>

