

ENG 004 Lecture 7, Oct 18, 2012

Announcements

- Homework #3 is due Tuesday
- Finish reading Chapter 3
- No office hours today

Topics

Coordinates

Primitives

Constraints/Conditions

More On Coordinate Systems

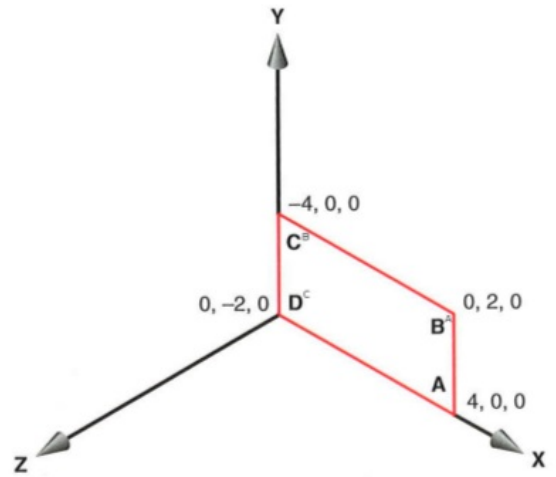
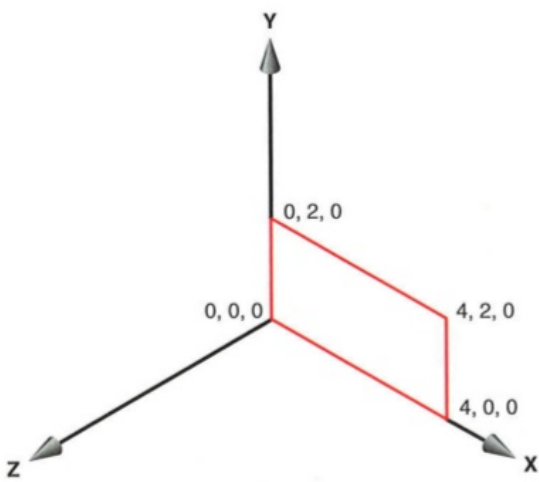
Absolute Coordinates

Coordinate values that always refer back to the origin.

Relative Coordinates

Coordinate values that refer back to a previously defined point or feature.

Absolute vs. Relative



More On Coordinate Systems

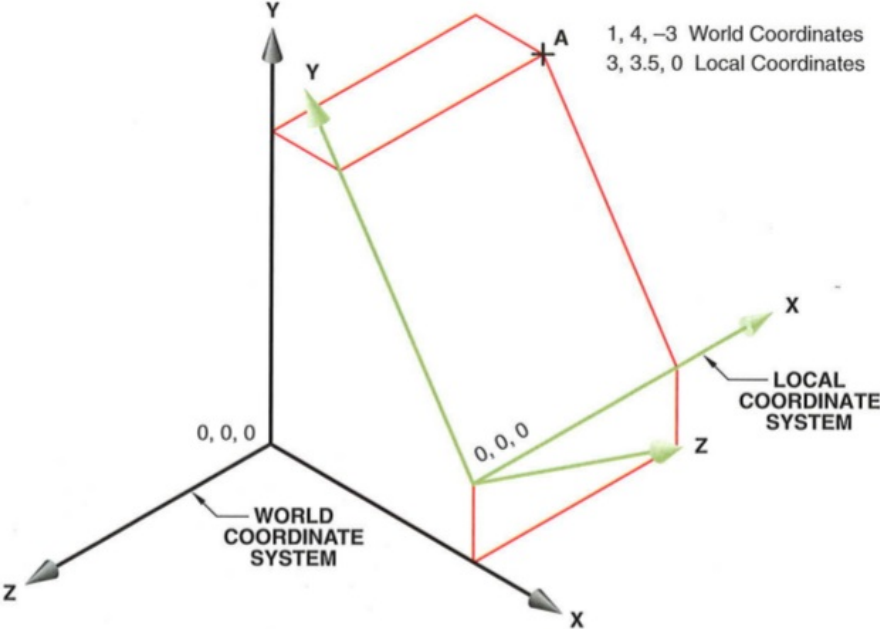
World Coordinates (WCS)

"Stationary" or "Fixed", never changes position or orientation relative to the model.

Local Coordinates (LCS)

Coordinate system defined by the designer or CAD system. May be located and oriented anywhere and in any direction within the World Coordinate System

World vs. Local



Geometric Elements: Primitives

Primitives are the building blocks used to create drawings and CAD models

Points/Nodes

No size, shape, width, height, or depth

Location only

Locus

All possible positions of a point

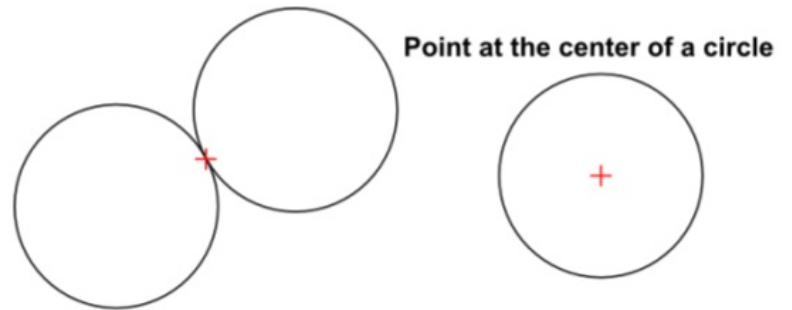
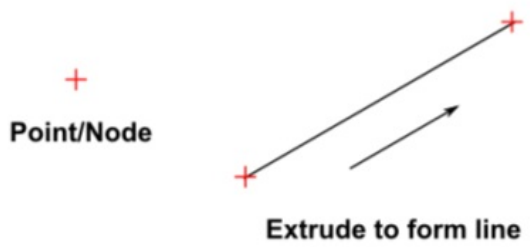
Lines

Length and direction, no thickness

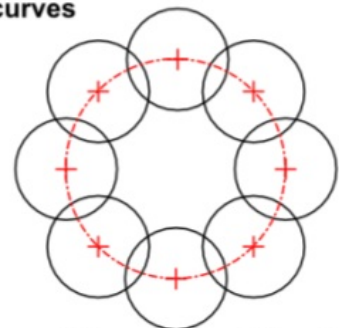
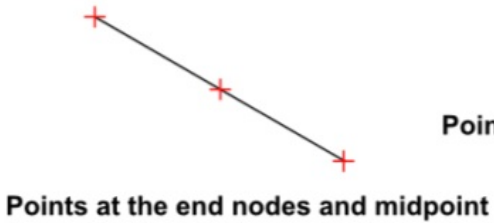
Curves

Generated by point moving in constantly changing direction

Points/Nodes



Point node at tangency of 2 curves



Locus of the centers of the circles

Lines



Finite Line



Infinite Line



Ray



Parallel Lines



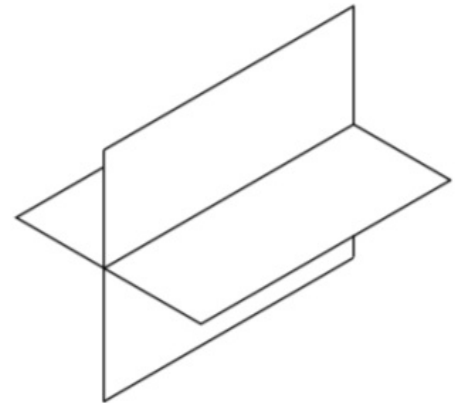
Perpendicular Lines



Intersecting Lines

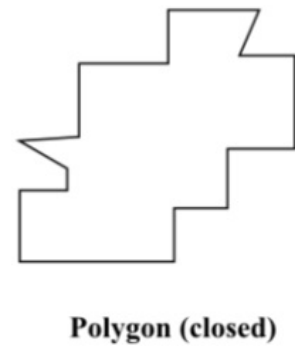
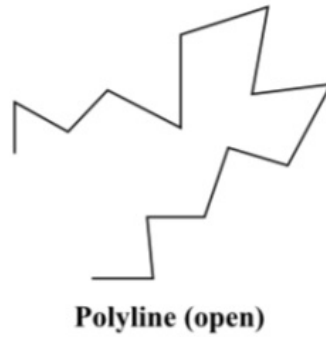
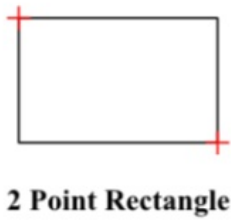
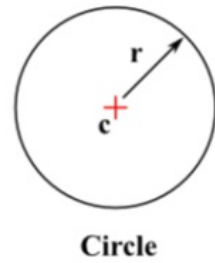
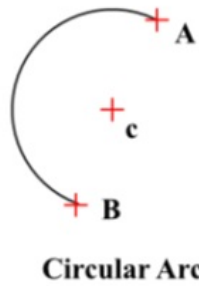
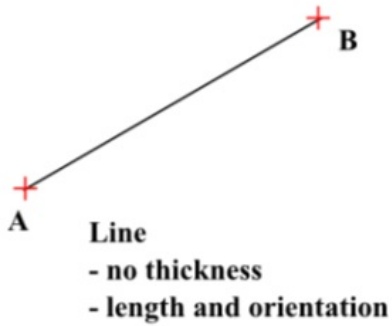


Tangent Conditions

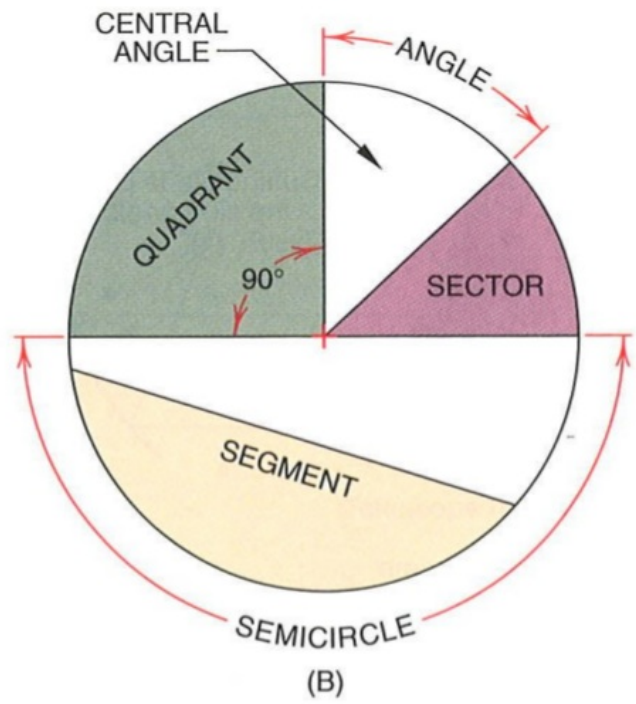
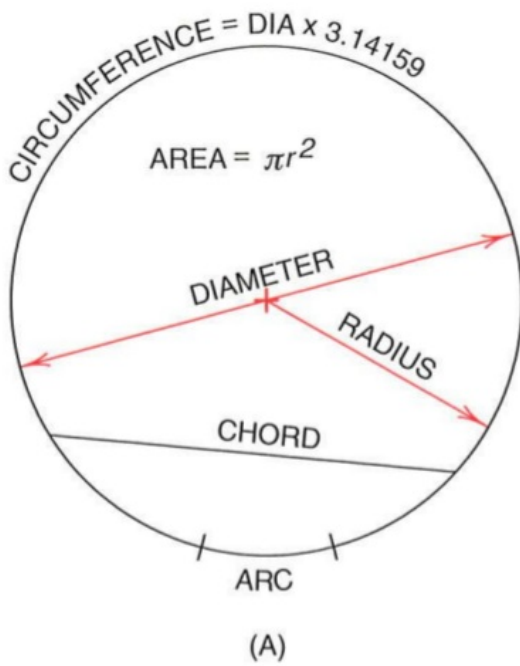


Intersection of two planes

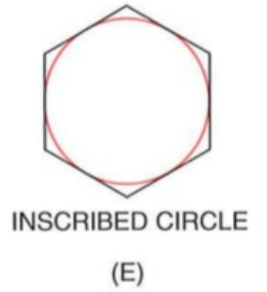
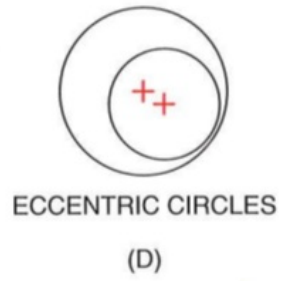
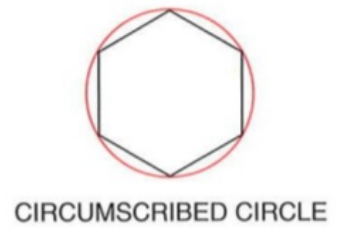
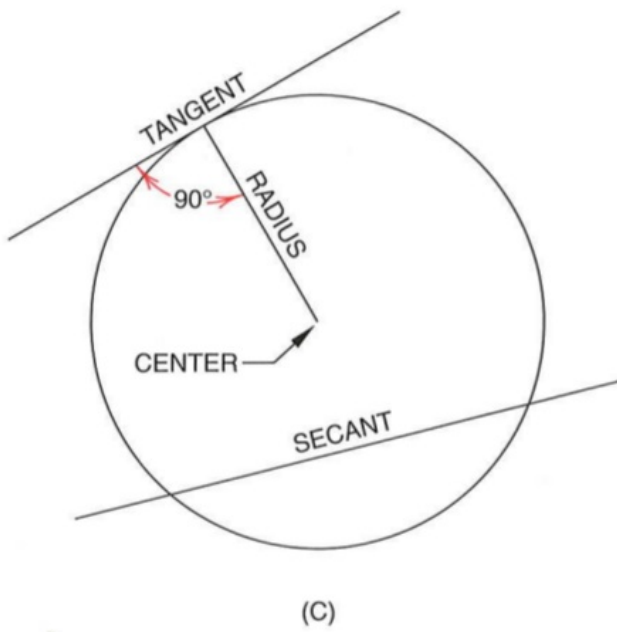
2D Primitives



Circles

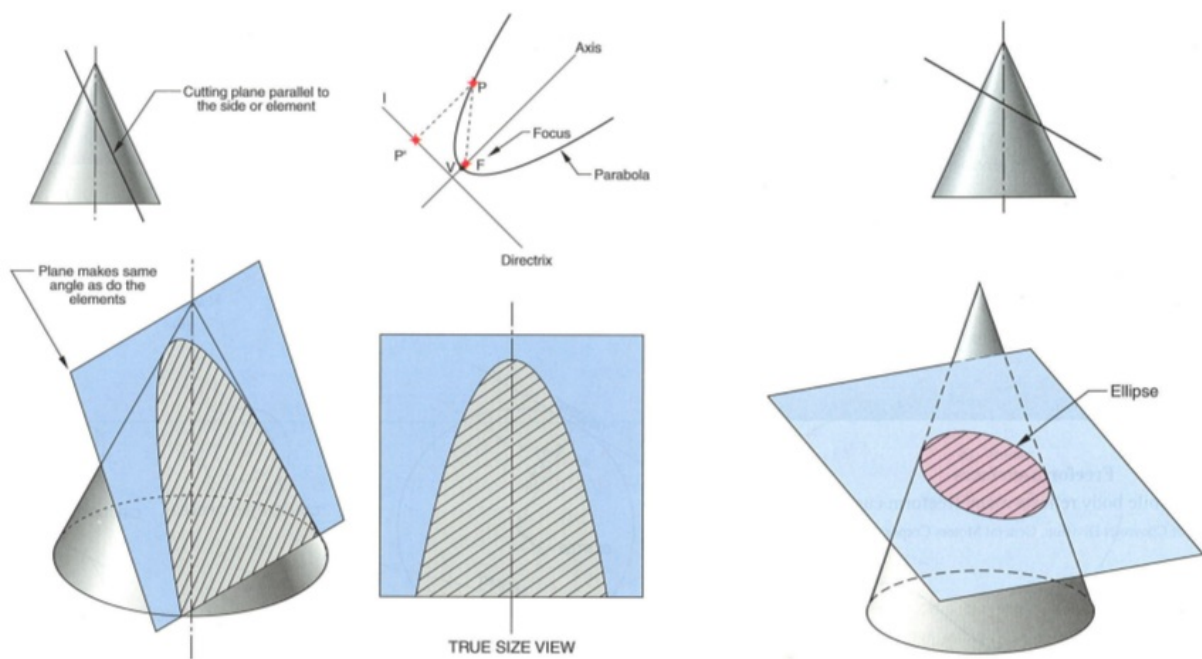


Circles



Curves from intersections

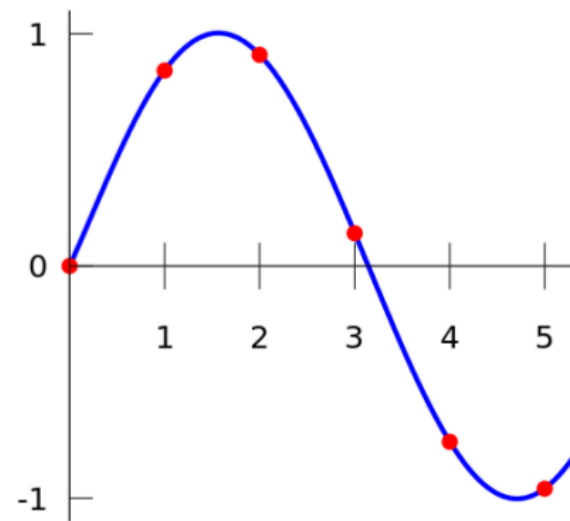
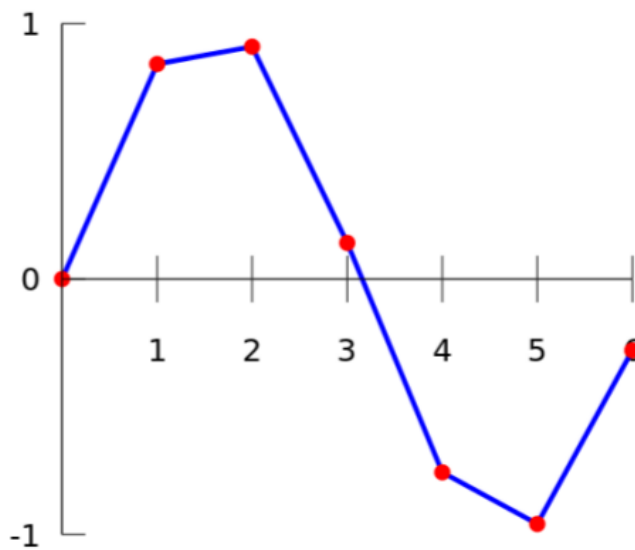
Curves can be generated by intersecting surfaces



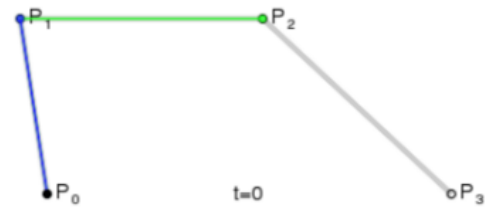
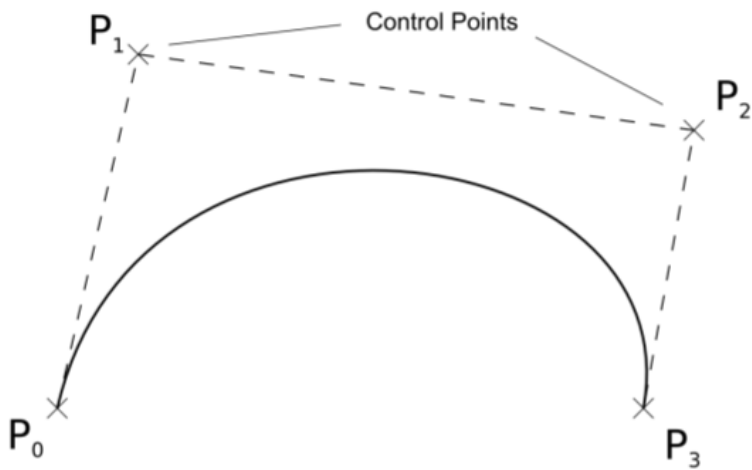
Interpolated Curves

Various order polynomials fit through every point

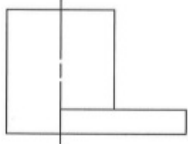
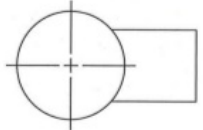
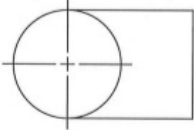
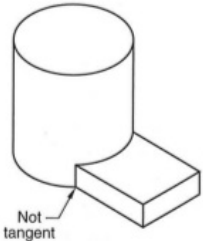
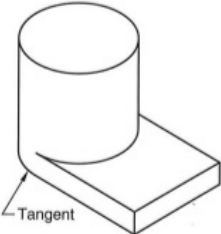
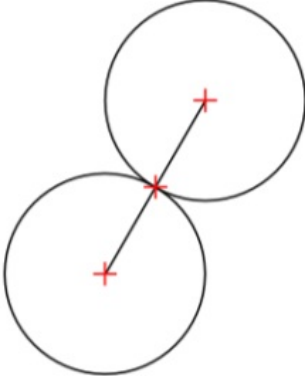
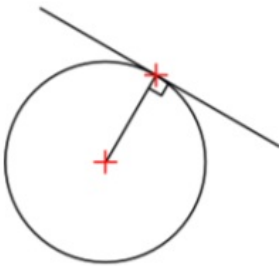
Splined: different polynomials used for different sections



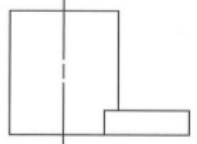
Bézier Curves



Tangency



No line drawn at tangency
(A)



Line drawn
(B)

Constraints

Constraints define the geometry through geometrical relationships

Implicit: software assumes constraints exist in a sketch

Explicit: user must define the constraints

Level of constraint

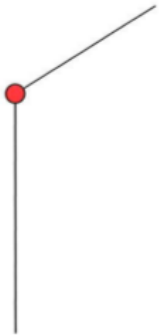
- **Fully constrained:** just enough constraints to define all of the geometry
- **Underconstrained:** not enough constraints to fully define the geometry
- **Overconstrained:** too many constraints that are conflicting

Conditions

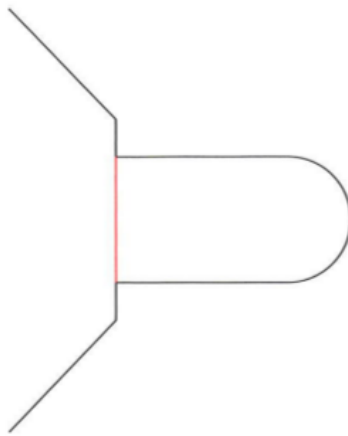
Conditions are similar to constraints but they are not enforced. Conditions are simply the geometric (or kinematic) state of the feature.

Constraints remain enforced until the designer releases them. Conditions are simply the state of the feature at a given moment or location.

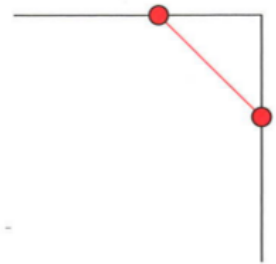
2D Constraint Types



Closure

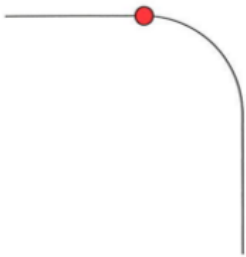


Segment Overlap



Endpoint / Line
Overlap

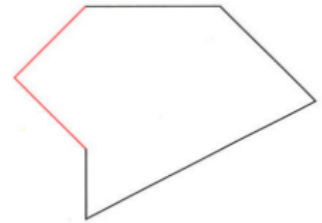
2D Constraint Types



Tangency

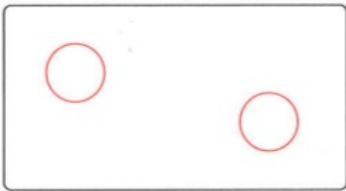


Parallelism

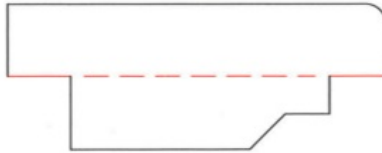


Perpendicularity

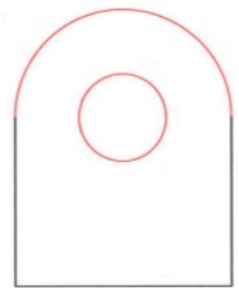
2D Constraint Types



Same Size



Coincident



Concentric