The Hitchhiker's Guide to AutoCAD 3D Solid Modeling

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Key Learning Objectives

Learn the basics of 3D solid modeling using only ten commands. Become familiar with practical tips, techniques, and caveats with real-life models.

- *Essentials* only, starting with 2D AutoCAD
- Practical techniques
- A learning roadmap and 24 sample DWGs

Please write down your questions for the end of the presentation

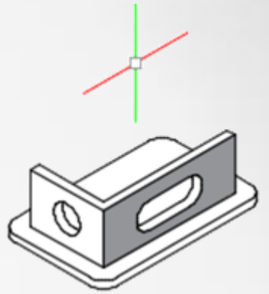
Viewing & Control
3DORBIT
PLAN
UCS
UCSICON

Profile Operations
EXTRUDE
REVOLVE
SWEEP

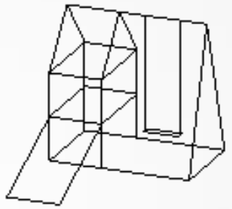
Boolean Operations
UNION
SUBTRACT
INTERSECT

Definitions for Context

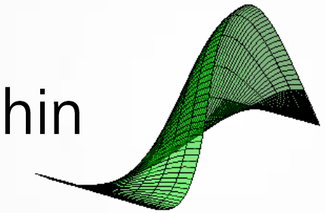
- Isometric drafting – illustrations in flat “2½ D”



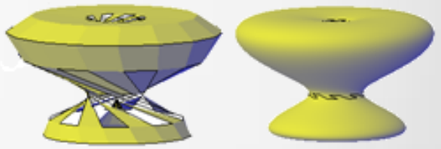
- Wireframe modeling – pipe cleaners



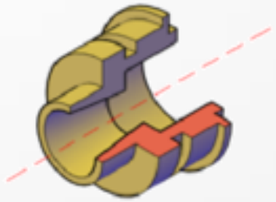
- Surface modeling – paper thin



- Mesh modeling – sculpting, smoothing chicken wire



- **Solid modeling – volume and mass**



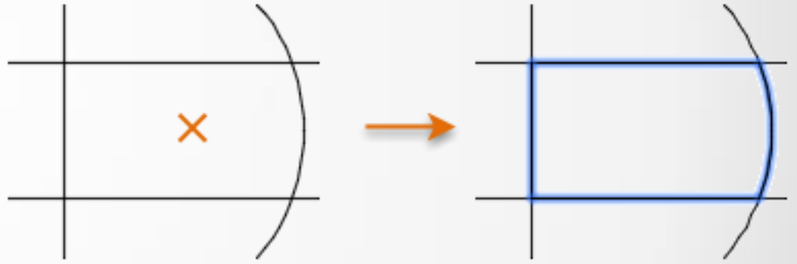
Topics

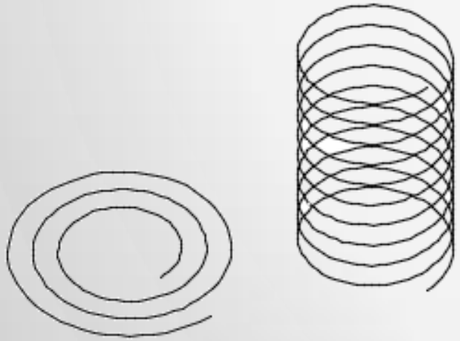
- 2D Commands Used with 3D Solids
- Viewing in 3D
- The User Coordinate System
- Profile Operations
- Boolean Operations
- Best Practices and Advice
- Next Steps

2D Geometry Commands

Used in 3D modeling

- MOVE, COPY, ROTATE, MIRROR, ERASE, PEDIT, FILLET
- Ortho mode and direct distance entry
- PLINE, RECTANG, CIRCLE
- ★ BOUNDARY (typically in plan view)
- HELIX (spirals, springs, threads)





2D Inquiry, Visibility, and Controls

Used in 3D modeling

- ID, MEASUREGEOM, PROPERTIES
- GROUP, UNGROUP for assemblies
- Isolate and Hide objects on the status bar

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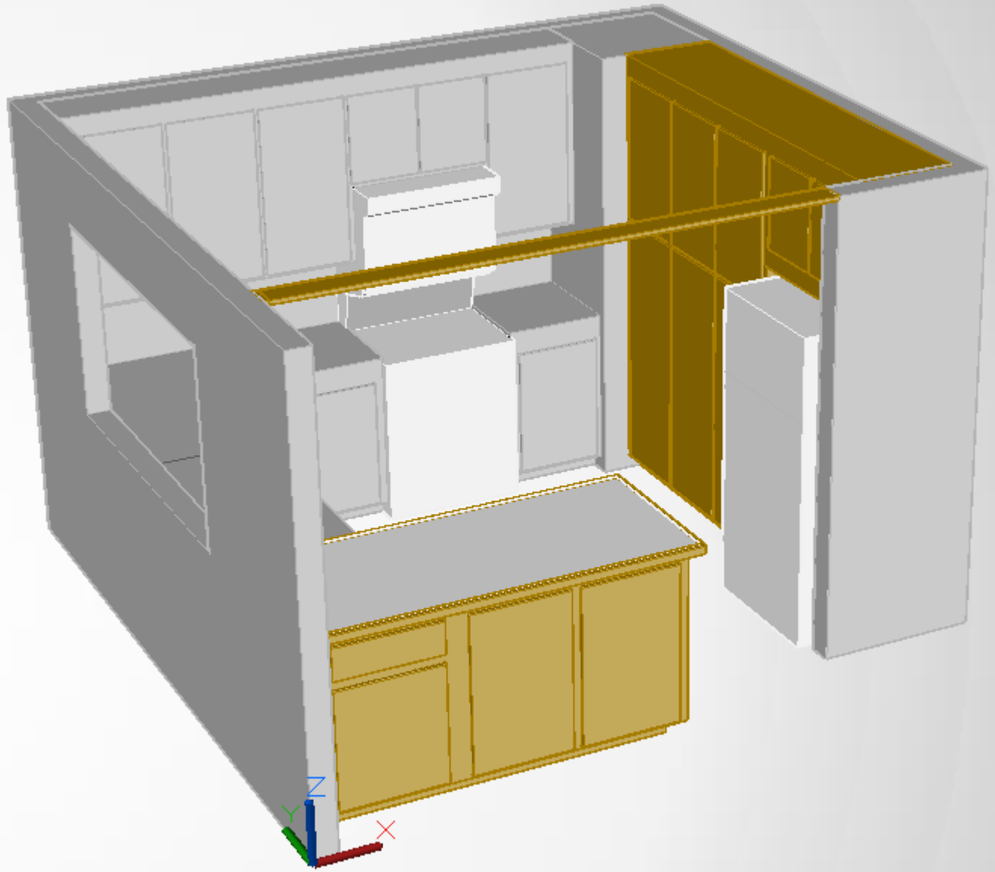
Viewing in 3D



- 3DORBIT (3DO)
  - Perspective vs. orthographic
  - Visual styles (VS)
  - Options > Display tab > Colors
  - Quick: Shift + press mouse wheel
- PLAN
  - XY plane of the current UCS
  - Mechanical Design vs. Architectural conventions

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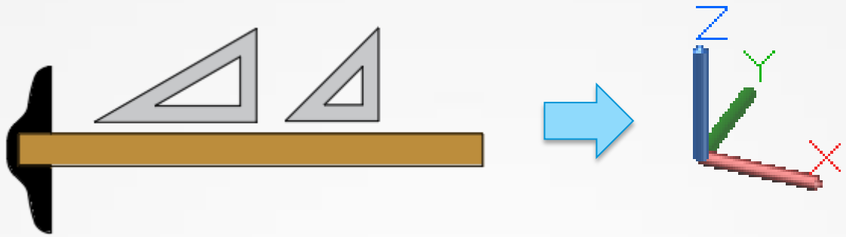
The User Coordinate System



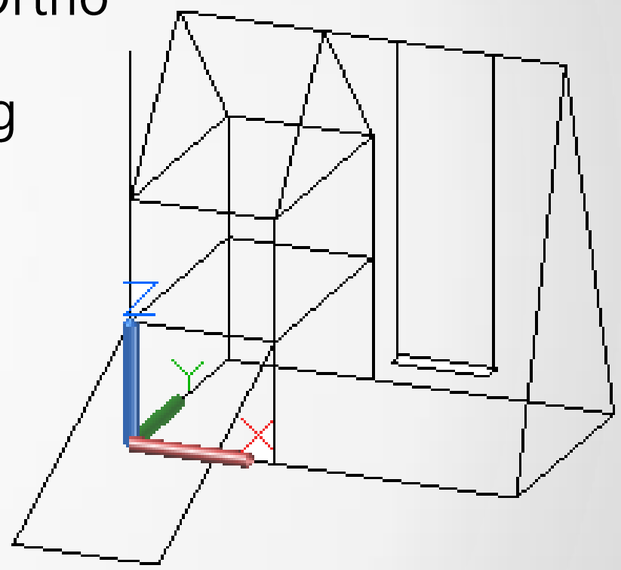
- What is it?
- What's it for?
  - Orientation: Construction plane for creating 2D objects
  - Orthogonal directions: X, Y, Z for direct distance entry, Ortho mode
  - Rotation: The Z axis is the "hinge" for rotation, right-hand rule

Tip: Turn off dynamic UCS by setting UCSDETECT = 0 [F6]

The User Coordinate System

- UCS – The essential options:
  - UCS **3P** – Locating the XY plane for 2D geometry, Ortho
  - UCS **ZA** – Specifying the Z Axis direction for rotating
  - UCS **W**orld – Getting back home

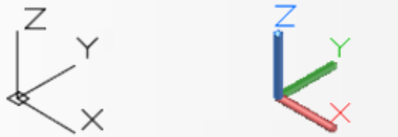
Tip: Enter UCS directly at the Command prompt



The User Coordinate System

- UCSICON – Controls the display of the UCS icon
  - Off for screenshots
  - On + display at Origin for modeling

Note: UCS display for 2D wireframe , other visual styles



2D Wireframe

All other VS

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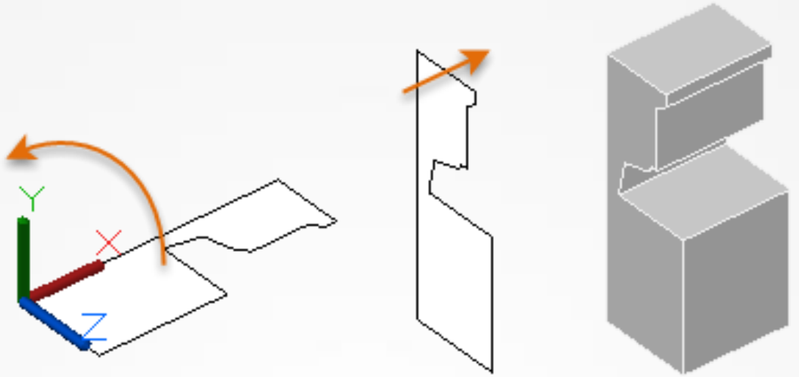
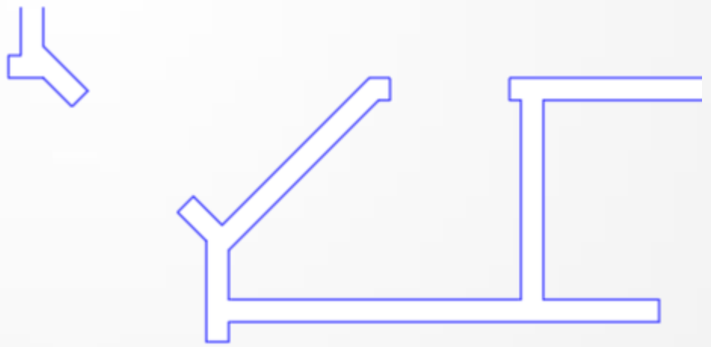
Profile Operations

- EXTRUDE (direction)
- REVOLVE (axis)
- SWEEP (path)





Profile Operations

- EXTRUDE (direction)
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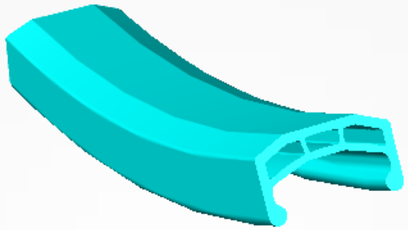
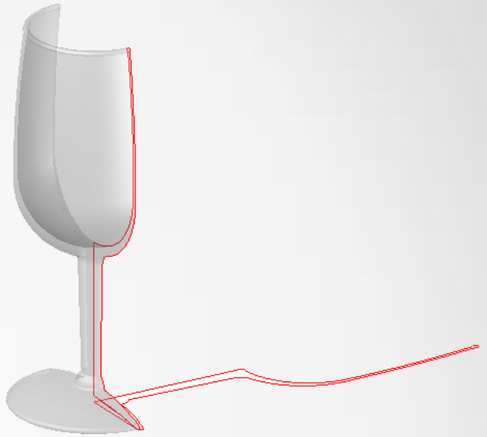
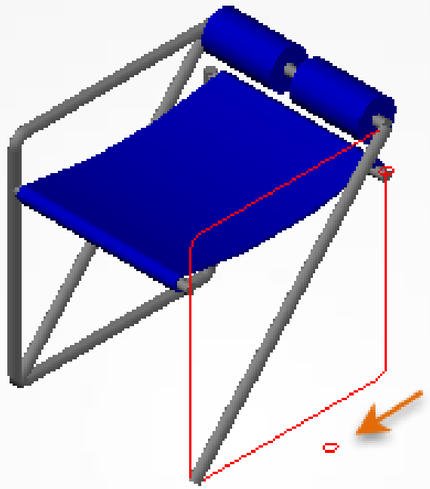




Profile Operations

- EXTRUDE (direction)
- REVOLVE (axis)
- SWEEP (path)
  - 2D polylines
  - + profiles



Profile Operations

- EXTRUDE (direction)
- REVOLVE (axis)
- SWEEP (path)

Tip: Set DELOBJ = 0 to retain profile geometry

- Why? Revise and reference
- Keep on separate Reference layers
- Choose a distinctive color

Topics

- 2D Commands Used with 3D Solids
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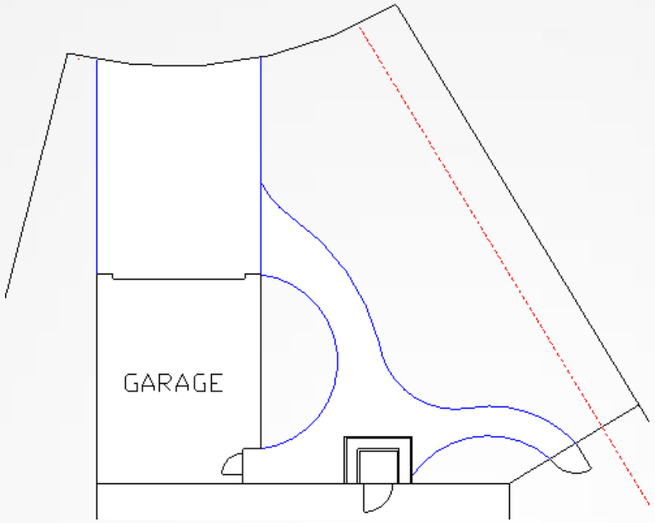
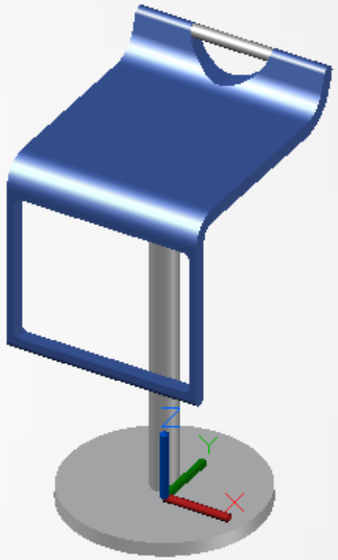
Boolean Operations

- UNION
- SUBTRACT
- INTERSECT



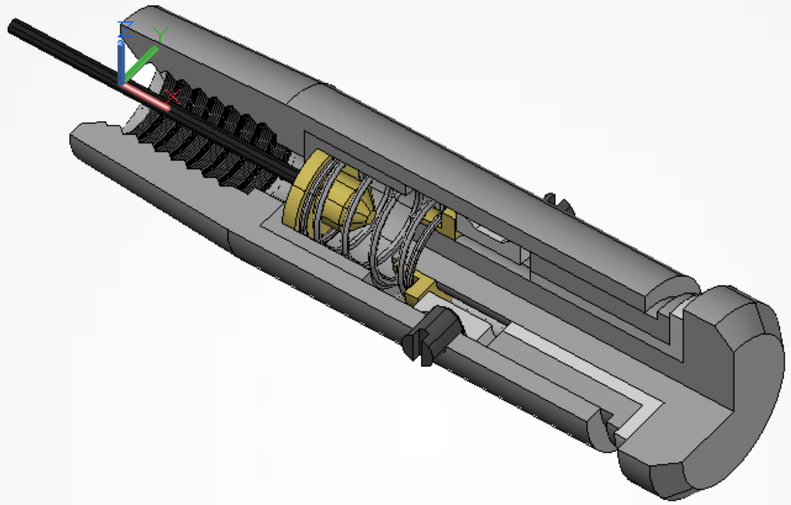
EXTRUDE, UNION, MASSPROP



EXTRUDE, UNION, SUBTRACT

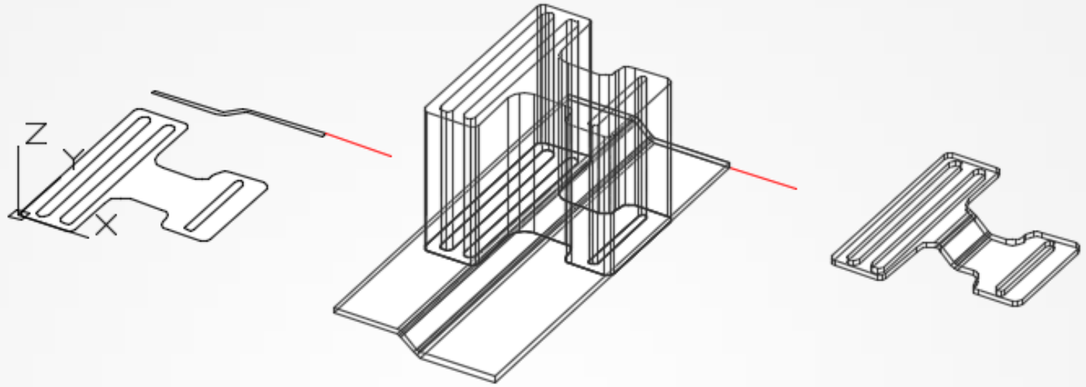
Boolean Operations

- UNION
- ★ SUBTRACT
- ★ INTERSECT

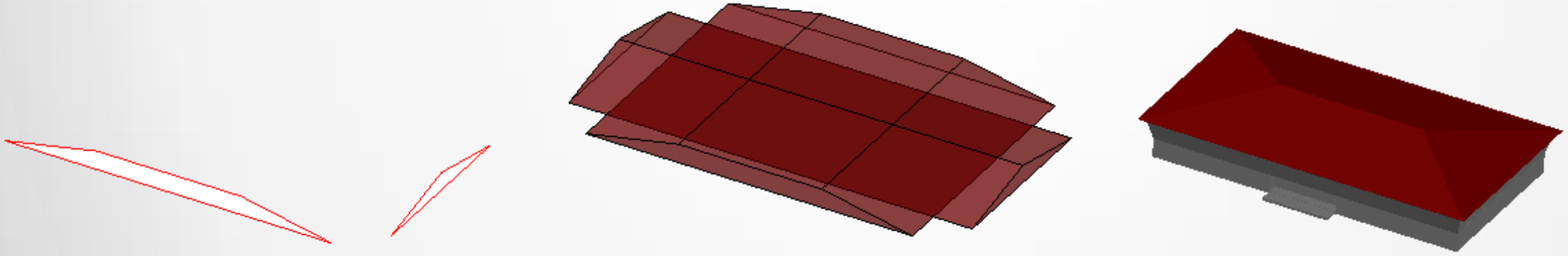


Boolean Operations

- UNION
- SUBTRACT
- INTERSECT



UCS ZA, ROTATE, EXTRUDE, INTERSECT



Quick Review

- Viewing commands
- UCS commands
- Profile Operations
- Boolean operations

Quick Review

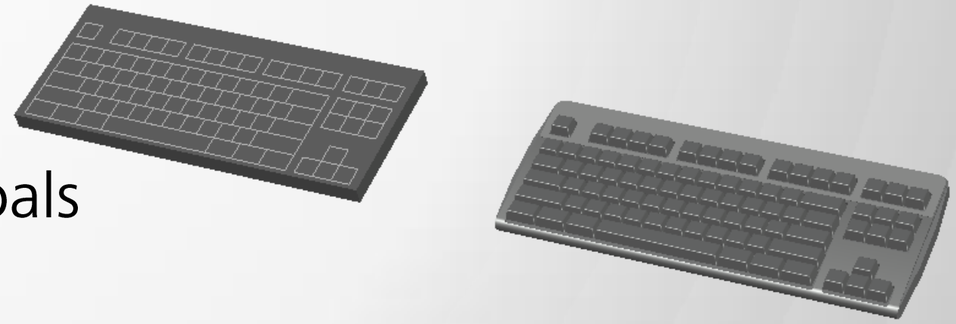
- Viewing commands – 3DORBIT, PLAN
- UCS commands – UCS, UCSICON
- Profile Operations – EXTRUDE, REVOLVE, SWEEP
- Boolean operations – UNION, SUBTRACT, INTERSECT

Topics

- 2D Commands Used with 3D Solids
- Viewing in 3D
- The User Coordinate System
- Profile Operations
- Boolean Operations
- Best Practices and Advice
- Next Steps

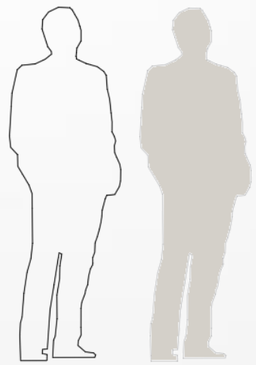
Best Practices and Advice

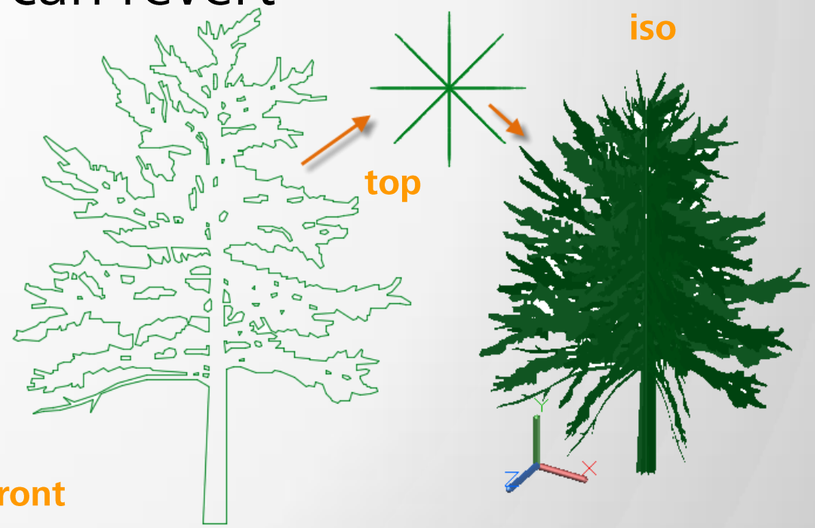
- Learn using simple models, become comfortable with the commands
- Use layers to manage visual complexity
- Create 2D profiles first (closed polylines and circles)
- Move and rotate 2D profiles and 3D objects into place
- Create and keep profile geometry (set DELOBJ to 0)
- Check and recheck distances and dimensions
- Limit the detail to what is justified for your goals



More Best Practices and Advice

- Delay filleting to preserve sharp corners for measuring and locating
- Use GROUP to associate objects that you don't want to Union
- Create blocks from repetitive objects to reduce DWG size
- Save a version of a model at each stage so you can revert
- 3D landscaping – purchase and insert as blocks
- People – Use transparent extrusions





Topics

- Common 2D Commands Used with 3D Solids
- Viewing in 3D
- The User Coordinate System
- Profile Operations
- Boolean Operations
- Best Practices and Advice
- Next Steps

Next Steps

- Download the class presentation, notes, and drawing files
- Review the presentation, try things with the 24 class models
- Create some simple models
- Review the Further Study section in the class handout
- Explore the 3D Basics workspace
- Experiment and have fun!

Be heard! Provide AU session feedback.

- Via the Survey Stations, email, or mobile device.
- AU 2016 passes awarded daily!
- Give your feedback after each session.
- Give instructors feedback in real-time.