## Rhino3D Cheat Sheet

Please add and circulate back to Sebastian Geiger (sebastian.geiger@pet.hw.ac.uk)

**Set tolerances and units**

*Do this always before you start building a model geometry!*

Dimension → Dimension Properties → Units

- Absolute tolerance: Should be 1/10 of your smallest geometry object
- Relative tolerance: Ratio of smallest to largest object in percent
- Angle tolerance: Set to 0.01
- Units must be in mm (CSMP interprets as m)

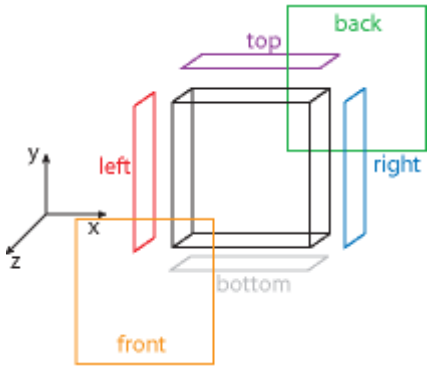
**Change grid**

Dimension → Dimension Properties → Units

- Set grid extent
- Set grid snap spacing
- Set minor and major grid lines

**Other important points**

- Always center geometry around origin (0,0,0) or start at origin
- Each surface needs a bounding curve, each curve a start and end point (CAD topology) but each curve (e.g. intersection curve) should only occur once
- Surfaces will be meshed in 2D models
- Multiple surface will enclose the volume(s) that will be meshed in 3D models (no gaps must occur between those surfaces!)
- Remember CSMP coordinate system (X: To the right, Y: Vertical, Z: To the front) – 2D models must be drawn in X-Y plane
- Create TOP, BOTTOM, LEFT, RIGHT boundaries (2D) plus FRONT and BACK (3D)




- Organise your objects in layers (e.g., FRACTURES, SANDSTONE, CARBONATE, FAULT, …)
- Ensure that you do not have any disconnected points or lines which do not have any geological meaning.

**Object snap**
Use Osnap (bottom panel) to snap curves to each other or points for avoiding small gaps between curves

**Function keys**
- F3: Object properties
- F9: Grid-snap on/off

**Command line**
Observe command line just below the different menus to complete actions as needed or enter values manually

**Generate a bounding box**
Solid → Box → Corner to Corner, Height

**Generate surfaces**
- Surface → Planar Curves: From circle/rectangle
- Surface → Loft: Loft a surface from two or more curves (e.g., fault traces)

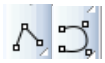
**Generate points at curves**
Curve → Point Object → Mark Curve Start or Mark Curve End

**Generate intersection curves along intersecting surfaces**
Curves → Curves from Objects → Intersection. Important: Each intersection curve should only exist once and collect intersections in an individual layer which allows mesh refinement along intersections. Intersections can also be created in ANSYS later in the geometry → curve menu.

**Generate outline curves along (disconnected/individual) surfaces**
Curves → Curves from Objects → Silhouette. Important: Each silhouette curve should exist only once, especially where two surfaces are in contact and must not be created where intersections are already present (if multiple curves, e.g. silhouettes from two different surfaces and/or intersection curves are present, small gaps can occur which cause ANSYS meshing problems). Silhouettes can also be created in ANSYS later in the geometry → curve menu.

**Edit layers (right panel)**
- Make layers invisible: Click on light bulb symbol (NB: Only visible layers will be available for meshing in ANSYS)
- Rename layers: Right-click layer
- Lock layer: Click on lock symbol
- Change active ("current") layers: Tick/untick layer (NB: All new objects will be added to current layer by default)
- Add object to a layer: Edit → Layers → Change Object Layer
- Right-click in layer panel to create new layer
- Right-click on individual layer to delete it

**Useful buttons (left and top panel, right-click for additional options)**

-  Polyline/Control point curve
-  Circle, ellipsoid, rectangle
-  Join/explode objects
-  Trim/split objects (NB: Surfaces must be trimmed at model boundaries)
-  Modify control points of curves
-  Center model in view pane

**Mouse controls and key-strokes**

- Hold + shift: Select multiple objects
- Hold + Ctrl: Deselect individual objects from multiple selected objects
- Right-click: Move view pane (Top, Front, Right pane "Hand tool") or rotate (Perspective pane)
- Mouse-wheel: Zoom in/out

**Change view pane**

Right-click on view pane

- Set View: Reset Top, Front, Right, Perspective
- Change surfaces from wireframe to shaded, rendered, or ghost

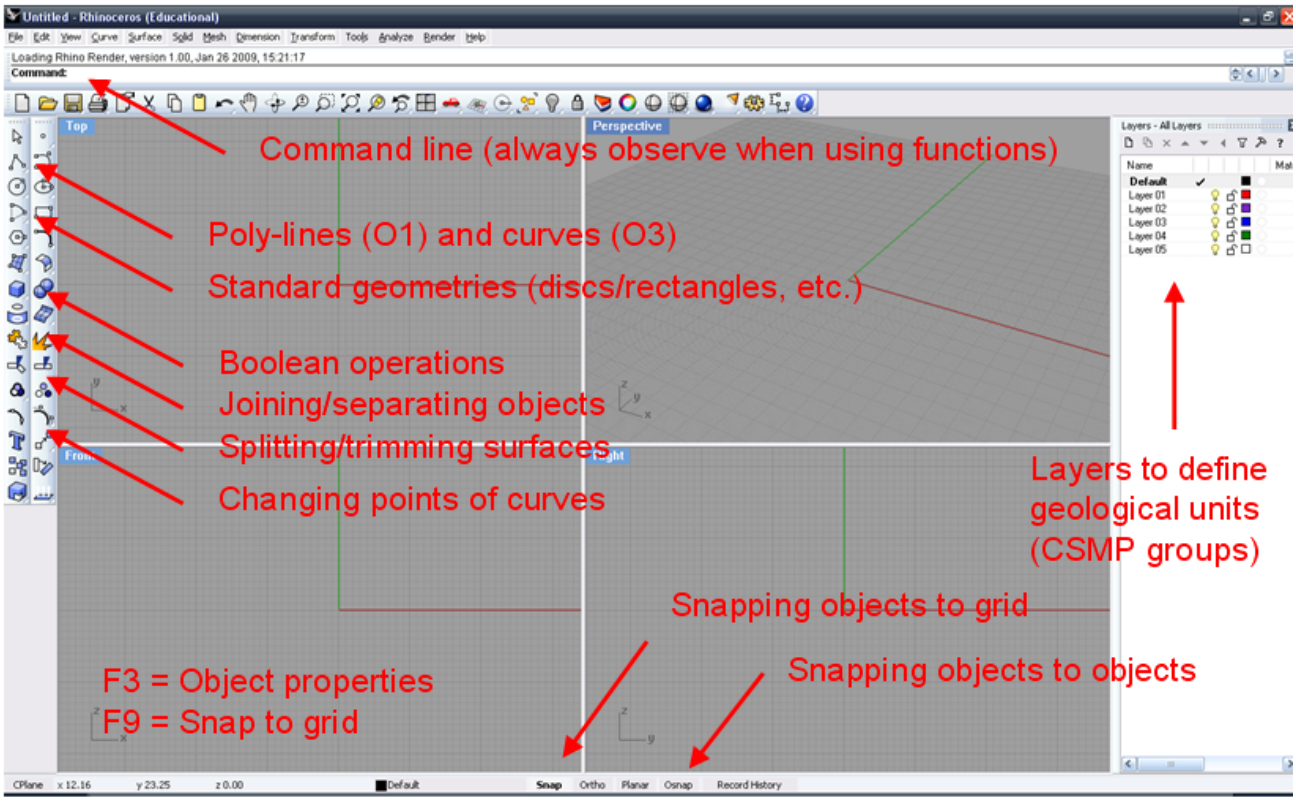
**Transform objects**

- Scale: Transform → Scale (multiple scale options 1D, 2D, 3D)
- Rotate: Transform → Rotate and Rotate 3D
- Plus many other options

**Output to ANSYS**

- Save geometry as Rhino Version 3
- Use 3dm2tin.exe file from DOS command prompt on the geometry (e.g., 3dm2tin.exe myfileV3.3dm)

**Rhino GUI**


Command line (always observe when using functions)
Poly-lines (O1) and curves (O3)
Standard geometries (discs/rectangles, etc.)
Boolean operations
Joining/separating objects
Splitting/trimming surfaces
Changing points of curves
Layers to define geological units (CSMP groups)
Snapping objects to grid
Snapping objects to objects
F3 = Object properties
F9 = Snap to grid