I. Hierarchical Modeling
   A. Limitations of models made from several pieces.
      i. Transformations applied globally to all pieces of a model are applied about each
         piece's local coordinate origin (pivot point).
      ii. Transforming each piece of a model separately becomes tedious and impractical.
   B. Grouping and Transformations
      i. Logical grouping of several sub elements, or nodes, is accomplished by defining
         a transformation matrix that propagates downward to the lower levels. This
         generates a new local coordinate system for the grouping.
      ii. Transformations can then take place on the group as a whole, or on each
         individual level.
      iii. Transformation Stack - the collection of all transformations currently in effect
         and how they propagate onto one another.
         a. Push and Pop - the act of starting and stopping transformations on a
            particular node, respectively.
         b. Transformations stay in effect until they are "stopped" at the conclusion of a node in the hierarchy.
   C. Representation of the Hierarchical Structure
      i. The Hypergraph - used to visualize graphical relationships between components
         of a scene.
         a. Scene Hierarchy - shows ordered arrangement of objects, lights, cameras, and other items that make up a scene.
         b. Dependency Graph - shows the architectural connections between Maya entities that input and output data (e.g. Shading Group connections).
         c. Use the Dependency/Scene Graph toggle icons in the Pane Toolbar.
      ii. Understanding Hierarchical Terminology
         a. Parent - object or other item that controls attributes of one or more children.
         b. Child - object having attributes controlled by a parent.
         c. Node - Any box in the graph. (Subnode - any node below another node in the hierarchy.
         d. Branch - all nodes from parent to child lay on a branch of the hierarchy.
         e. Transform node - contains an object's transformation attributes as well as information regarding parent-child relationships.
         f. Shape node - holds and objects geometry attributes. Shape nodes don't appear in the Hypergraph by default.
      iii. Working with the Hypergraph (assume menu commands are in the Hypergraph's Pane Menu).
         a. Displaying special nodes - Use the Options menu to toggle visible nodes and connections that are invisible by default.
            1. Shape Node - holds an object's geometry, and is a child of the objects transform node.
            2. Invisible Nodes - displays any object hidden by Display -> Hide.
            3. Underworld Nodes - layer below an object's surface node. They hold info on curves on surfaces, they are not evaluated in world coordinate space.
         b. Collapse/Expand Hierarchy - useful tools for easy viewing.
            1. Edit -> Collapse to hide the hierarchy under it's parent node. use
            2. Edit -> Expand to reveal hidden children nodes.
         c. Frame buttons - allow you to frame up the Hypergraph window around nodes.
         d. Rearranging scene hierarchy nodes - toggle on the Freeform graph icon on right side of toolbar pane.
   D. Parenting and Grouping
      i. Parenting
         a. MMB drag the child node onto the parent node.
         b. Edit -> Parent - parents all selected nodes to the node selected last.
         c. Edit -> Unparent - unparents a child from a parent. All children of the unparented child stay parented. Select the node you wish to separate from the hierarchy.
         d. MMB drag a child away from a parent to separate them.
ii. Grouping
   a. **Edit -> Group** - allows you to group a selection of objects under a new transformation node.
   b. **Edit -> Ungroup** - to break up a group by selecting the parent node.
      (Use unparent to remove individual nodes from a group.

E. Duplicating Objects
   i. **Edit -> Duplicate** - allows you to duplicate any selected object in the world.
   ii. Workflow - select items you wish to duplicate, then pull the menu.
   iii. Duplication parameters -
      a. Translate, Rotate, etc. - this is where you specify the offset values for each duplicate.
      b. Copy/Instance toggle - select the type of duplicate you wish, see Efficient Modeling below for further info on this topic.
      c. Smart Transform - concatenates continually on singular duplicates.
      d. Upstream/input graph - duplicates all upstream nodes being fed by the select node, and all of the nodes feeding into the selected node.

II. Curve and Surface Editing - all menu items can be found under **Edit Curves or Edit Surfaces**.
   A. Insertion - inserting edit points and surface isoparms.
      i. Simply select two isoparms or edit points you wish to insert the EP or isoparm.
      ii. Keep originals is always a wise decision until you know exactly what you want.
      iii. # Knots to insert - enter in the number of knots you wish to add between your selected components.
      iv. To interactively insert a knot/isoparm, click on an isoparm and drag along the surface before selecting **Edit Curves -> Insert**.
   B. Attach - attaching two object types together, to form one new curve or surface.
      i. Select two curves to connect then **Edit Curves -> Attach**.
      ii. Select two surfaces to connect, then **Edit Surfaces -> Attach**.
      iii. Various Settings
         a. Connect - join the two curves/surfaces without substantially altering the curvature of the curve/surface.
         b. Blend - will attempt to impose continuity on the input curves/surfaces based on the blend bias setting.
         c. Insert knot - only available for blend attach, inserts a knot at the join.
   C. Detach - used to break a curve/surface into two curves/surfaces.
      i. Same workflow as the **Insert** tool.
      ii. To interactively detach a knot/isoparm, click on an isoparm and drag along the surface before selecting **Edit Curves -> Insert**.
   D. Surface/Curve Direction - if you get unpredictable results from the edit curve/surfaces tools, examine your surfaces, and determine that the UV directions are the same. If they aren't use **Edit Curves -> Reverse Curve Directions** (same with surfaces).
   E. Rebuilding Curves - used to rebuild curves, changing their parameterization, number of spans, etc.

III. Efficient Modeling
   A. Build Smarter - use the least number of edit points/CVs to build your curves.
   B. Instancing vs. Copying - use instance instead of copy when duplicating objects.
      i. Instancing
         a. Merely points to the geometry of the original object.
         b. A new transformation node is created, without any geometry.
         c. You can only rotate, scale, and move and instanced object, you can not change the geometry, CVs, isoparms etc.
         d. Uses less system memory during modeling.
      ii. Copying
         a. Makes a copy of an objects geometry and transformation matrix.
         b. Adds to the amount of memory your models/scene holds.
         c. Offers you the freedom to manipulate and edit geometry.
   C. Remove unwanted geometry - remove construction history when done, remove unnecessary edit points, trim curves, etc.