EN1740 Computer Aided Visualization and Design

Spring 2012

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Last Time:

- Shared data
  - Copied Geometry
  - Component Operations
- Family Tables

Tonight:

- Intro to Top-Down Design
  - Fundamentals
  - Skeletons

AutoCAD Next Up

- We're going to tackle an introduction to AutoCAD in the next few lectures
- Please go to Autodesk's educational community site and register
  - **www.Autodesk.com/edcommunity**
- Once registered you'll be able to download AutoCAD 2012
  - Please do so in anticipation of the lectures to come

Drawing Tips for Project

Things To Keep In Mind:

- Cross-sections
  - Need a SINGLE LETTER name
  - Must be accompanied by section arrows
- Don’t leave dimension on the object
- Provide good spacing for the dimensions
- Don’t cross dimension and extension lines
- Don’t leave geometry shaded on drawing (perspective view included)
- Make sure you use a drawing format (title block)
- Include appropriate note for CTFD (provided on supporting page)
- DON’T double dimension
- HIDE DATUM FEATURES ON DRAWING!!

Top-Down vs. Bottom-Up

Let's say you wanted to design this….

http://allworldcars.com/wordpress/?p=2208

Top-Down vs. Bottom-Up

Top-Down would start with this…..

…then figure out what would fit, then place the engine, bumpers wheels, etc….

Top-Down vs. Bottom-Up

Bottom-up would start with this stuff…..

…and start putting them together

Top-Down vs. Bottom-Up

Top-Down:

Benefits

- Product needs to be fairly well defined, so you're starting with the answer
- Facilitates large assemblies well
- Very effective way to work in cross-functional groups

Drawbacks:

- Limits flexibility
- Must have team buy-in

Bottom-Up:

Benefits

- Does not need well defined structure to start
- Very flexible

Drawbacks:

- Team needs to communicate more frequently
- Can get unwieldy in large assemblies

Real World is going to be a mix of these philosophies

Top-Down Tools

There are a number of tools available to manage and facilitate top down design

- Skeletons
- Data sharing
    - Published
    - Copied
    - Component operations – Merge, Cut
- Simplified reps
- Shrink Wrap
- Many others

Skeletons

Skeletons provide:

- Product layout and envelope
- Components interface locations and size
- Product volume
- Connections and mechanisms

Skeletons – There's a lot of rules

FROM THE PRO/E MANUAL:

Before creating a skeleton model, consider the following points:

- Only one motion skeleton can be created or inserted in an assembly.
- Multiple standard skeletons can be created in an assembly when the multiple_skeletons_allowed configuration option is set to yes.
- A skeleton model is similar to any other assembly component. It has features, layers, relations, views, bodies, and so on.
- External reference control settings can be used to restrict geometry and assembly placement references to skeleton models only (Edit > Setup > Ref Control > Skeleton Model). These options control references for all skeletons in the assembly.
- Skeleton models can maintain their own family tables. This means that assemblies can maintain different skeleton instances across a family table.
- All simplified representation functionality available in Part and Assembly mode is available for skeleton models (beginning with Pro/ENGINEER 2001).
- Skeleton models can be selected By Rule when managing simplified representations.

Skeletons

In the end, Skeletons are pretty simple

- A “Skeleton” can be any part comprised of datum planes, axes and curves that define a product
- If created as a standard part, Skeleton rules won’t apply
    - This may not be all bad

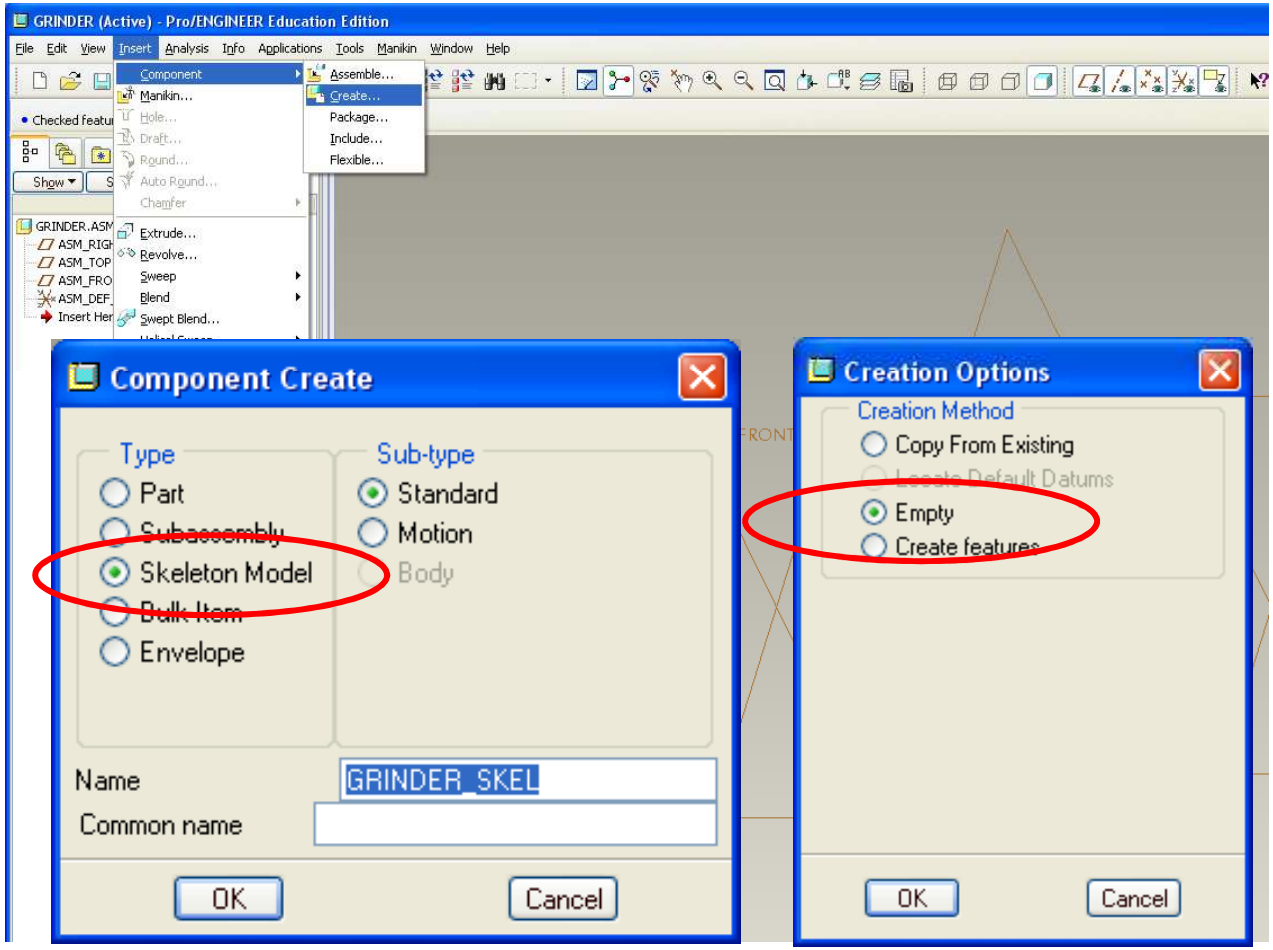
EXERCISE – Top-Down Design Tools

We'll illustrate the use of Top-Down tools with a relatively simple product

EXERCISE – Top-Down Design Tools

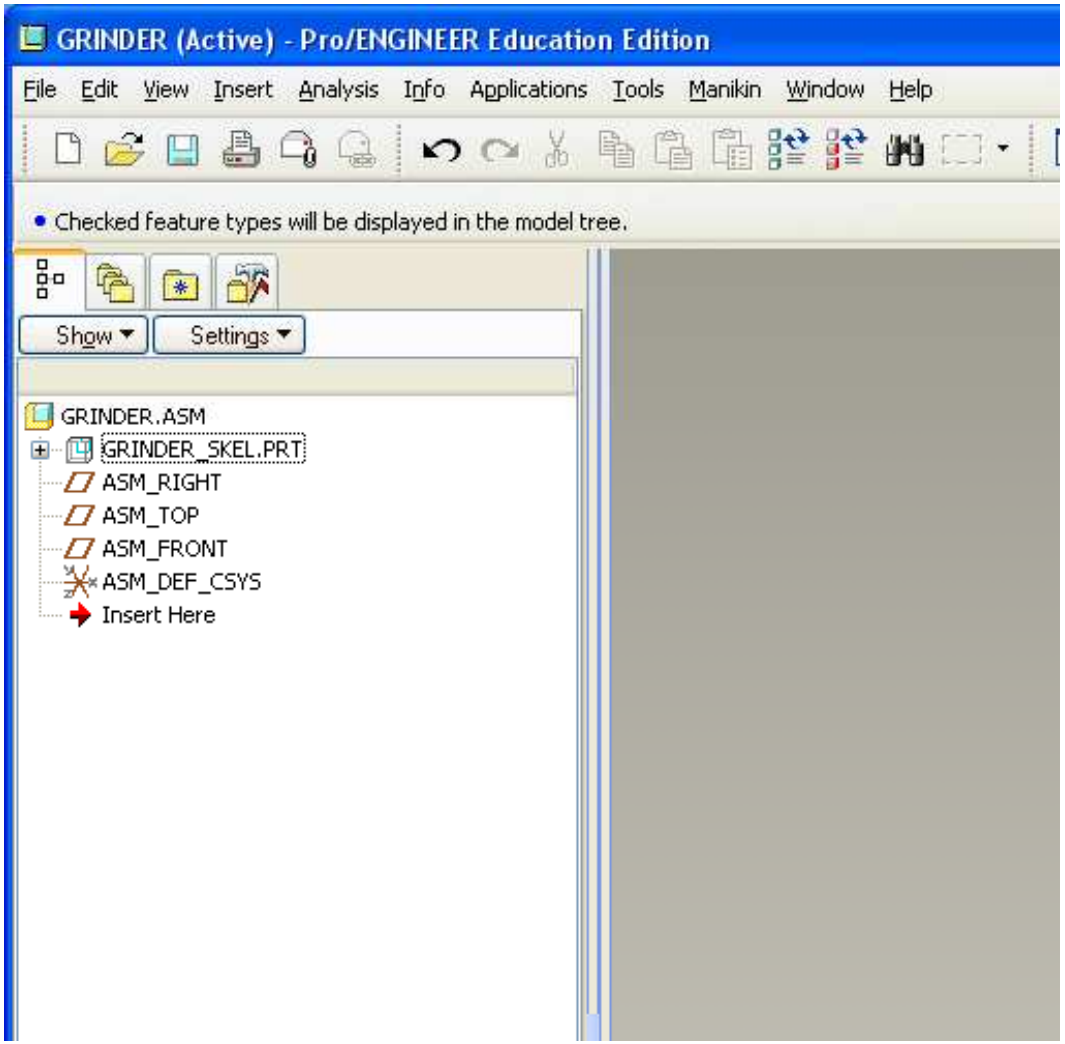
Begin by creating a skeleton

- Create a new assembly > grinder.asm
- Insert > Component > Create
- From Component Create dialog Select Skeleton Model
- From Creation Options Select Empty



EXERCISE – Top-Down Design Tools

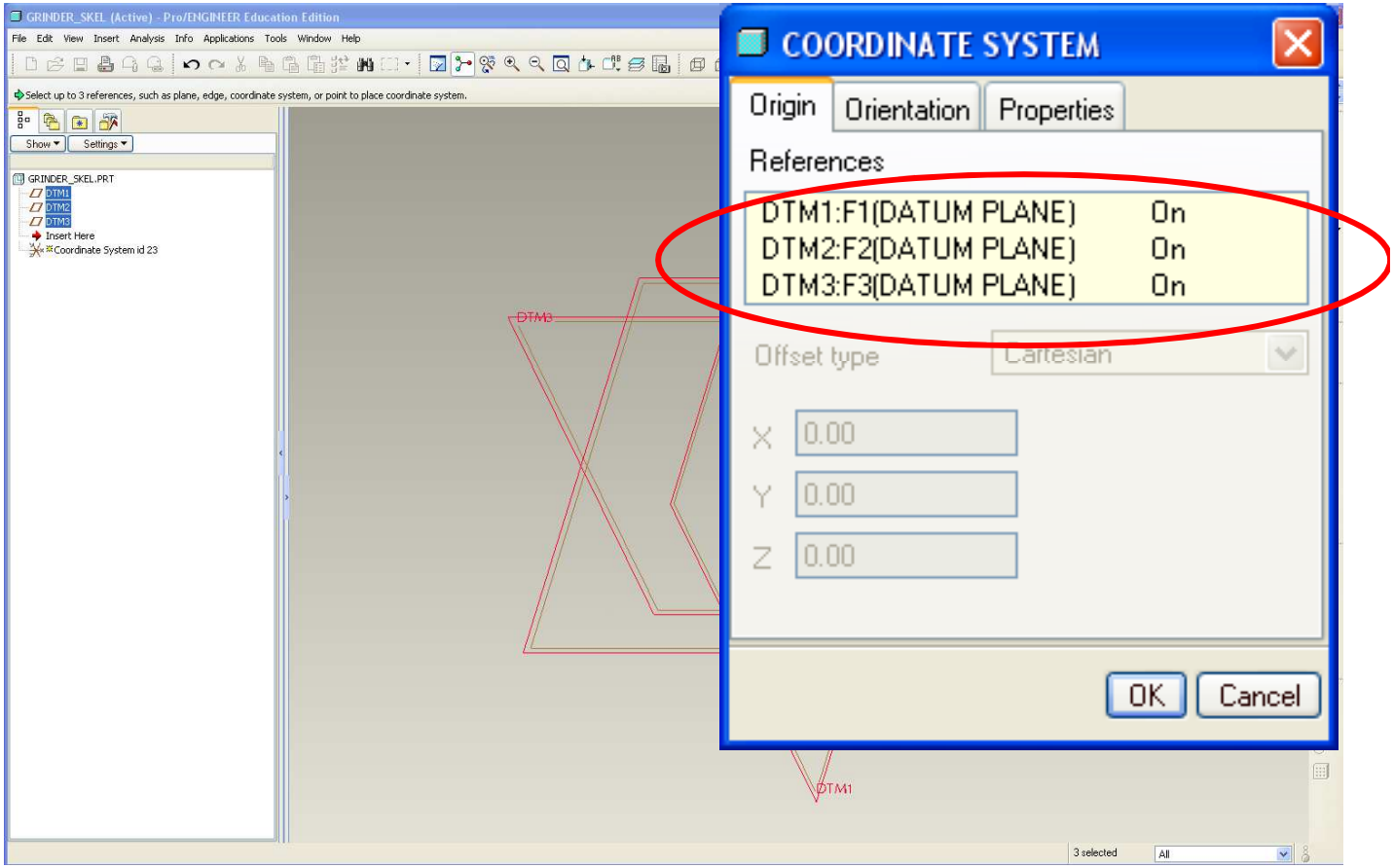
- Notice in the Model Tree the addition of the Skeleton as the first feature
    - Skeletons are always first
- Right Click on the Skeleton and open it



EXERCISE – Top-Down Design Tools

Create default datums

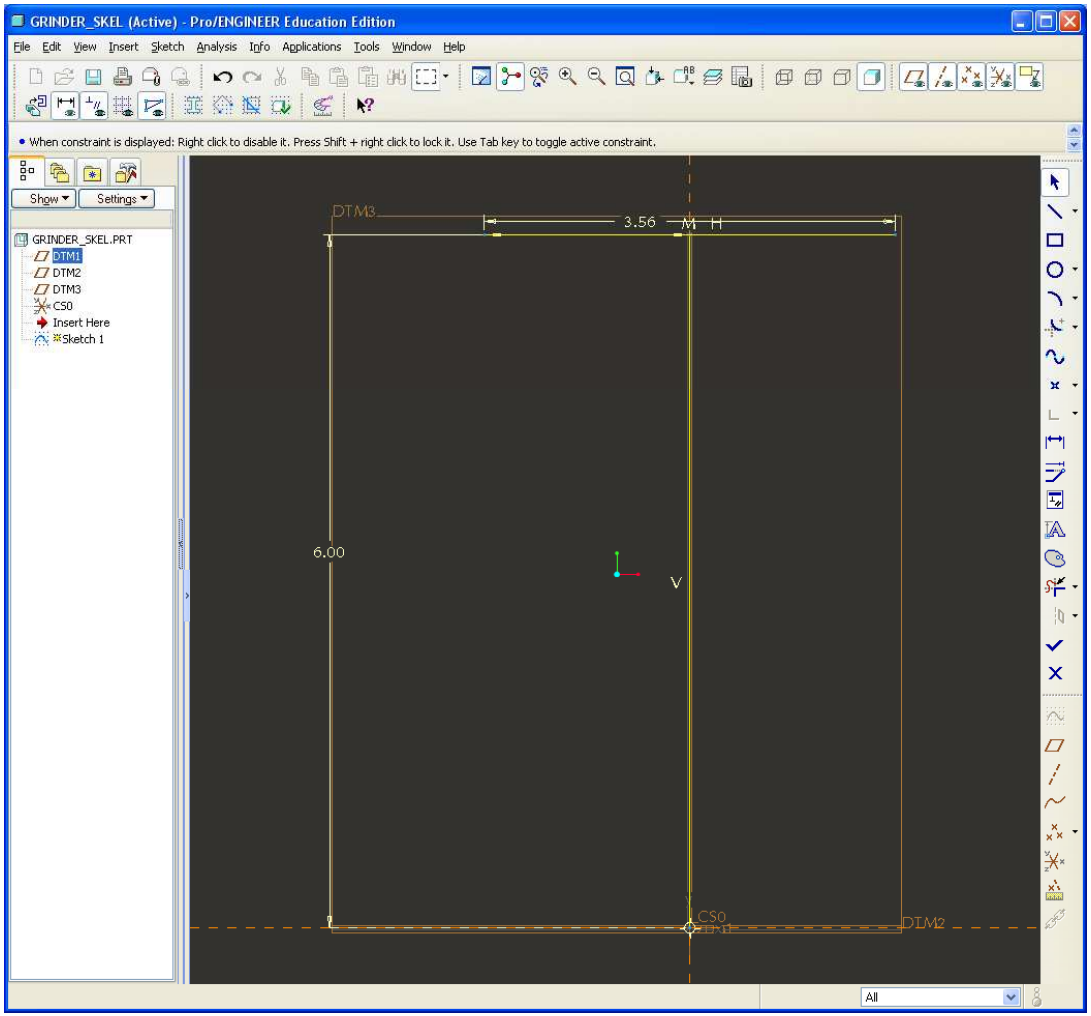
- Click create datum plane icon to create default datums
- Click create coordinate system
- Select DTM1, DTM2, DTM 3 in order as references



EXERCISE – Top-Down Design Tools

Create a sketch to scale skeleton

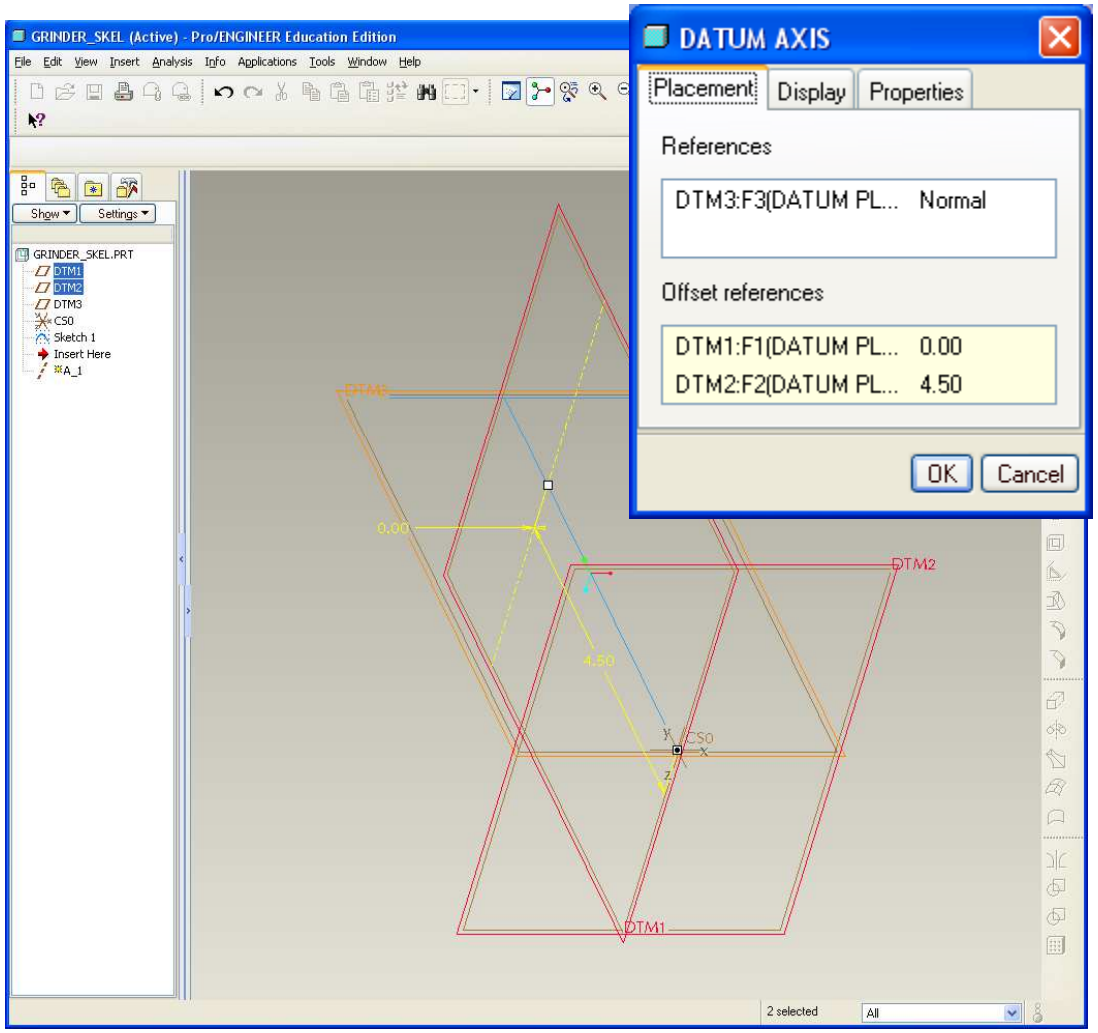
- Create a Sketch
  - Select DTM3 as Front
- Sketch a “T” as shown
  - 6H X 3.56W



EXERCISE – Top-Down Design Tools

Create layout datums

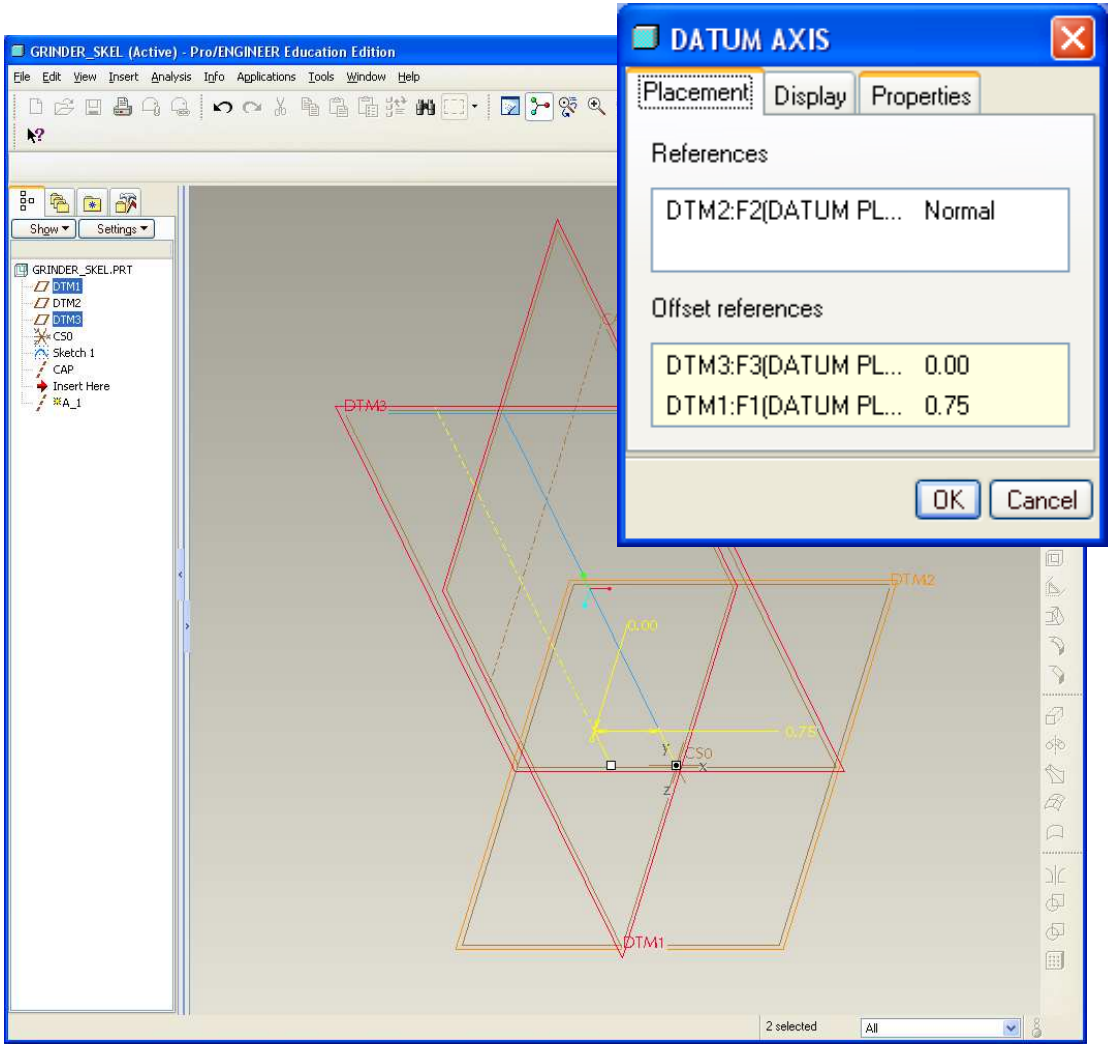
- Create an Axis normal to DTM3 and offset 4.5in from DTM2
- Rename axis as “CAP”



EXERCISE – Top-Down Design Tools

Create layout datums (cont.)

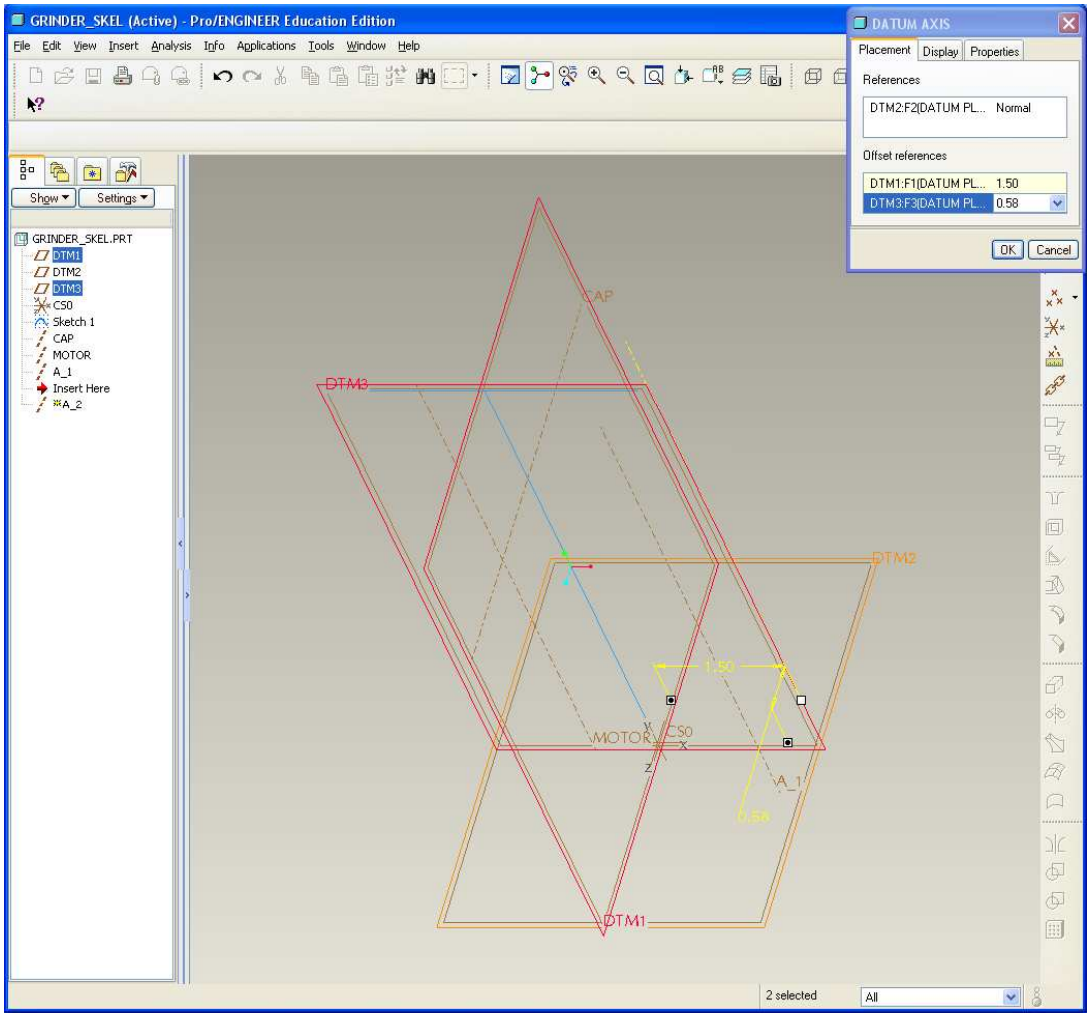
- Create an Axis normal to DTM2 and offset .75in from DTM1
- Rename axis as "MOTOR"



EXERCISE – Top-Down Design Tools

Create layout datums (cont.)

- Repeat the process twice more to locate two AA batteries
  - Normal to DTM2, offset from DTM1 & DTM3 1.5in and .58in, respectfully
- Rename axes BATT1 and BATT2

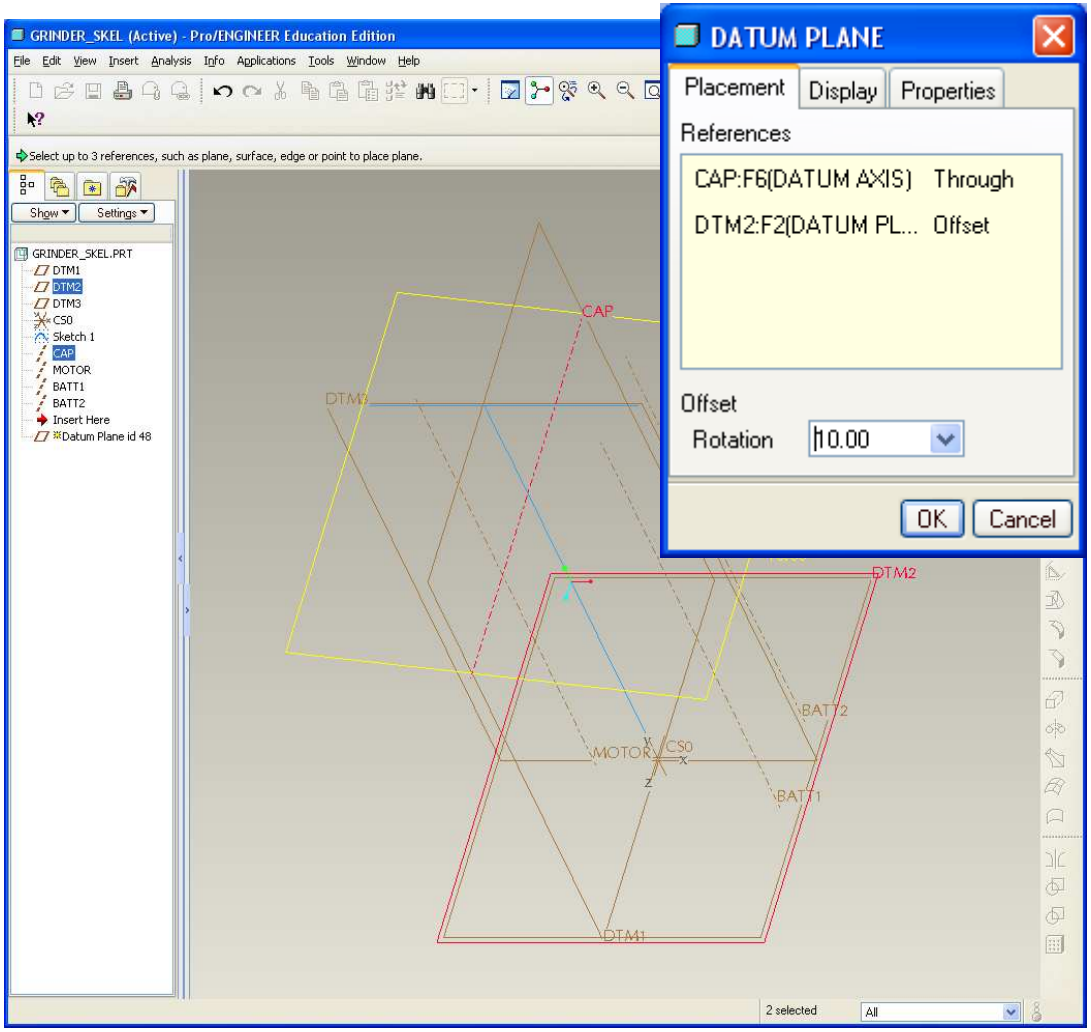


EXERCISE – Top-Down Design Tools

Create layout datums (cont.)

• Create a datum plane through CAP axis and at a -10deg angle to DTM2

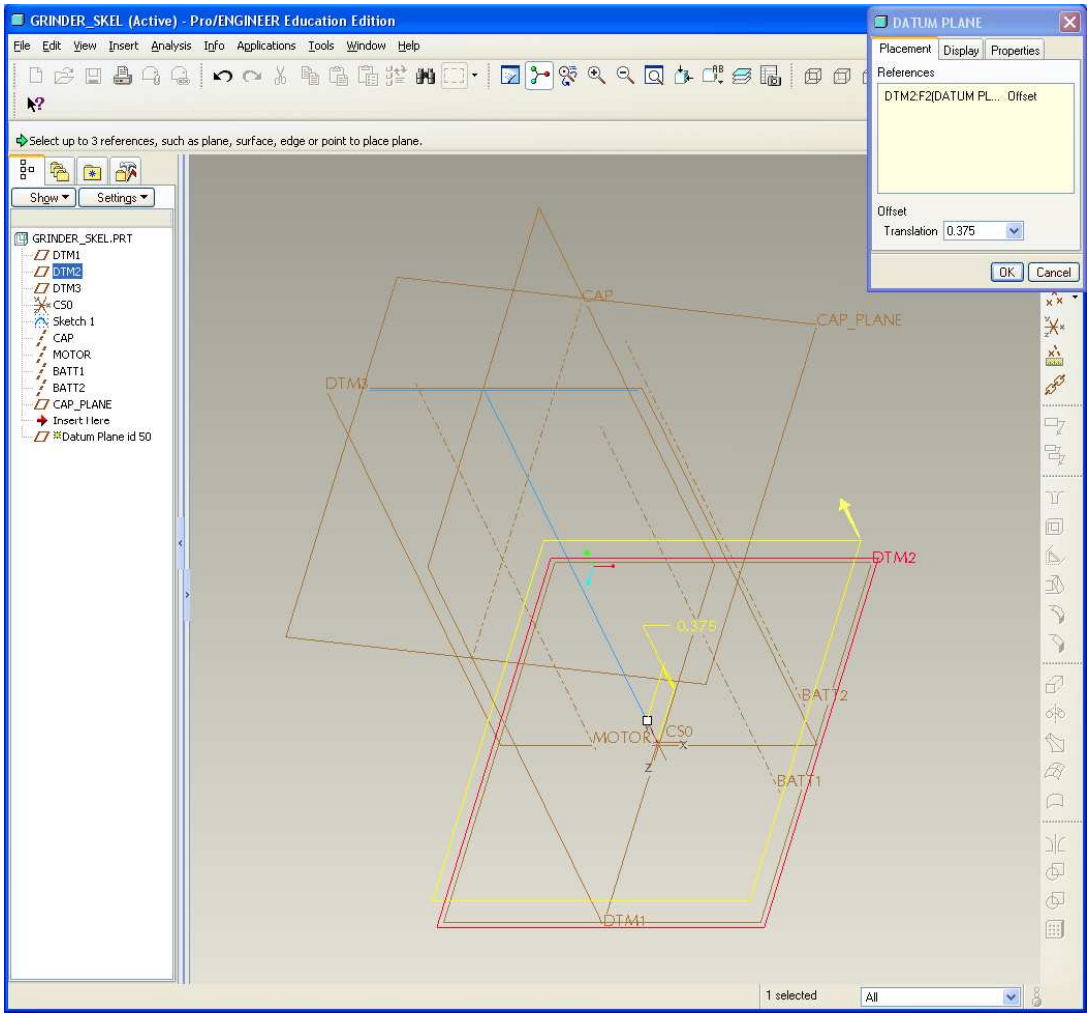
• Rename plane “CAP_PLANE”



EXERCISE – Top-Down Design Tools

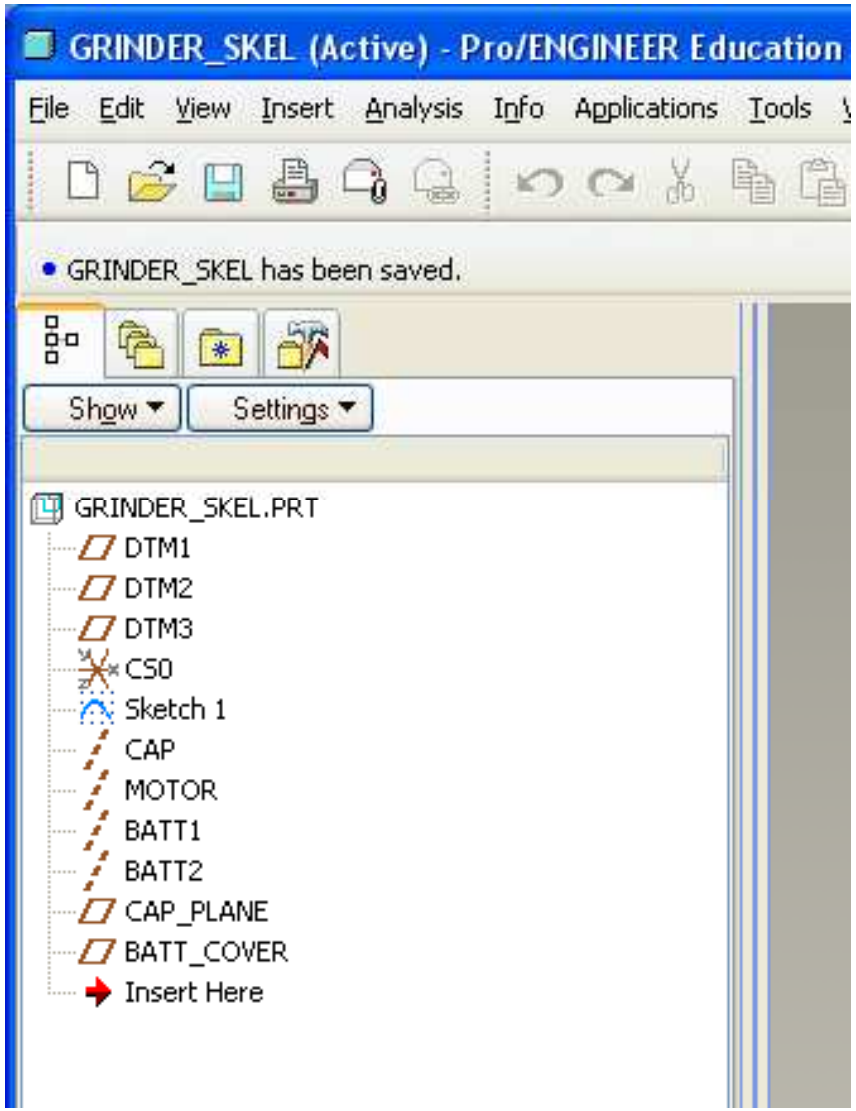
Create layout datums (cont.)

- Create a datum plane offset .375 from DTM2
- Rename plane "BATT_COVER"



EXERCISE – Top-Down Design Tools

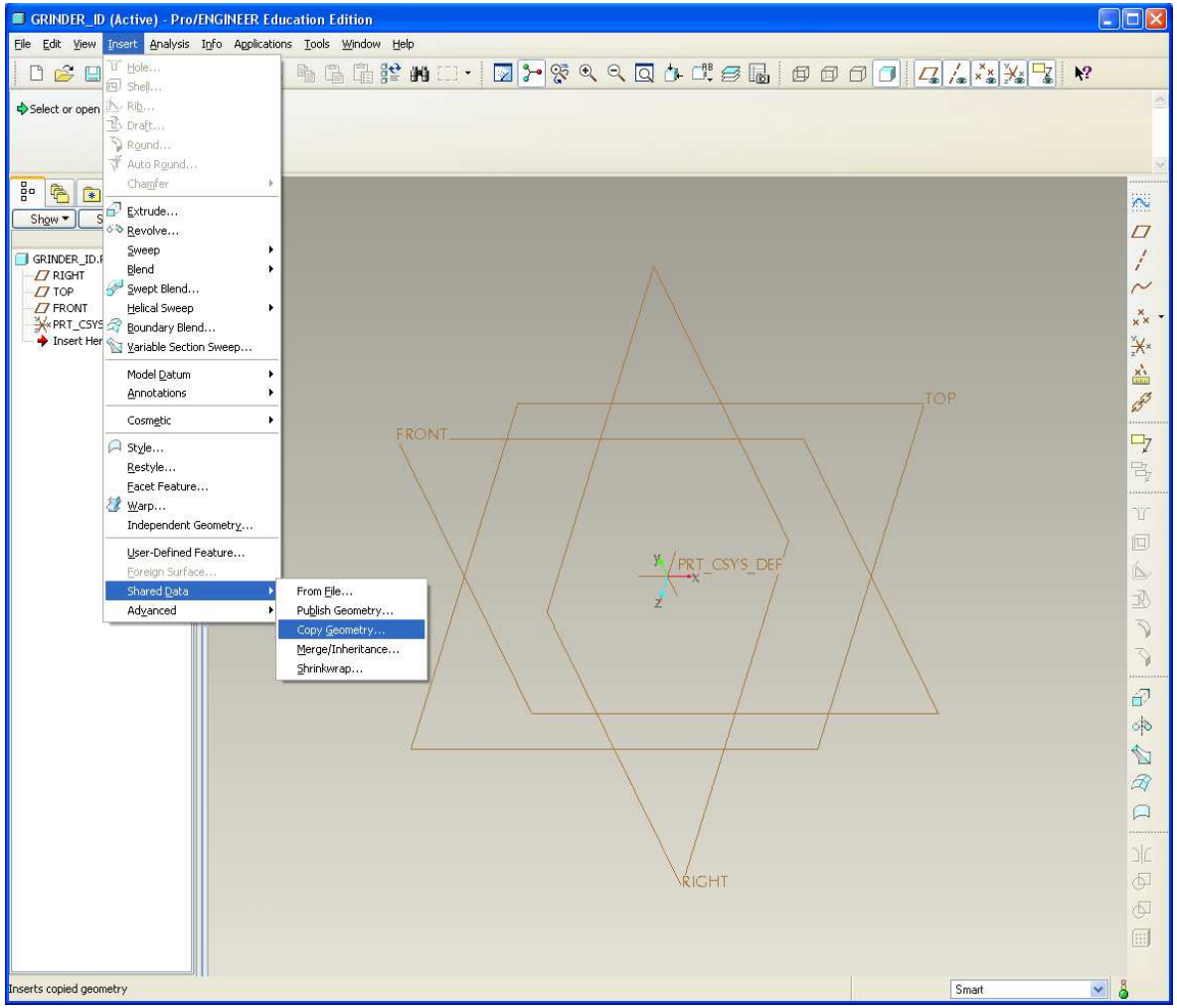
- Model Tree for Skeleton should look like this when done



EXERCISE – Top-Down Design Tools

Create an Industrial Design model

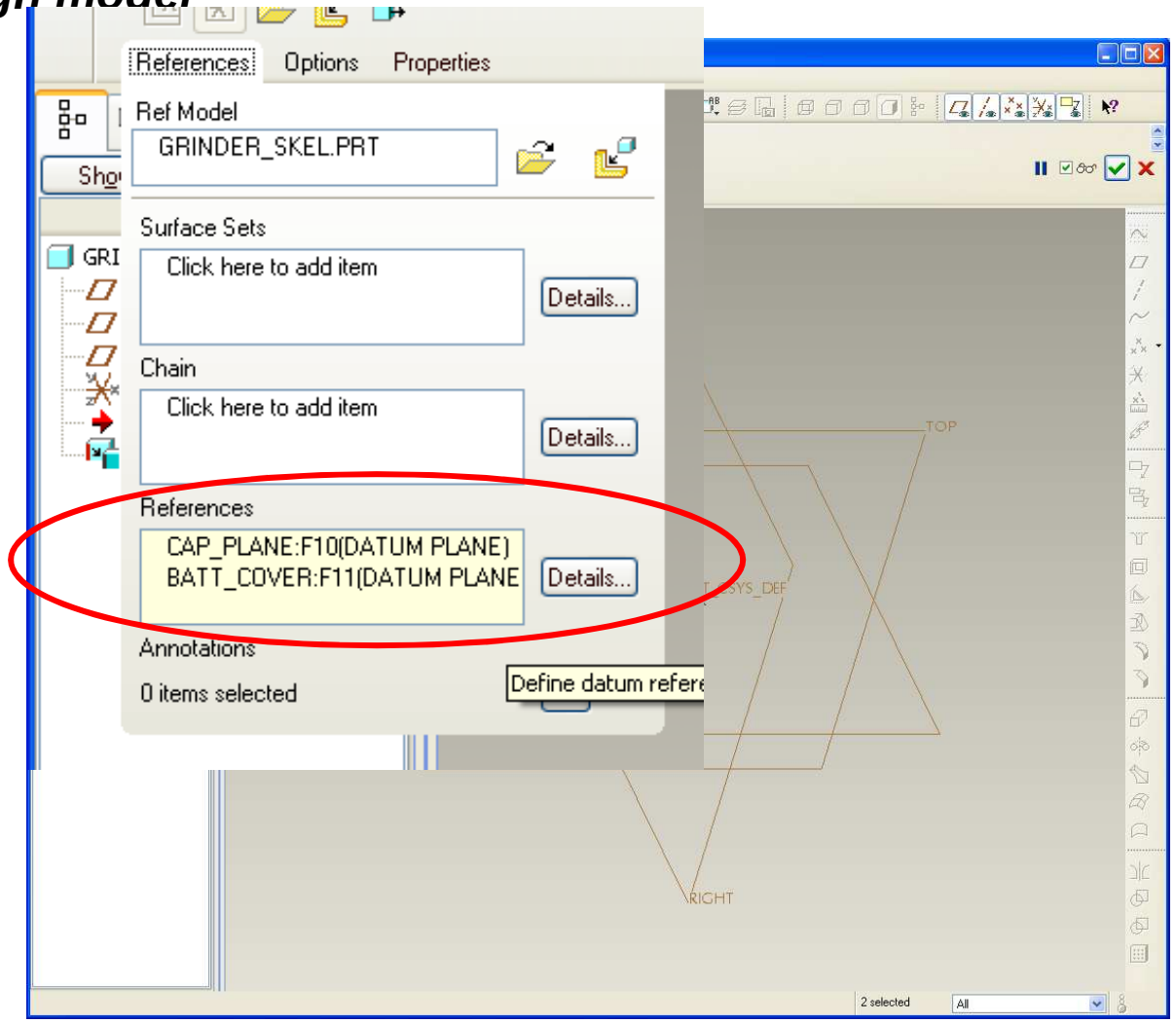
- File > New Part > “grinder_ID.prt”
- Insert > Shared Data > Copy Geometry…
- Turn off “Published geometry only”
- Select grinder_skel.prt as reference part
- OK for Default CSYS



EXERCISE – Top-Down Design Tools

Create an Industrial Design model

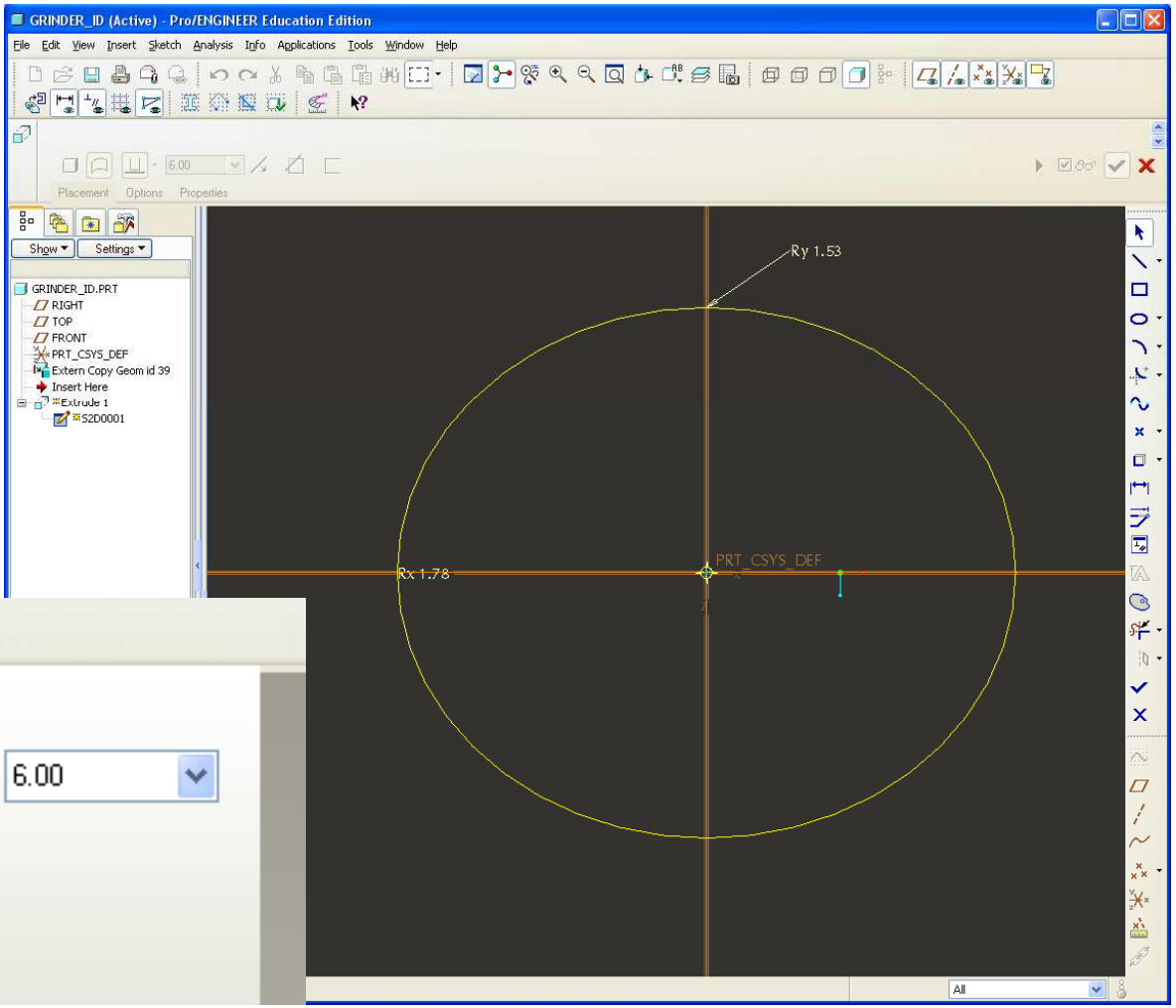
- In Copy geometry… dashboard, click in References selection
- Select the CAP_PLANE and BATT_COVER datum plane

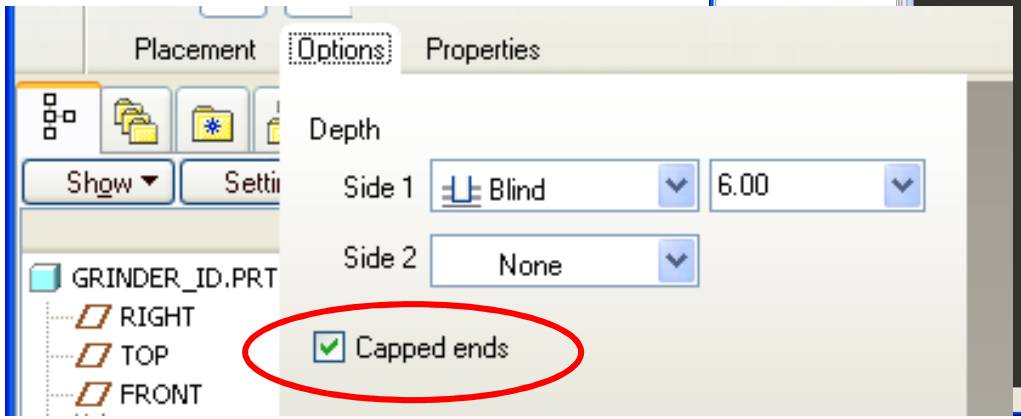


EXERCISE – Top-Down Design Tools

Create an Industrial Design model

- Extrude an Ellipse from the TOP datum plane
  - Ry=1.53, Rx=1.78, 6in H
- Choose Capped ends under Options

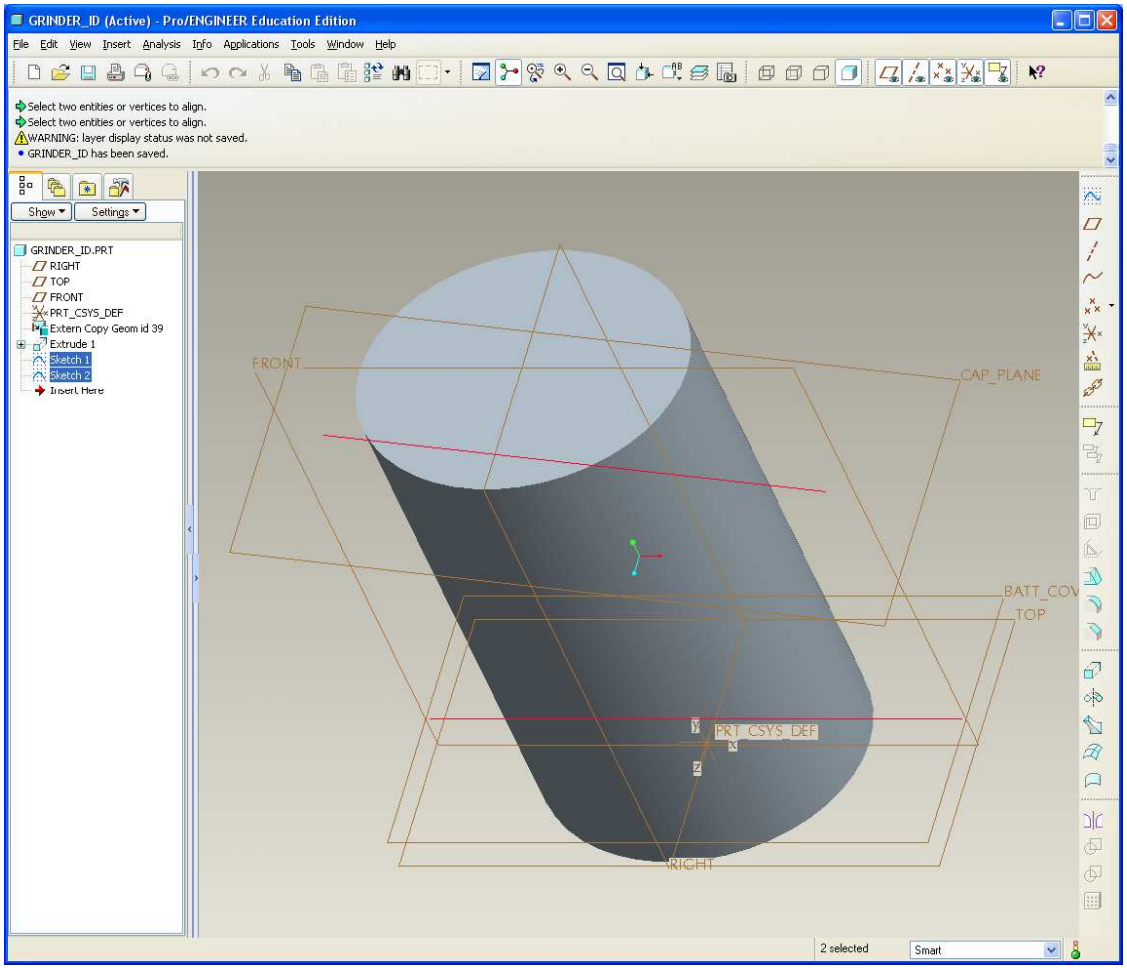




EXERCISE – Top-Down Design Tools

Create an Industrial Design model

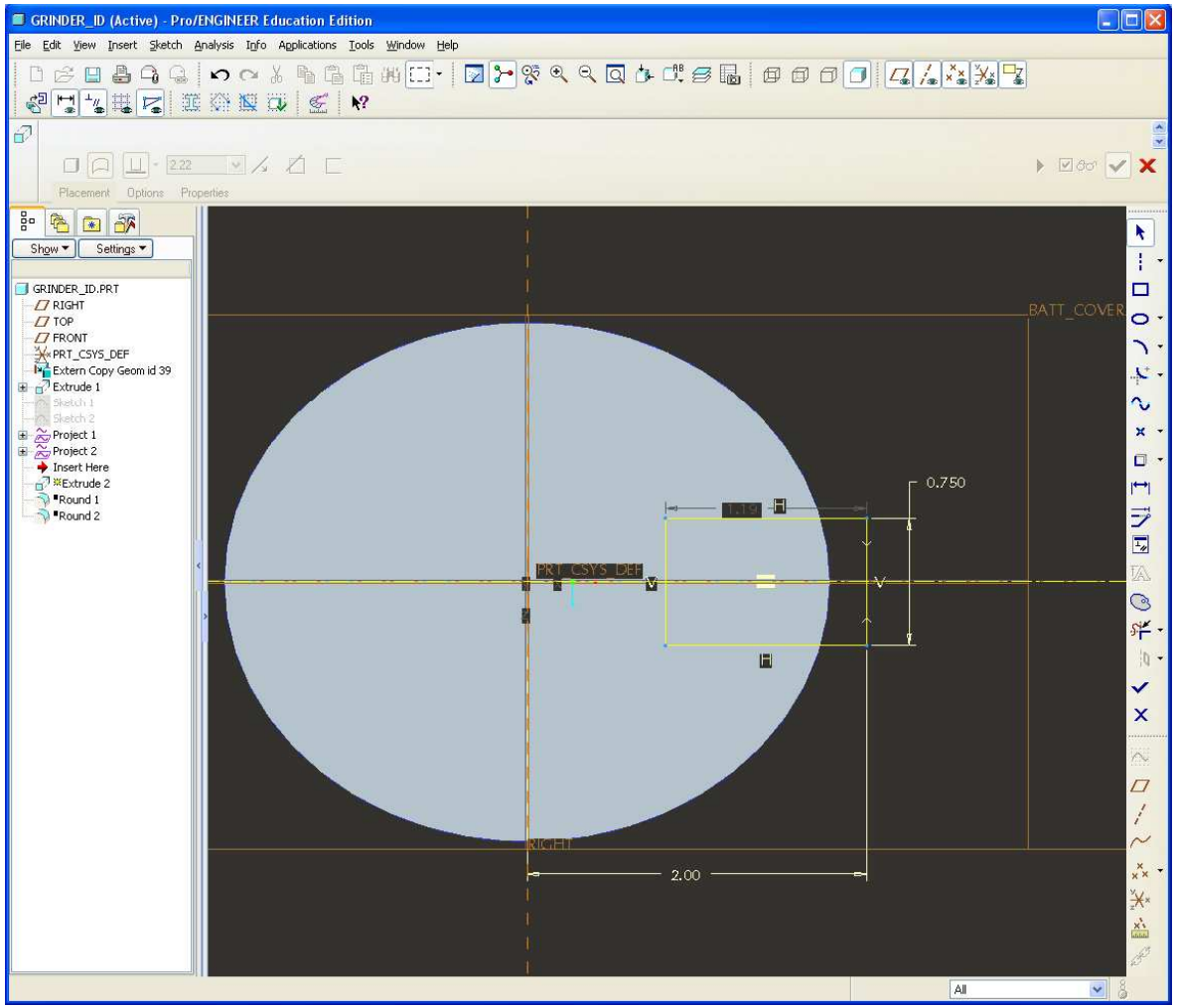
- Sketch a straight curve aligned with CAP_PLANE datum
- Sketch a straight curve aligned with BATT_COVER



EXERCISE – Top-Down Design Tools

Create an Industrial Design model

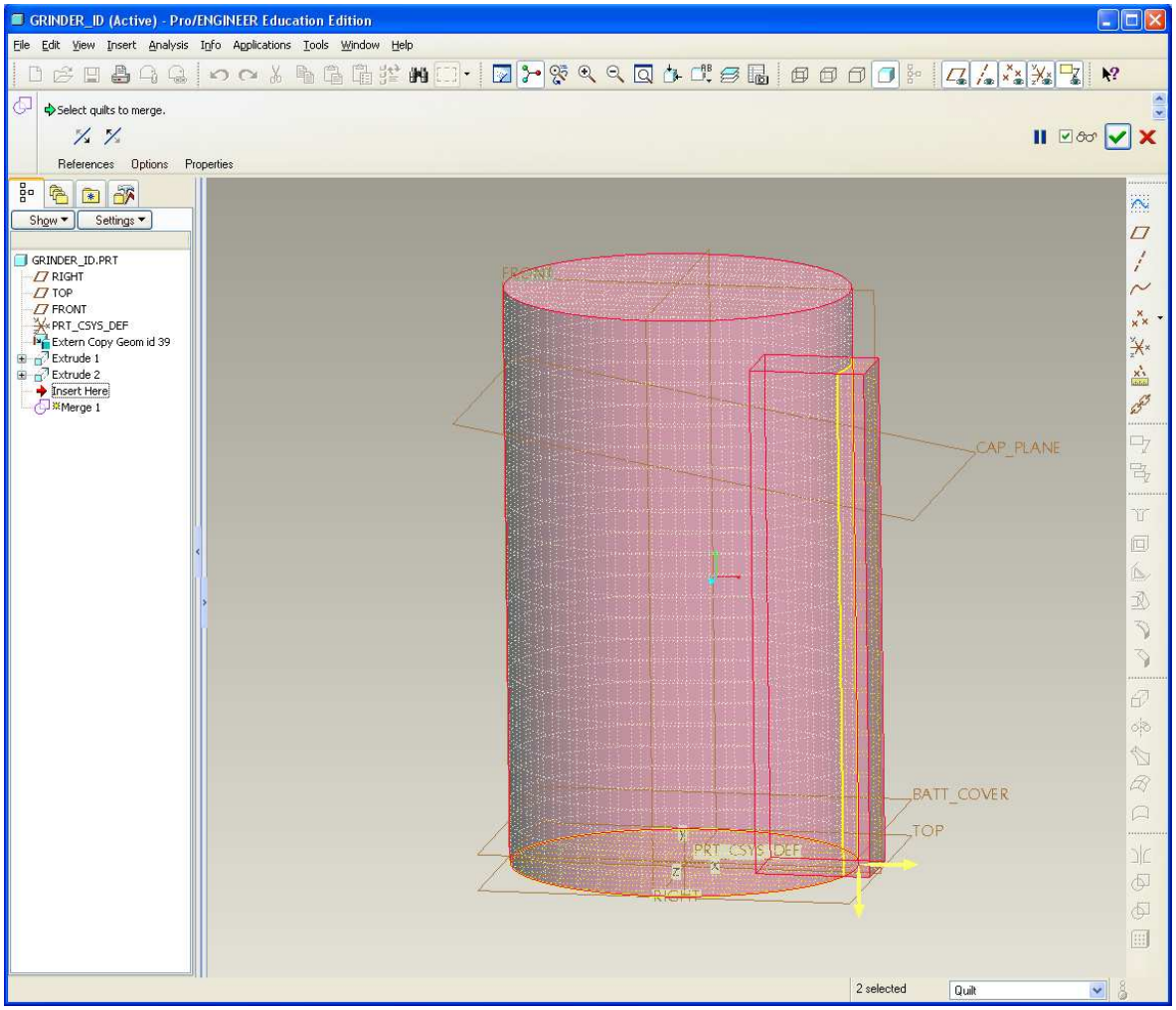
- Sketch latch spine



EXERCISE – Top-Down Design Tools

Create an Industrial Design model

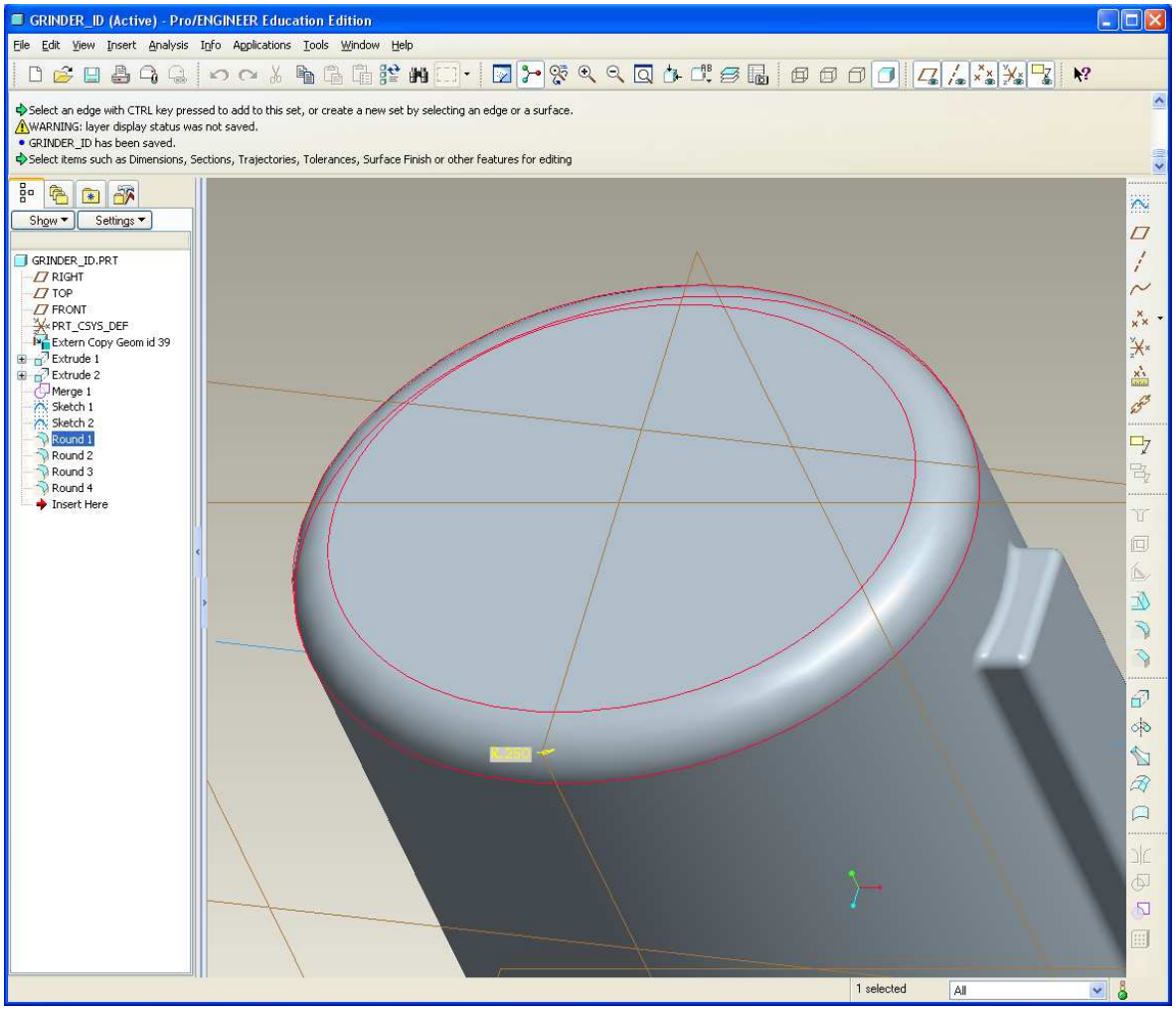
- Merge surfaces together



EXERCISE – Top-Down Design Tools

Create an Industrial Design model

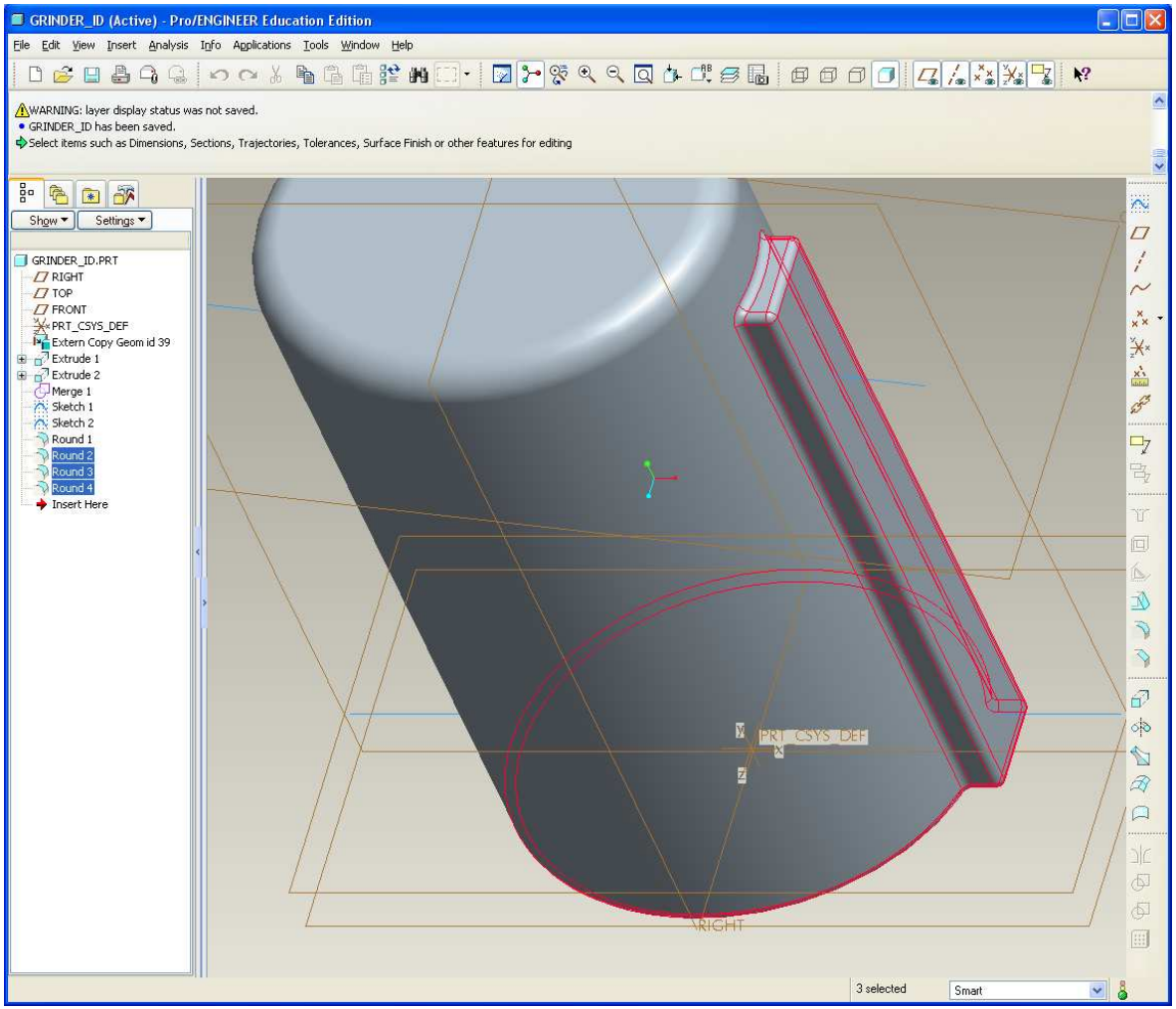
- Add R.250 radius



EXERCISE – Top-Down Design Tools

Create an Industrial Design model

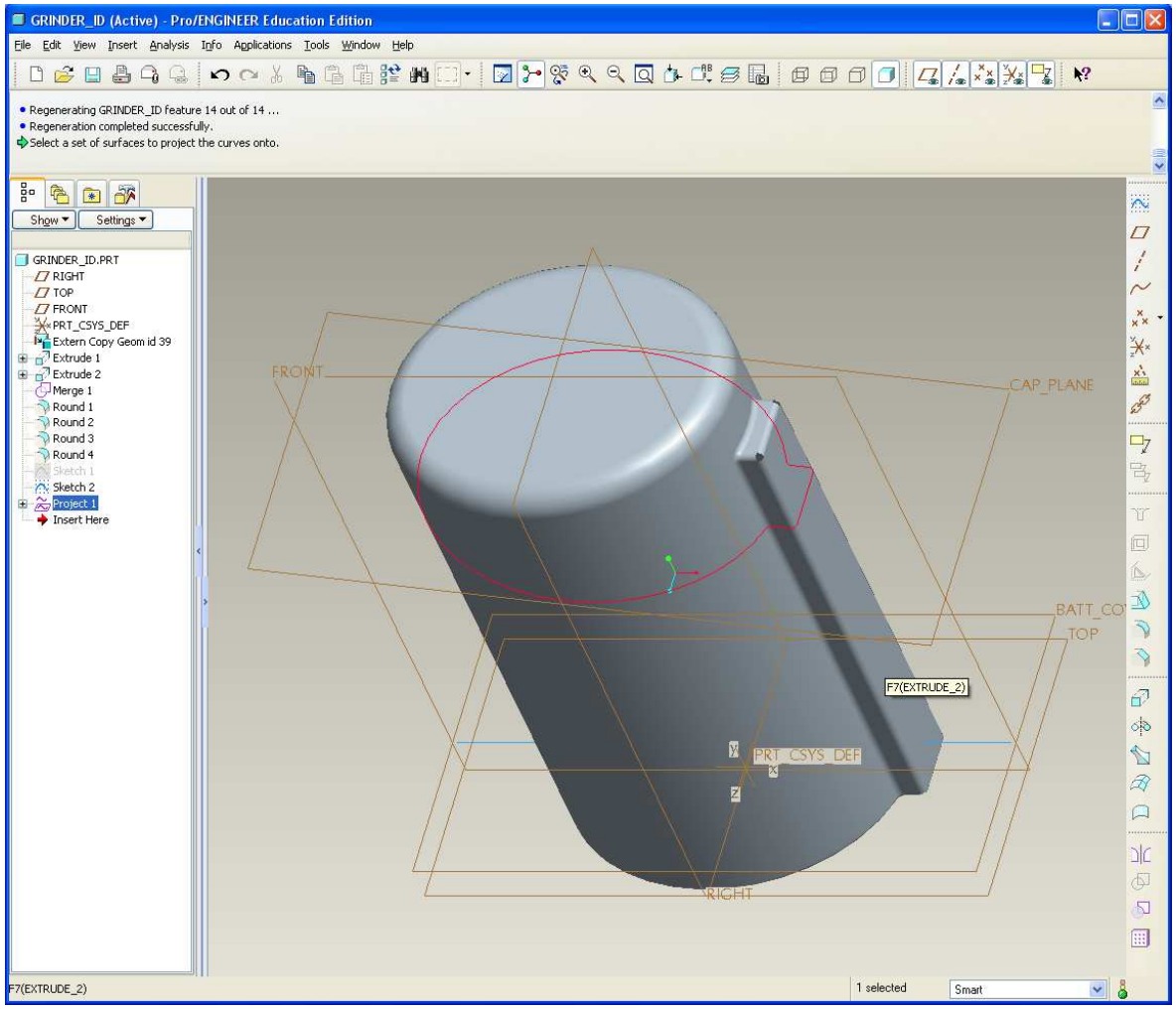
- All other radii R.060



EXERCISE – Top-Down Design Tools

Create an Industrial Design model

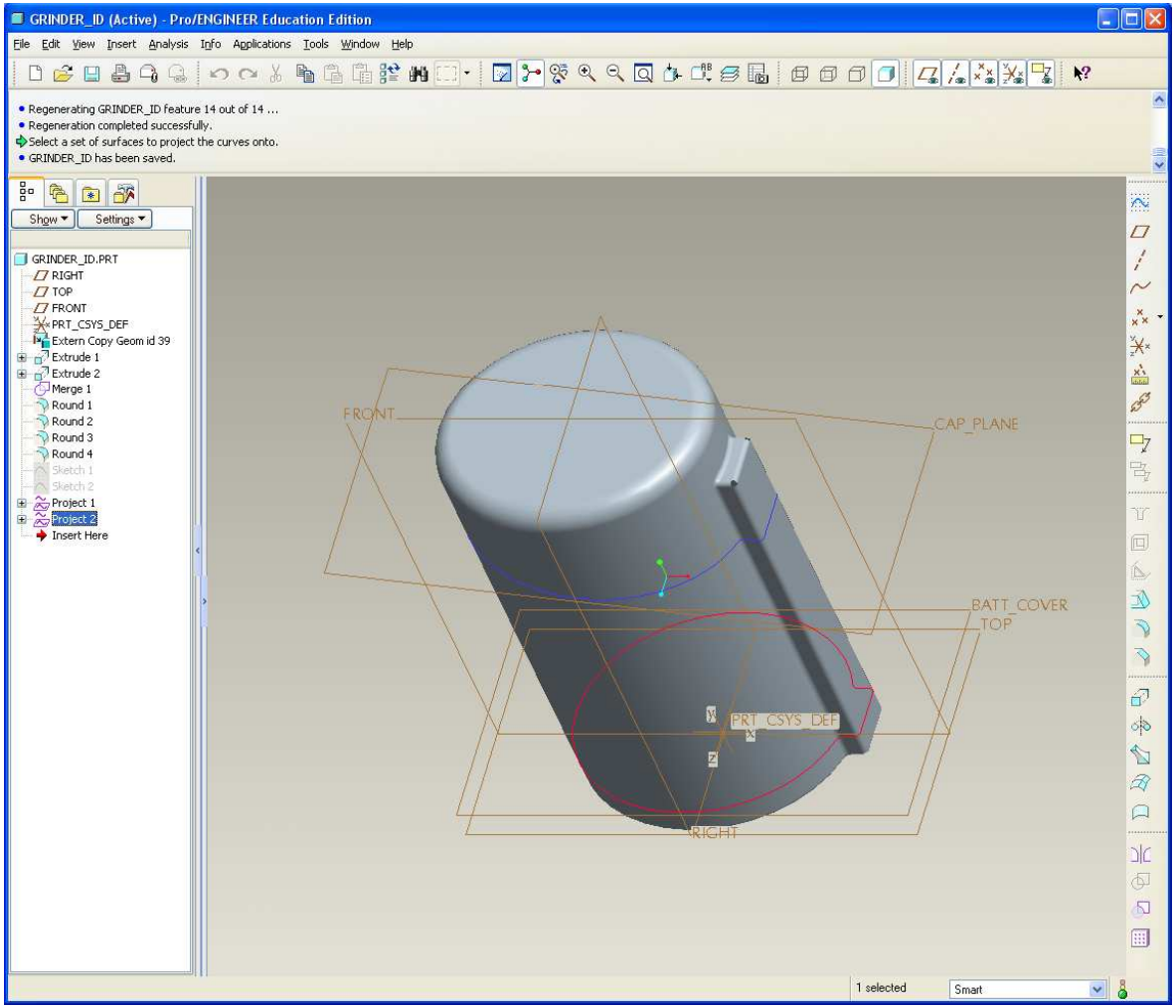
- Project sketched curves onto surface
  - Select curve
  - Edit > Projected
  - Select all intersected surfaces



EXERCISE – Top-Down Design Tools

Create an Industrial Design model

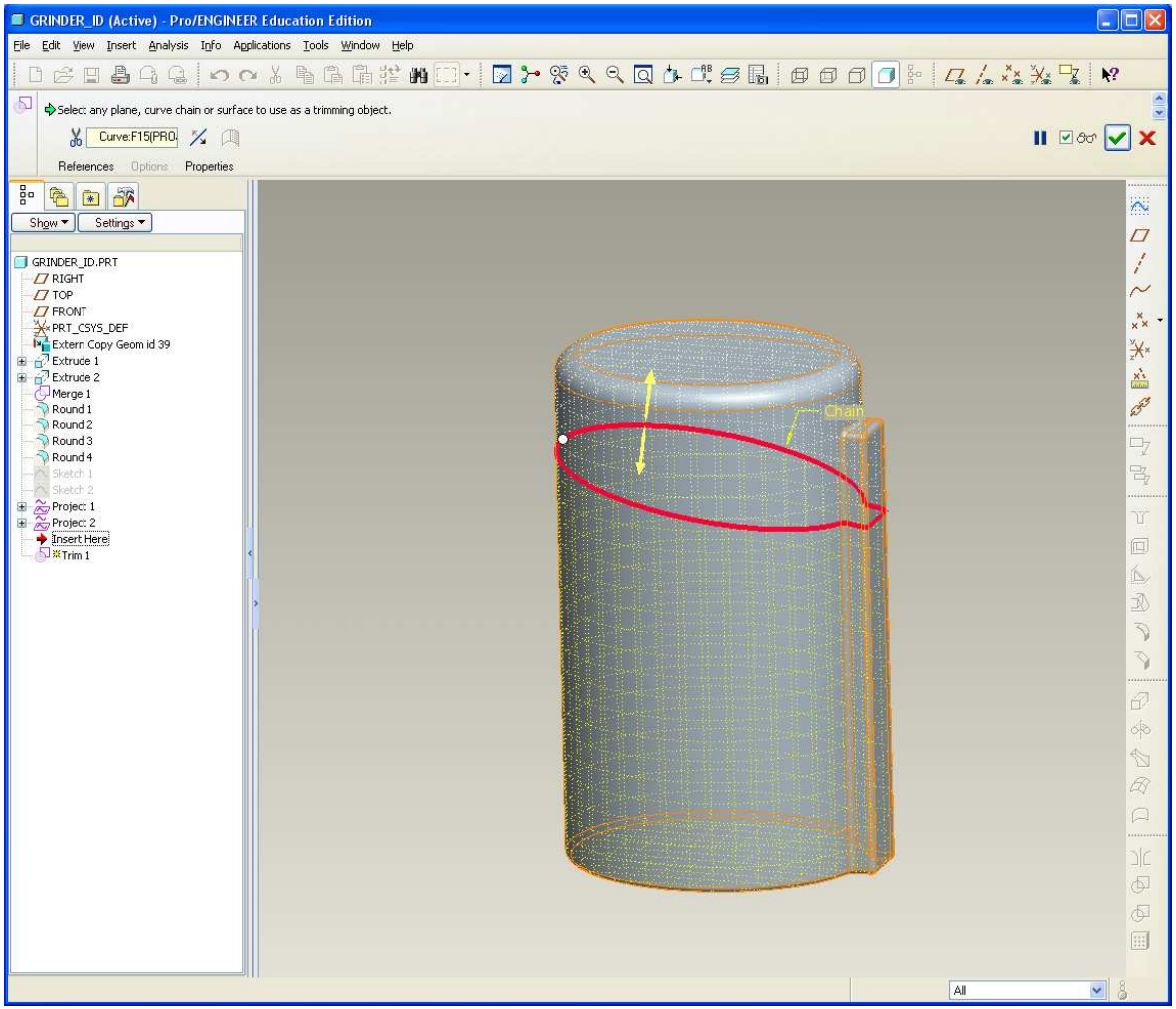
- Repeat for bottom curve



EXERCISE – Top-Down Design Tools

Create an Industrial Design model

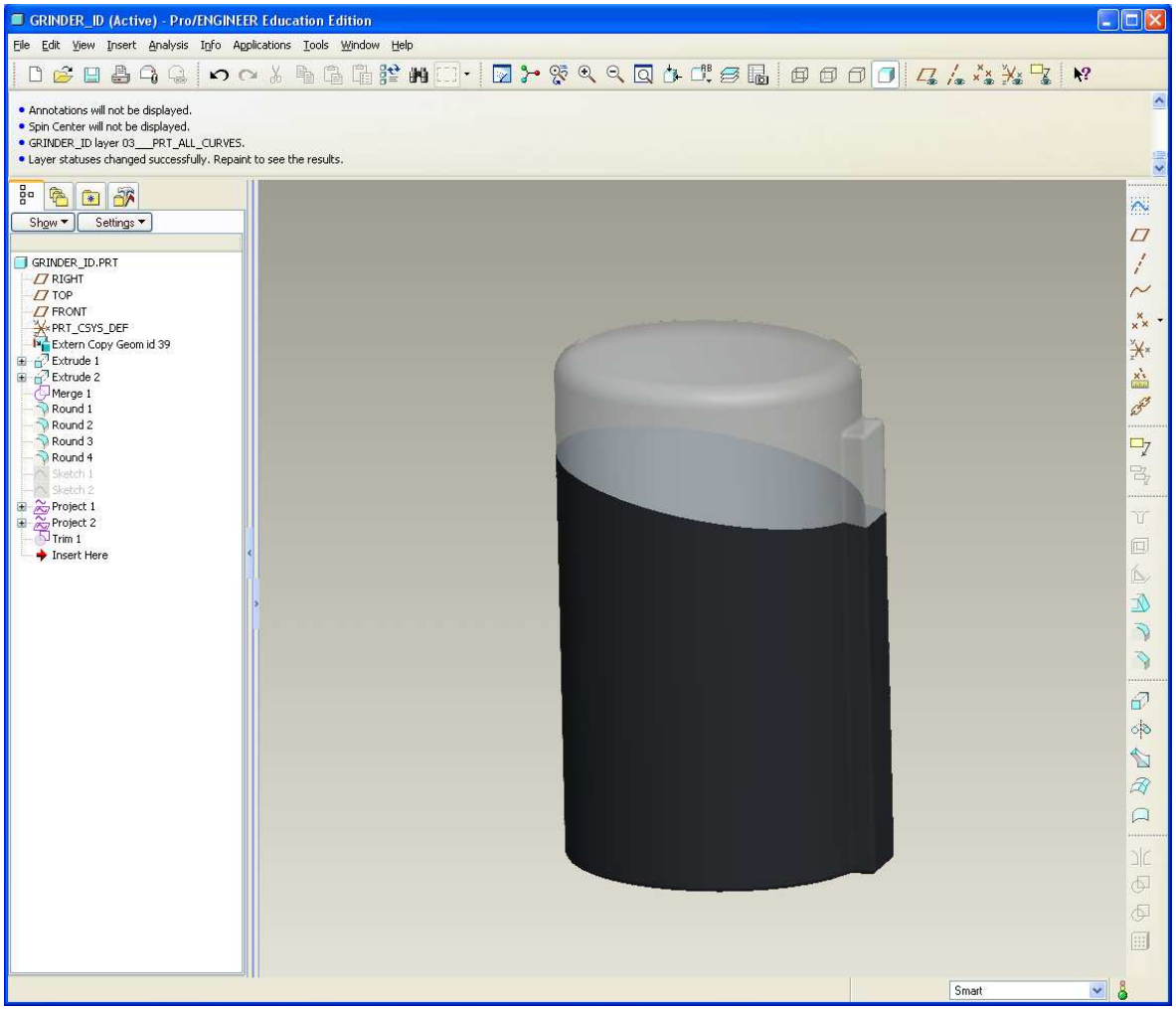
- Cut surface with Trim
  - Select surfaces
  - Edit > Trim
  - Toggle through until keep both sides is selected



EXERCISE – Top-Down Design Tools

Create an Industrial Design model

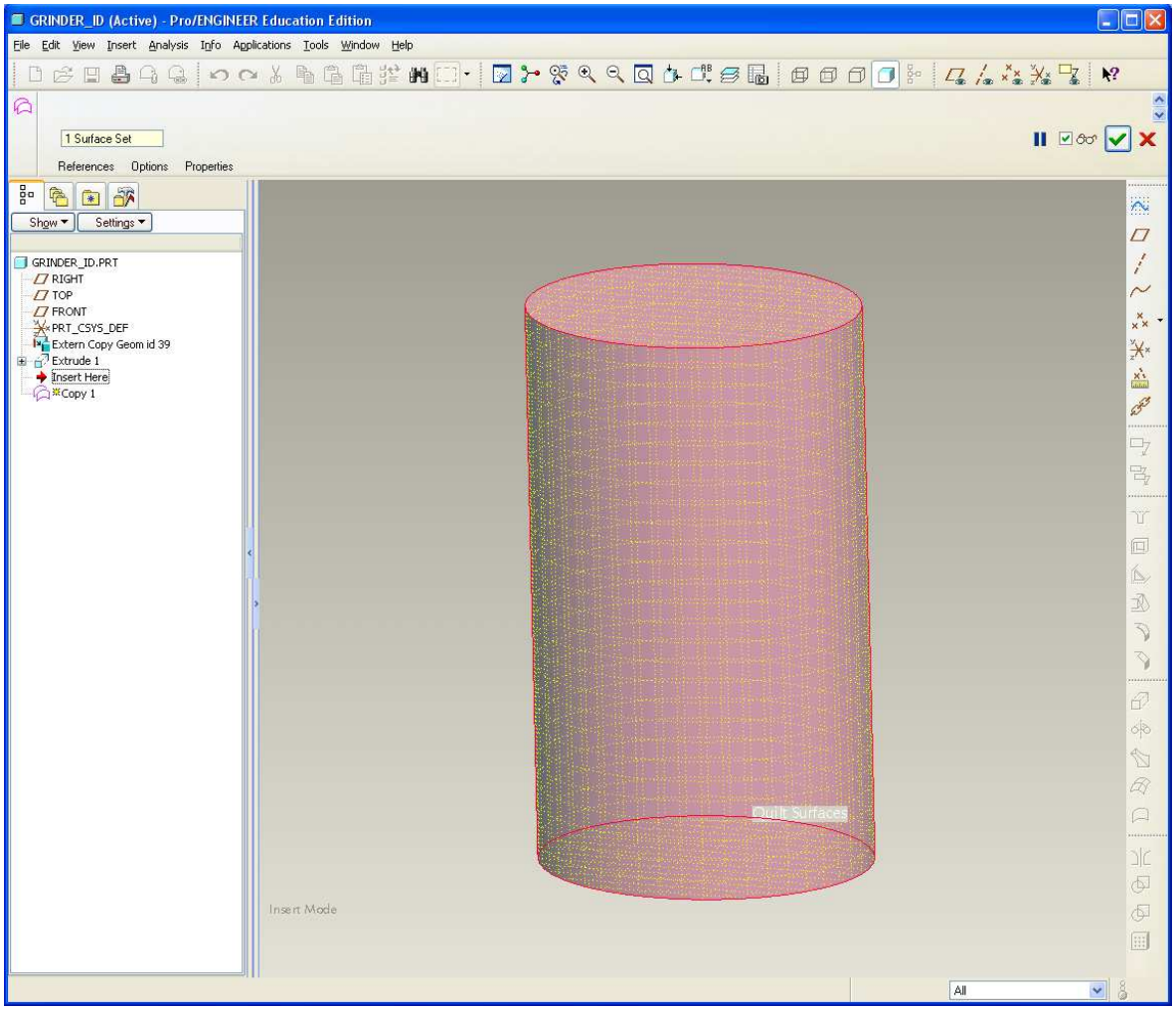
- The reason for a separate ID model…most Industrial Designer want to see the whole product while designing



EXERCISE – Top-Down Design Tools

Create an Industrial Design model

- Insert a copy of the base surface feature into the tree, just after it's created.



EXERCISE – Top-Down Design Tools

Create an Industrial Design model

- Here's the ID model