

# Introduction to Computer Aided Design for Engineering (CAD)

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## *TinkerCAD to Solidworks*

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Dates: Tuesdays, 4pm-5pm, 4/26/2022 – 5/24/2022

Instructor: David Caditz

Week 1: AutoDesk TinkerCAD

Founded in 2010

Acquired by AutoDesk in 2013

Cloud-based, runs in Web Browser

Uses “Constructive Solid Geometry” - Objects are built up from simple ‘Primitive’ shapes. Combining shapes creates new designs. Shapes can be used as either **solids** or **holes**.

1) Get an account:

<https://www.tinkercad.com>

Create AutoDesk account or sign in with Google/Facebook/Apple/Microsoft

2) Start your first design:

Click ‘Create new design’

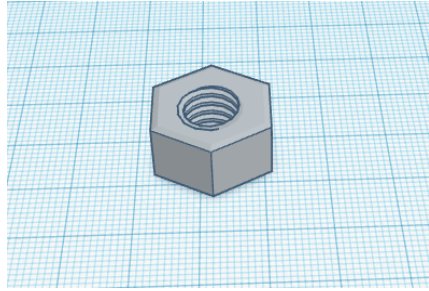
Concepts:

**Default Workplane:** perspective, zoom.

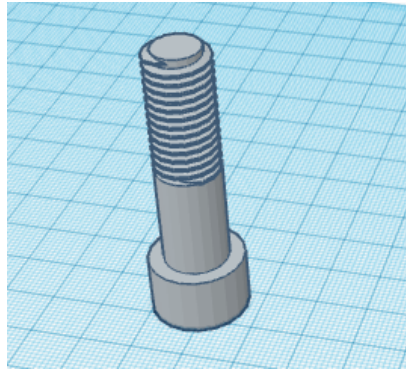
**Panel:** Basic shapes, text, symbols, .....

**Menus:** **Left** -> copy, paste, duplicate, delete. **Right** -> group, ungroup, align, flip

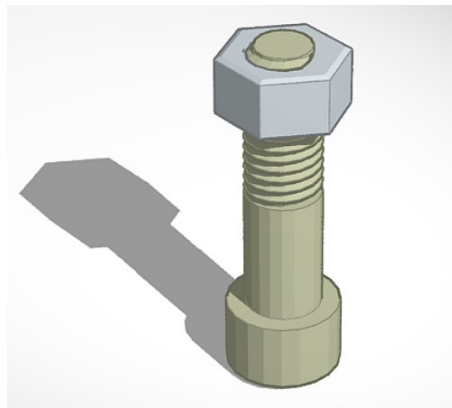
3) **Example 1:** Create a nut



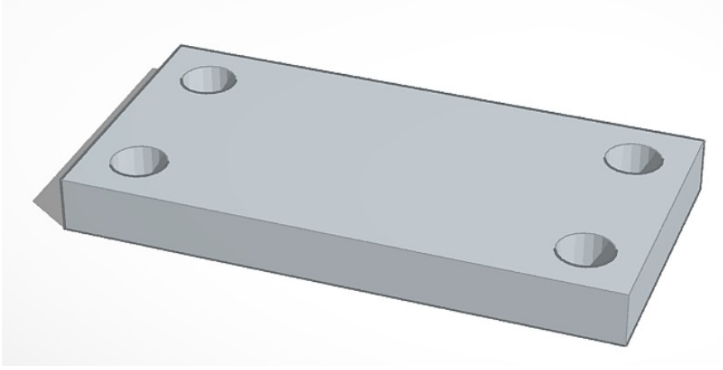
4) **Example 2:** Create a cap screw



5) **Example 3: Combining objects** Export to .STL; Import into design



6) **Example 4: Rulers**



## Week 2: Trimble Sketchup

<https://app.sketchup.com/>

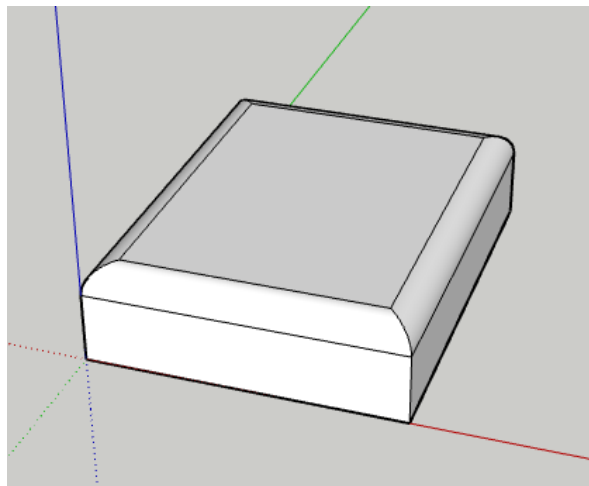
Free and paid versions

### Important Concepts:

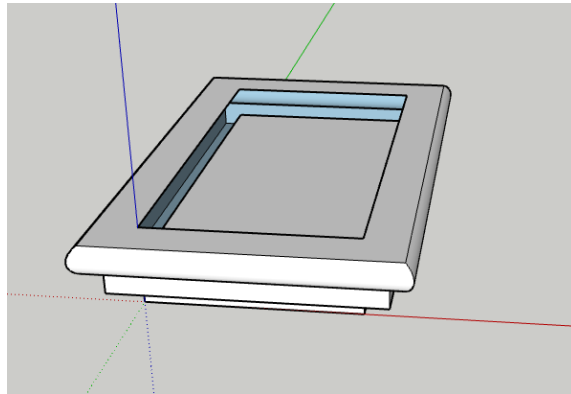
- Face Modeler: 3 or more closed edges on same plane
- Inference: hover over midpoint, corner, along axis, etc.
- Sticky: objects that touch stick together
- Group/Explode

- 1) Create account and sign in.
- 2) Create new project (feet and inches)
- 3) Tools on left, panels on right, also right click commands
- 4) Orbit, Pan, Zoom
  - a. Keyboard shortcuts:
    - i. Orbit = Center mouse button
    - ii. Pan = Shift + Center button
    - iii. Zoom = Scroll wheel
- 5) Drawing Tools: line, shape, arc, text
  - a. Select line tool, click start, click end (don't hold-drag). Esc or close to exit.
  - b. Constrain to axis: X = right arrow, Y = left arrow, Z = up arrow (click, don't hold)
- 6) Extrude (push/pull), Follow me
- 7) Group: triple click or drag select, right click menu -> group
- 8) Copy: Ctrl (option) drag

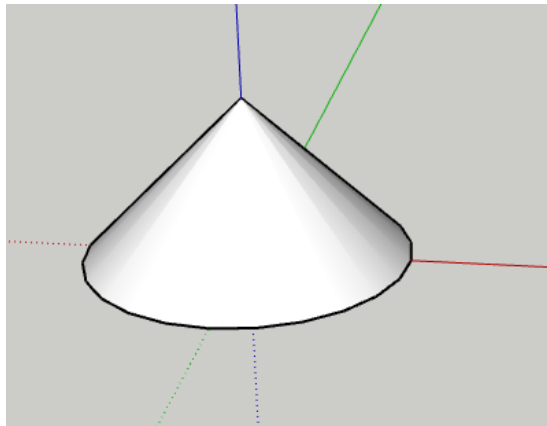
Example 1: Beveled solid (rectangle, extrude, arc, follow me)



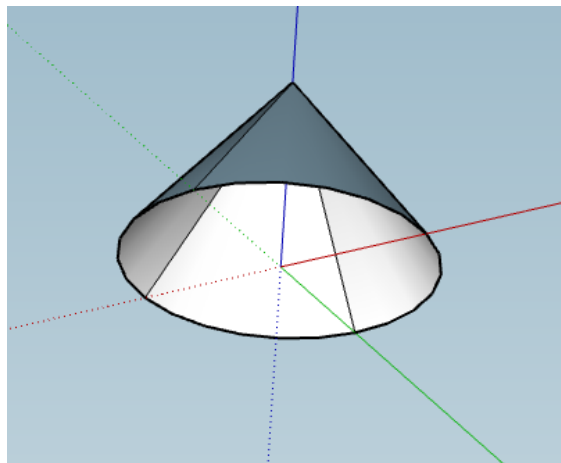
**Example 2: Picture Frame: (rectangle, extrude, shape, follow me)**



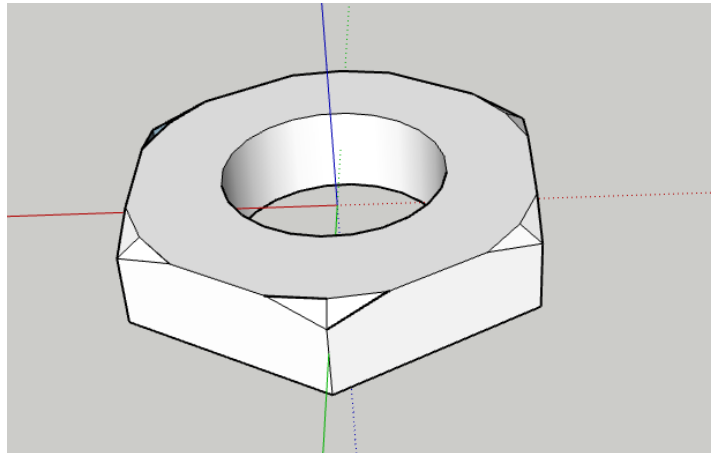
**Example 3: Cone (circle, triangle, follow me)**



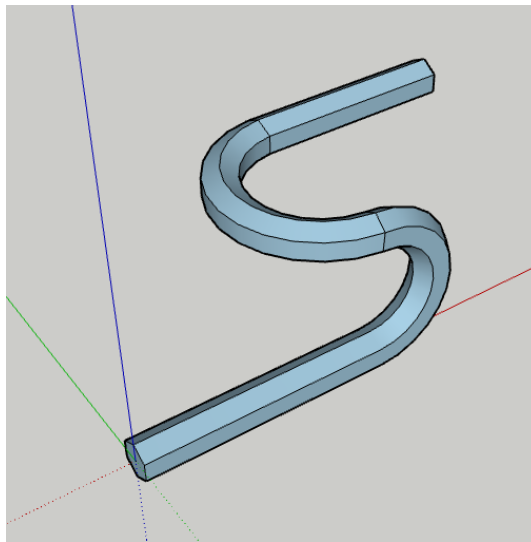
**Example 4: Conical surface (circle, reference line, move tool)**



**Example 5: Chamfered nut (hexagon, hole, cone, intersect, cleanup)**



**Example 6: Extruded shape (guideline, shape, follow me)**



## Week 3: Solidworks

<https://www.solidworks.com/>

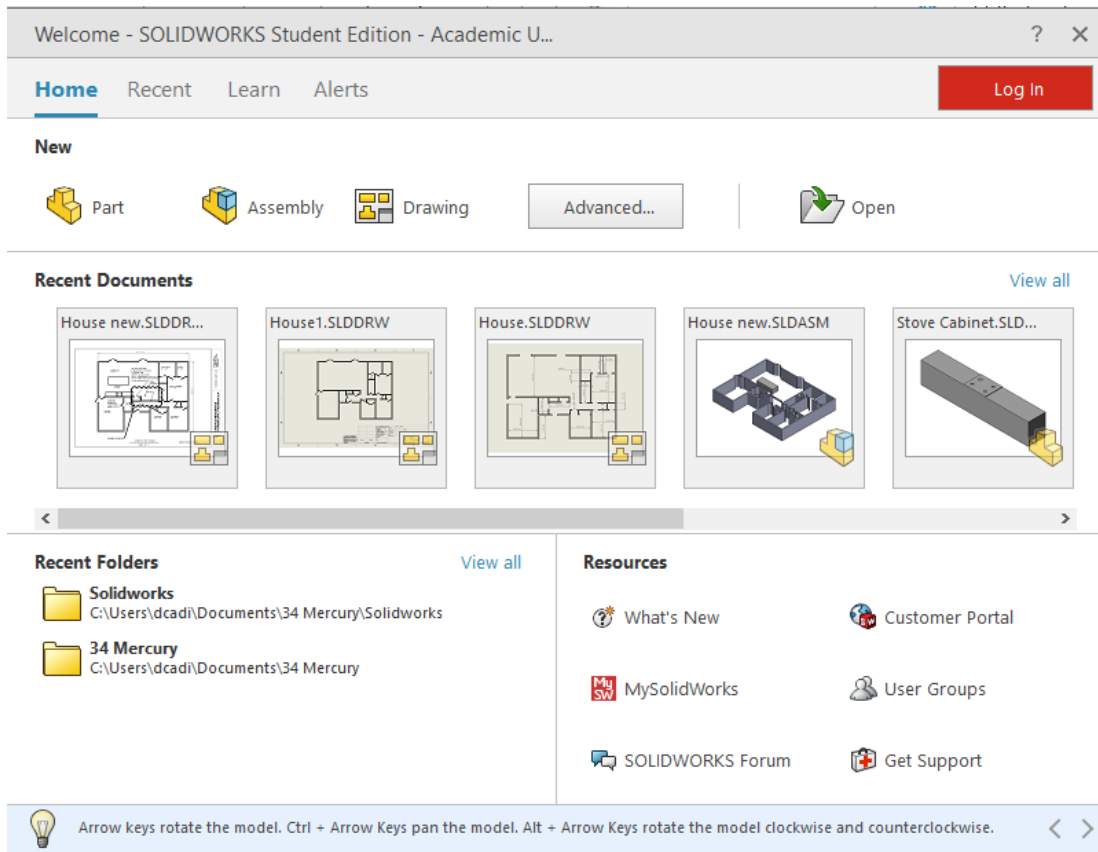
Free online trial version: <https://my.solidworks.com/try-solidworks>

### Concepts:

Part

Assembly

Drawing



## Modeling Environment:

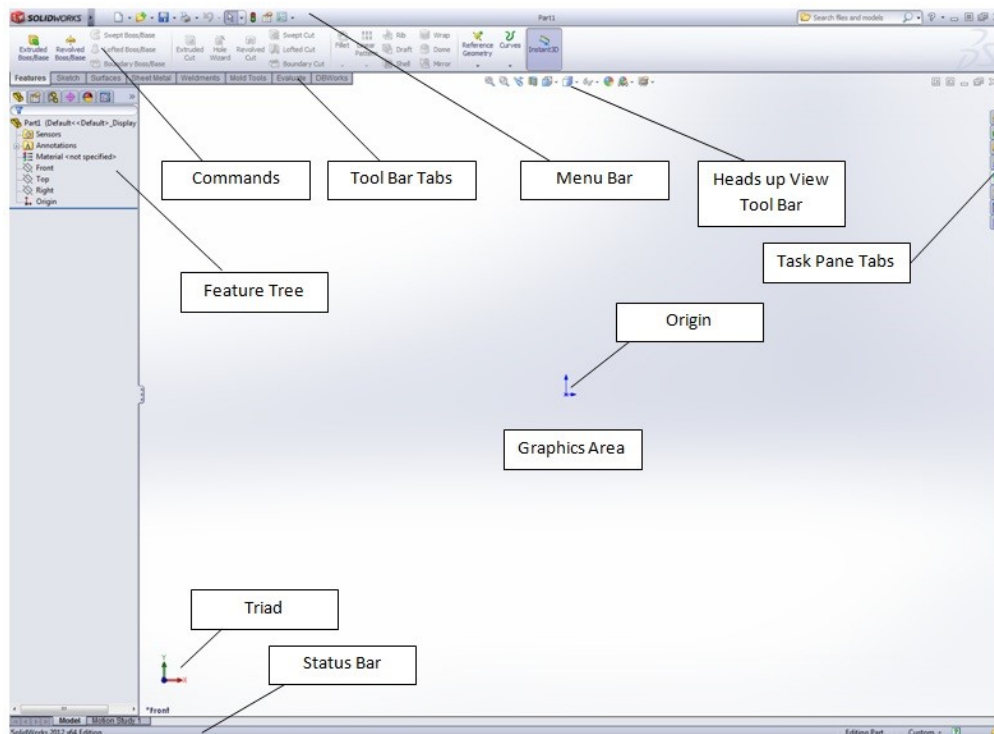
Tabs (Features, Sketch, Surfaces, Sheet Metal, Evaluate)

Toolbars (Change with Tabs)

Managers (Features, Properties, Configurations, Dimensions, Display)

Display Plane

Coordinate Systems, Planes



## Navigation:

Mouse:

Zoom: scroll wheel

Orbit: Center button & drag

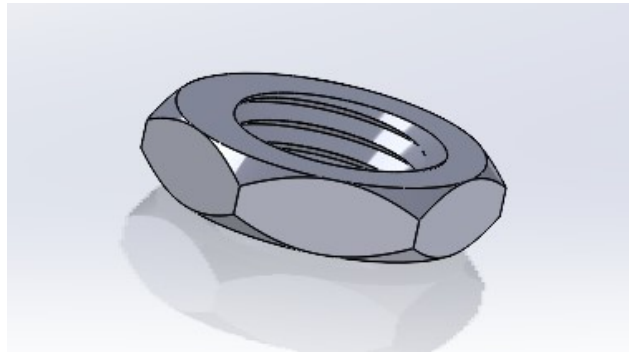
Pan: Control + center button & drag

Keyboard:



Space bar and click view plane





## Example 1: Nut






### 1) Create a sketch:

- a. Welcome screen -> New -> Part
- b. Sketch Tab -> click sketch 
- c. Select a plane to sketch onto
- d. Use polygon tool to draw a hexagon
- e. Exit sketch 

### 2) Extrude 3D:

- a. Features tab
- b. Make sure sketch is selected and click Extruded Boss/Base 
- c. Drag extrusion or enter height
- d. Checkmark to exit 

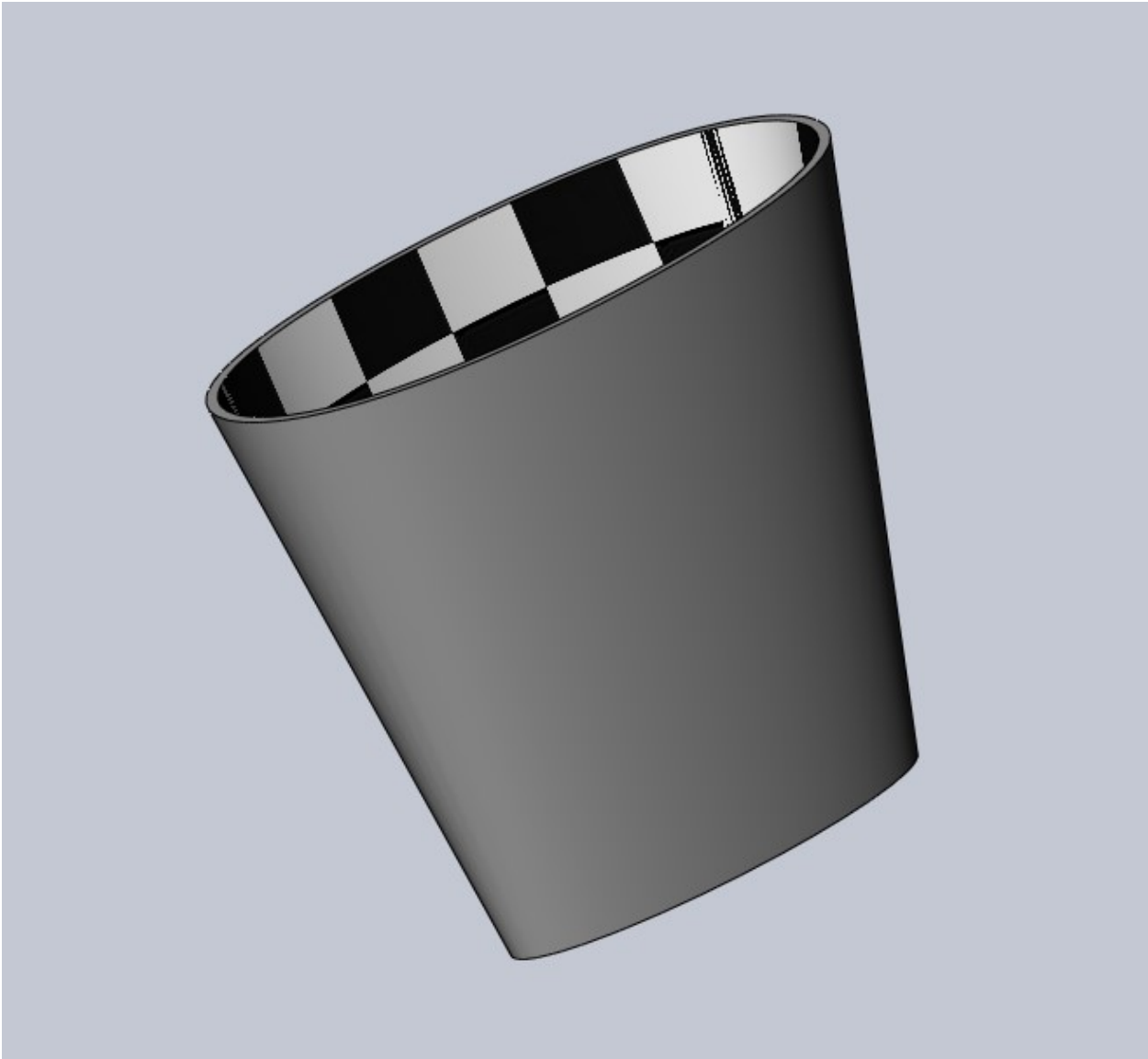
### 3) Create a hole:

- a. New sketch on face
- b. Draw circle and exit 
- c. Features -> Extruded Cut  -> Through All -> Save 

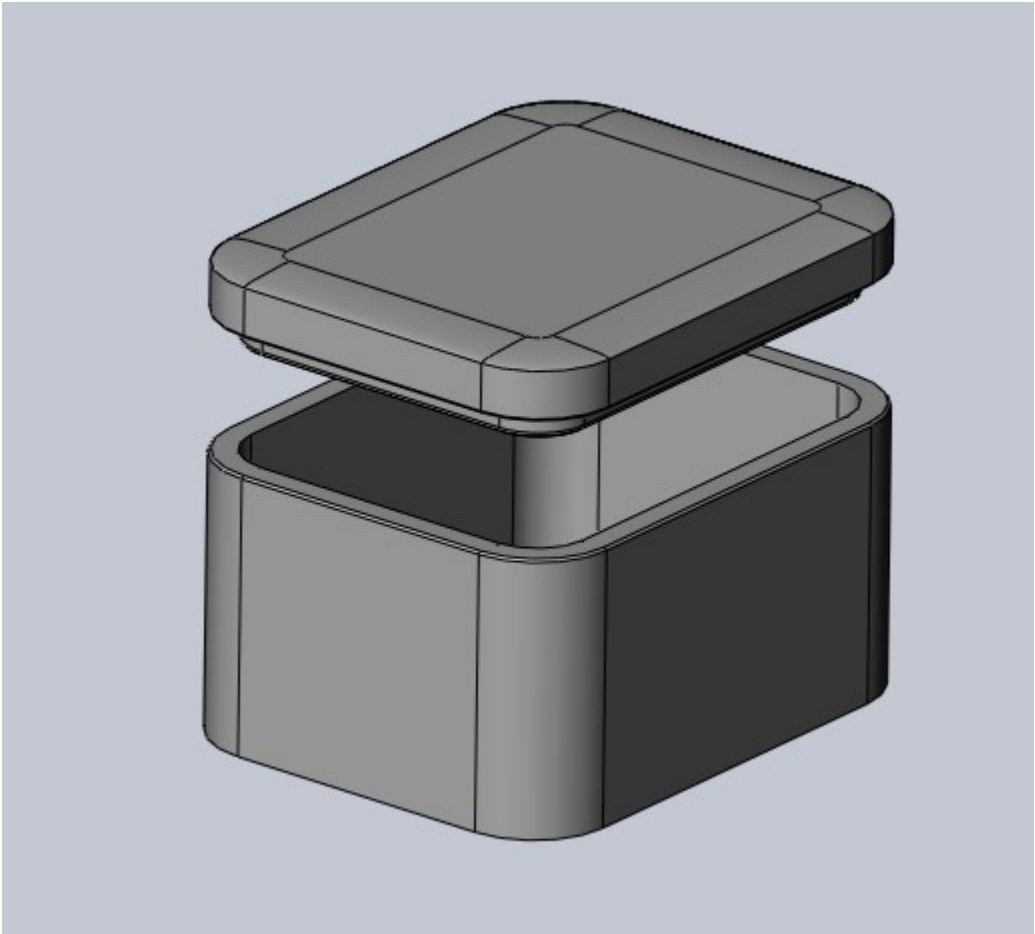
### 4) Create chamfer

- a. 2 methods
  - i. Features -> Fillet/Chamfer tool
  - ii. Features-> Extruded cut

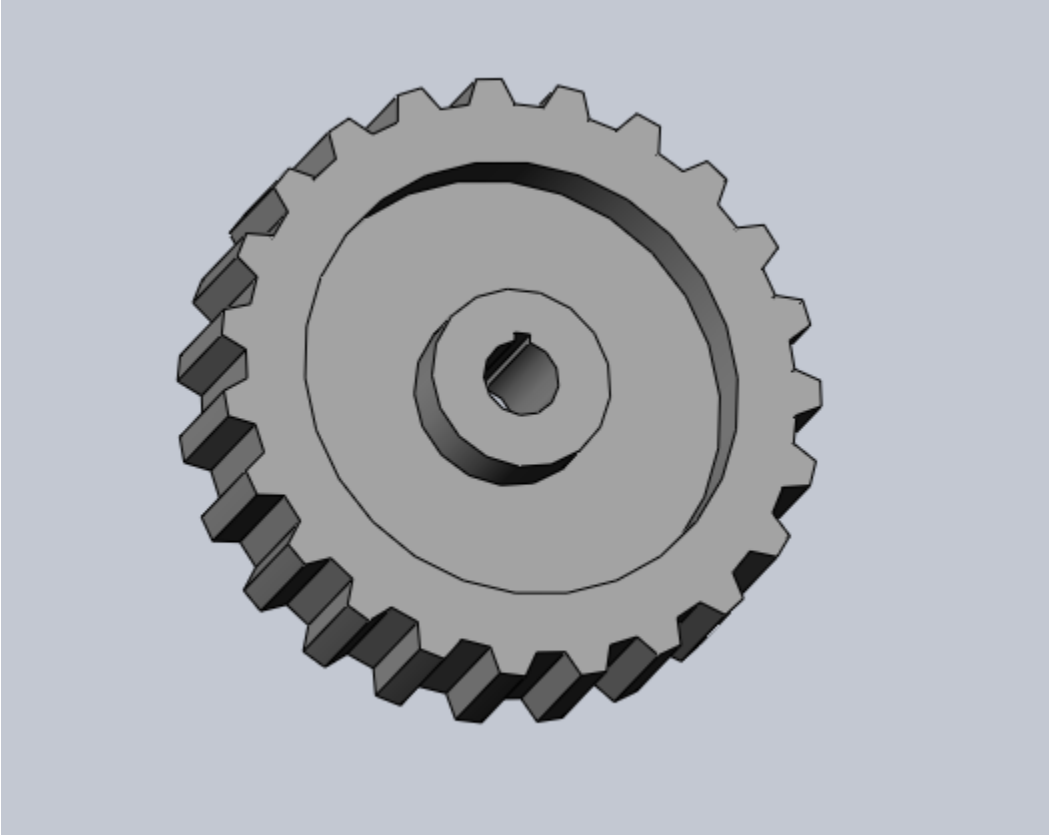
**Example 2: Basket**



**Example 3: Box with Lid**



**Example 4: Gear**



## Week 4: Solidworks cont'd

<https://www.solidworks.com/>

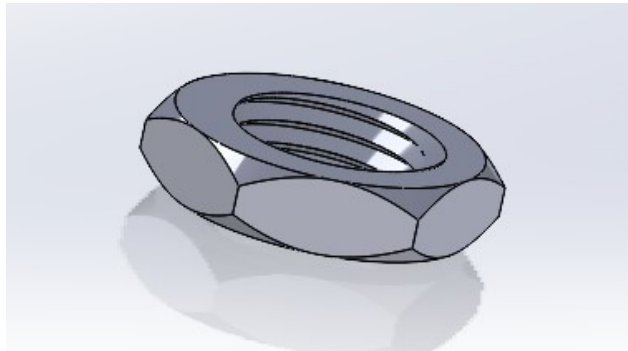
Free online trial version: <https://my.solidworks.com/try-solidworks>

### Review:

Sketch

Feature (e.g., extrude, cut, shell, pattern, curves, sweep, etc.)

### Example 1 (cont'd): Nut - Cutting threads:



- 1) Draw helix
- 2) Draw triangular profile
- 3) Use Features -> Swept Cut

### Example 2: Exploring other features:

- Swept cut
- Convert Entities
- Offset Entities
- Lettering

Drawings

With Nut still open: File-> Make Drawing From Part

