



Mechanics and machines, lab 1

Intro to subject
History of CAD
Solid modeling

Class activities

Triple repetition: lab, HW, project

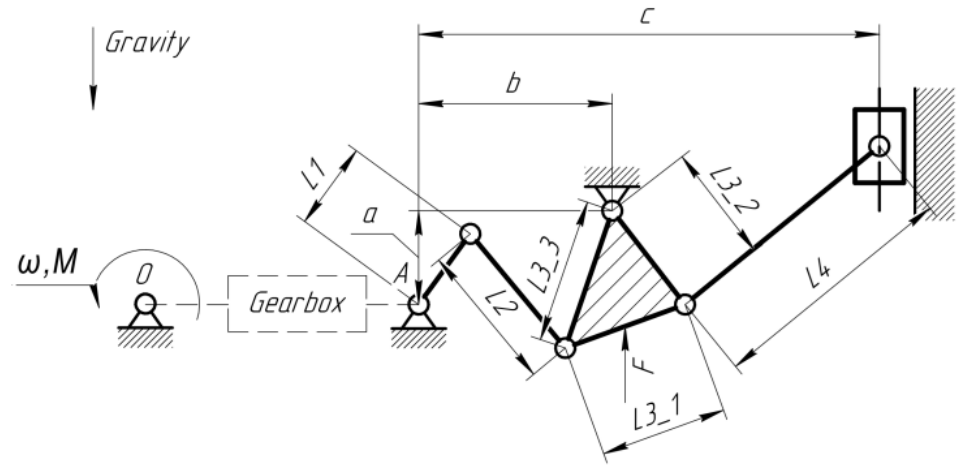


Lab goals

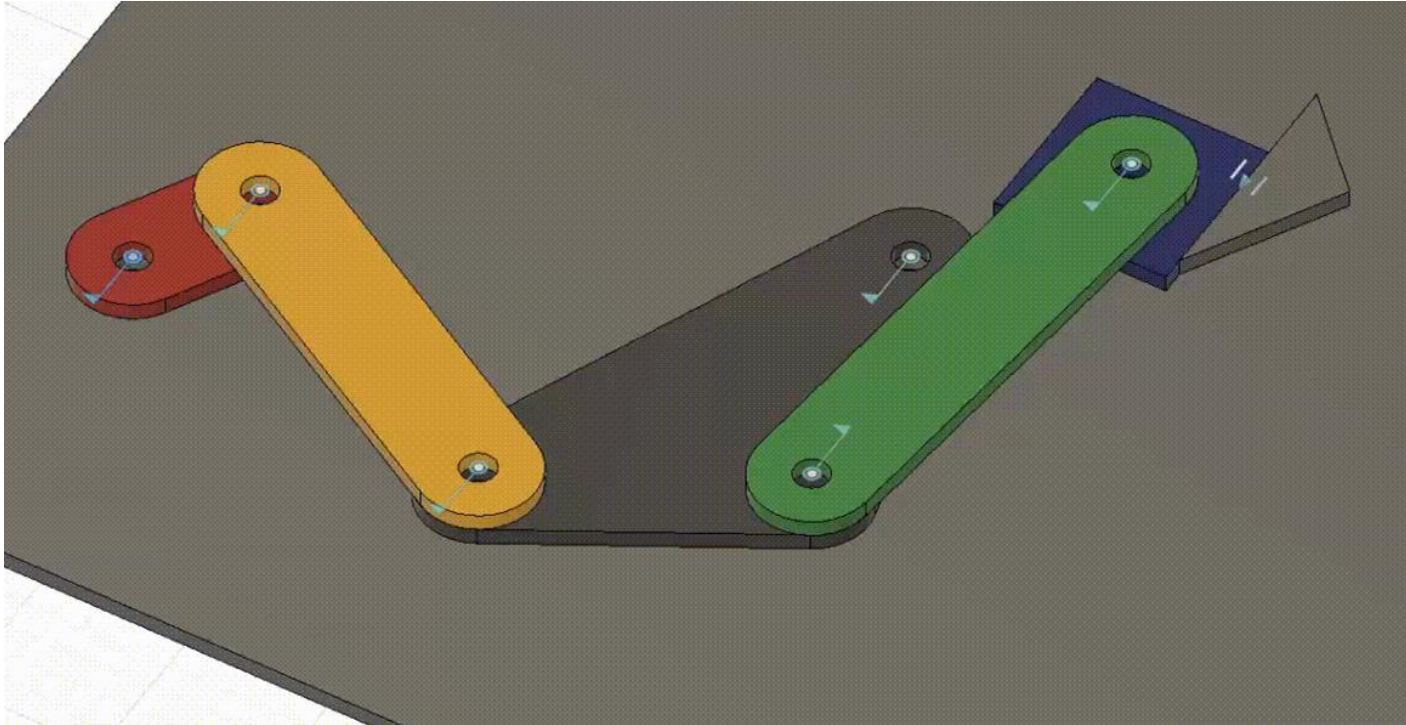
To obtain the needed tools for
solving the design part of the
course project

Almost final exam task

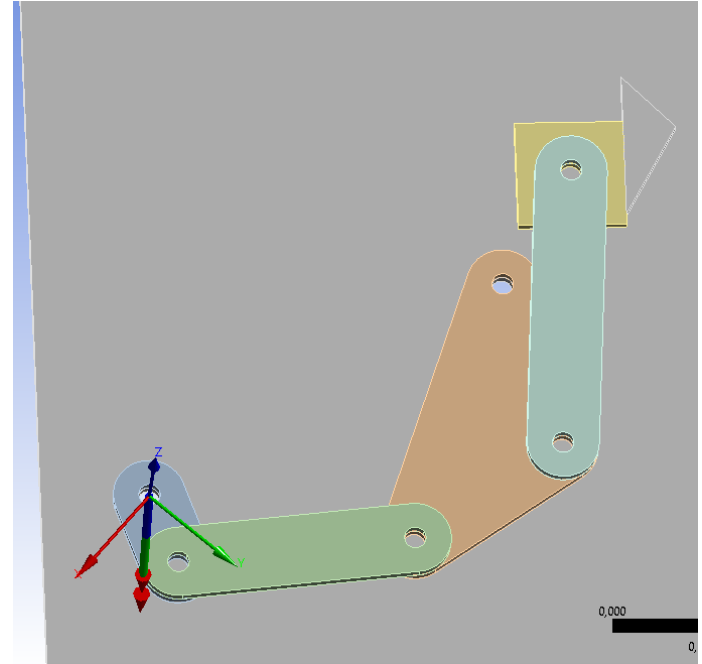
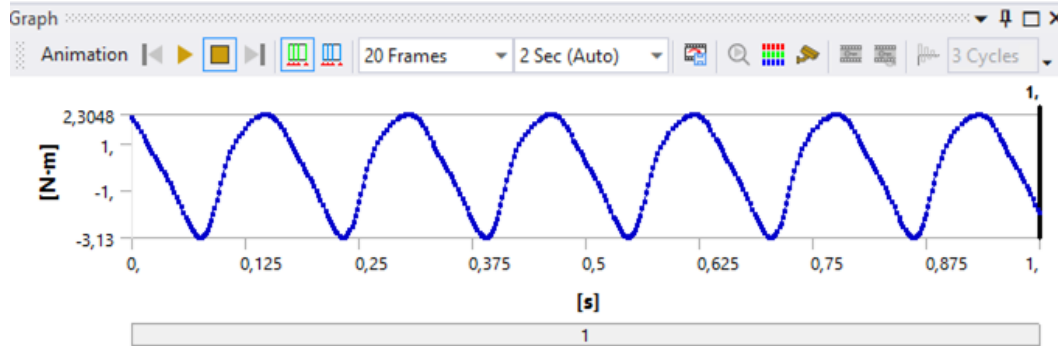
1. Make CAD model
2. Solve Inverse Dynamics problem
3. Balancing the mechanism
4. Propose a gearbox
5. Check the durability of the mechanism



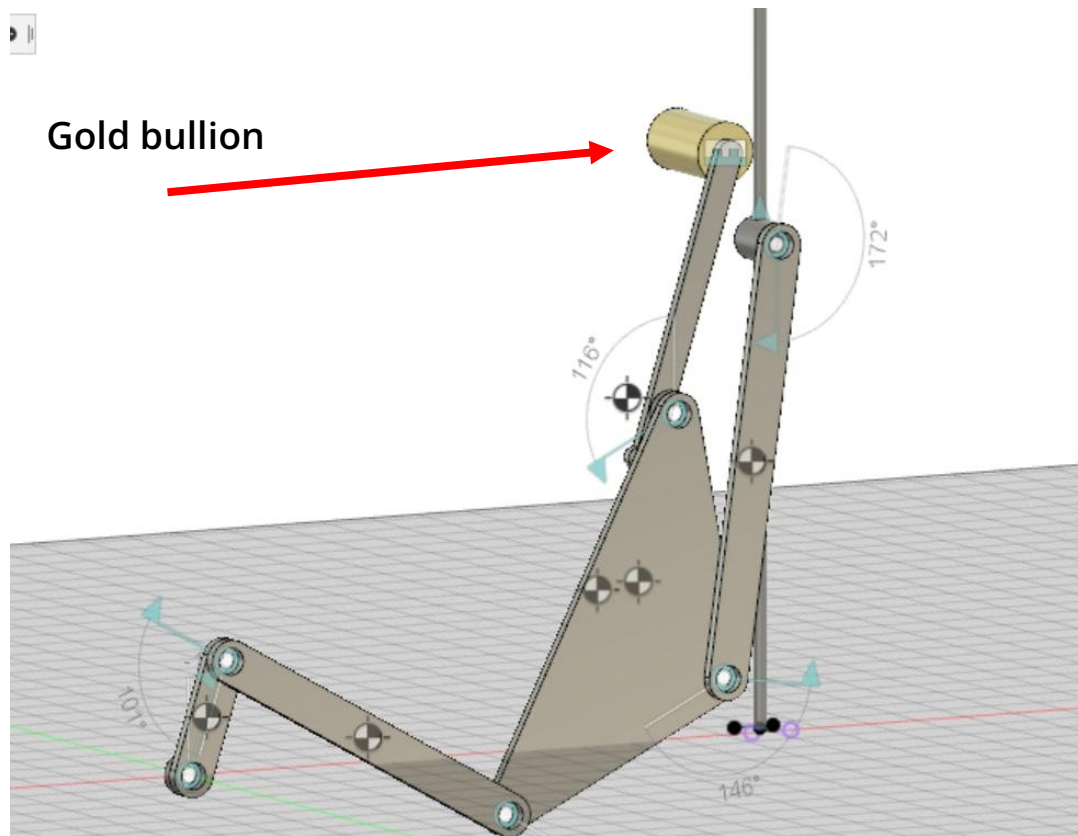
Fusion 360: kinematics



ANSYS: inverse dynamics problem



Balancing



Gearbox



Series	Size	Ratio	Type
CSD	50	80	2A-GR

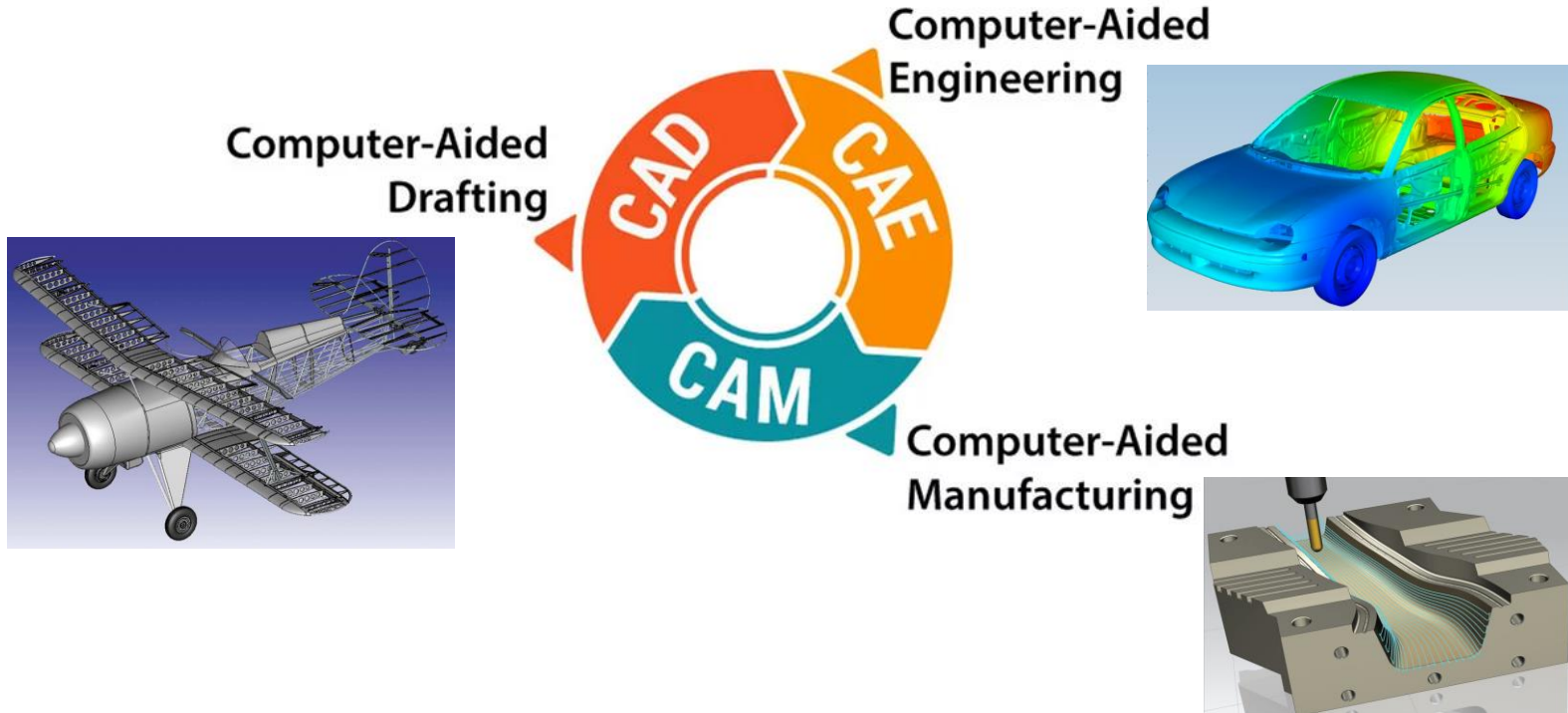
- Zero-backlash
- Reduced thickness, 1/4 size of CSF Series
- Hollow through bore, extra-large through bore also available
- Extremely high positioning accuracy
- Excellent Repeatability
- Compact and simple design

Gear Model Number	CSD-50-80-2A-GR
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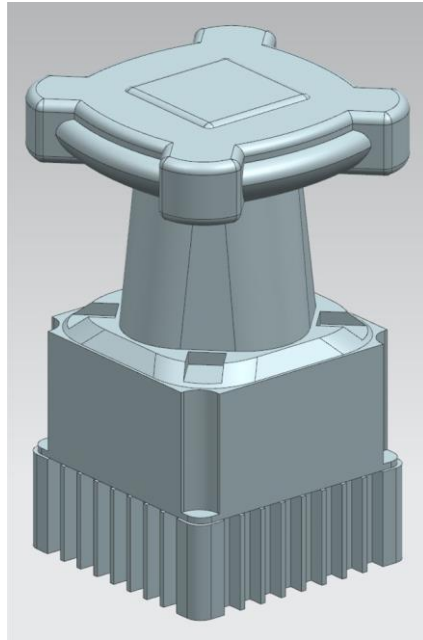
Gear Performance Data		
Rated Torque L10	260	Nm
Limit for Average Torque	363	Nm
Limit for Repeated Peak Torque	659	Nm
Limit for Momentary Peak Torque	1,000	Nm
Starting Torque	63	Ncm
Backdriving Torque	62	Nm
Ave. Input Speed	2,500	rpm



Computer Aided Design (1)



Computer Aided Design (2)



Solid Modeling



Surface Modeling



History of CAD (1)

- 60th — Theoretical studies of the possibility of solving design problems on the computer were carried out.
- 70th — Methods, algorithms and programs for solving individual tasks for different design stages were developed.
- 80th — CAD is being developed and improved. 3D modeling became more popular.
- 90th — Developers had finished formation of base concepts of CAD and unified data transfer between systems.

CAD benefits

Cheaper

Safer

Faster

Popular CAD systems in Russia (1)



CAD

Inventor



CAD/CAM/CAE/PDM

SolidWorks



CAD

Компас 3D



CAD/CAM/CAE/PDM

Siemens NX



CAD

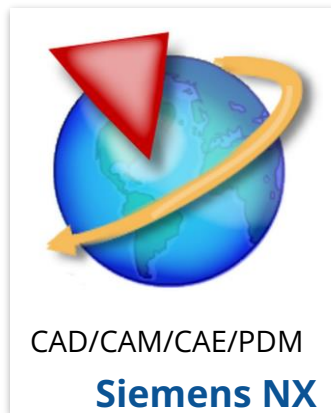
AutoCAD

Siemens NX



Prof

- All in one system (CAD,CAM,CAE,PDM)
- Free for students
- Can create a real aircraft



Cons

- Complex system
- Not popular in small companies



Common usage

- 1) If you need a good drawings. Make CAD anywhere, afterwards import to Kompas-3D
- 2) If you need Standard Component Library (SCL), use either Kompas, or Solid Edge, or <https://www.mcmaster.com/> . Insert needed stuff in NX

Creating a solid body



Most of the bodies can be created using only 4 operations:

- Sketch
- Extrude
- Revolute
- Combine

NX workspace, checklist

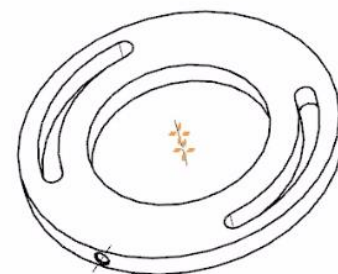
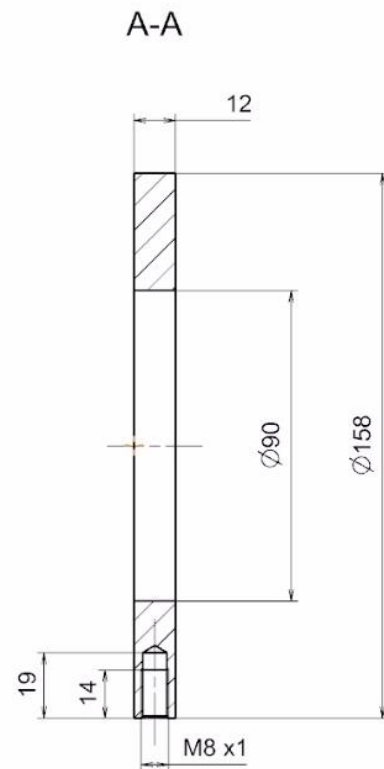
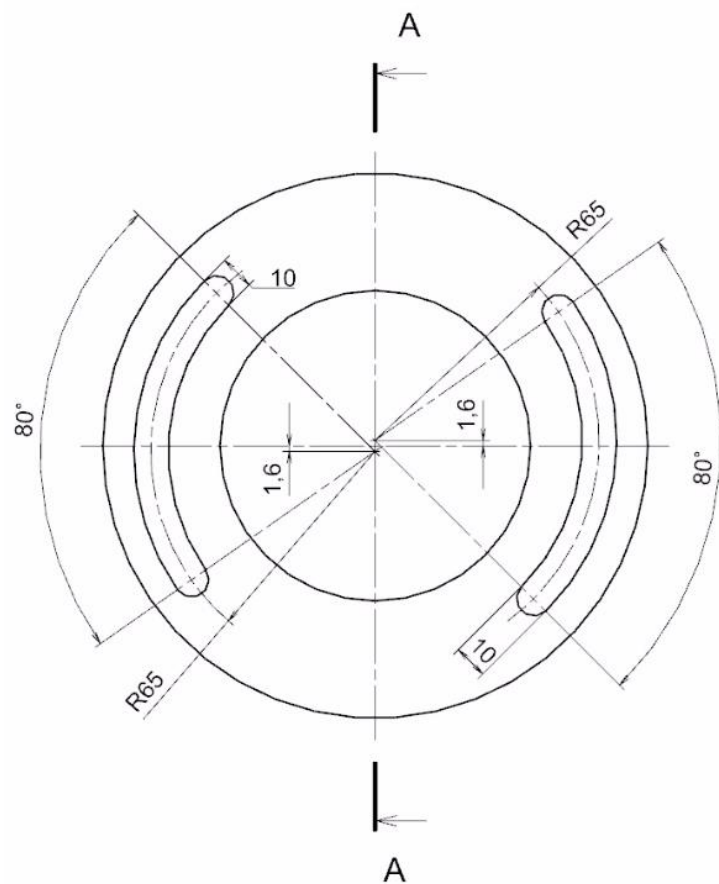


- ☐ Browser
- ☐ Design History
- ☐ Toolbar
- ☐ Data Panel
- ☐ View Cube
- ☐ Help

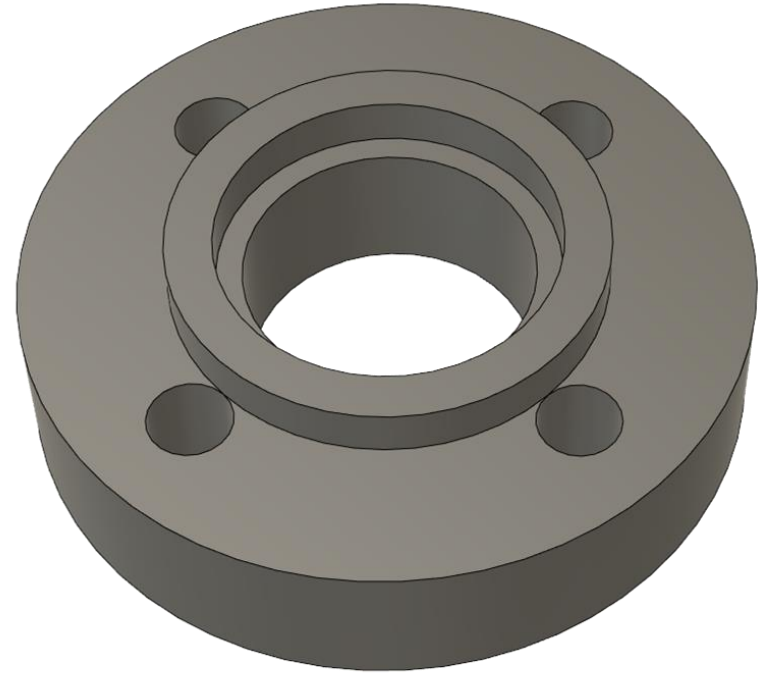
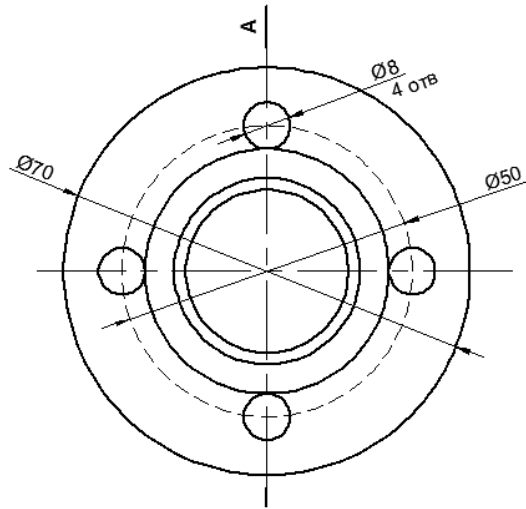
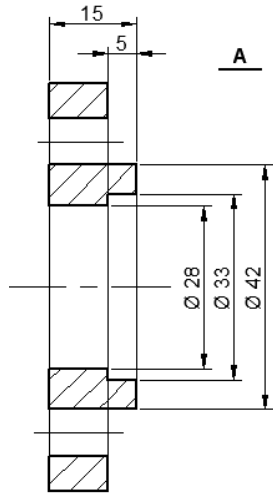
Sketches, checklist



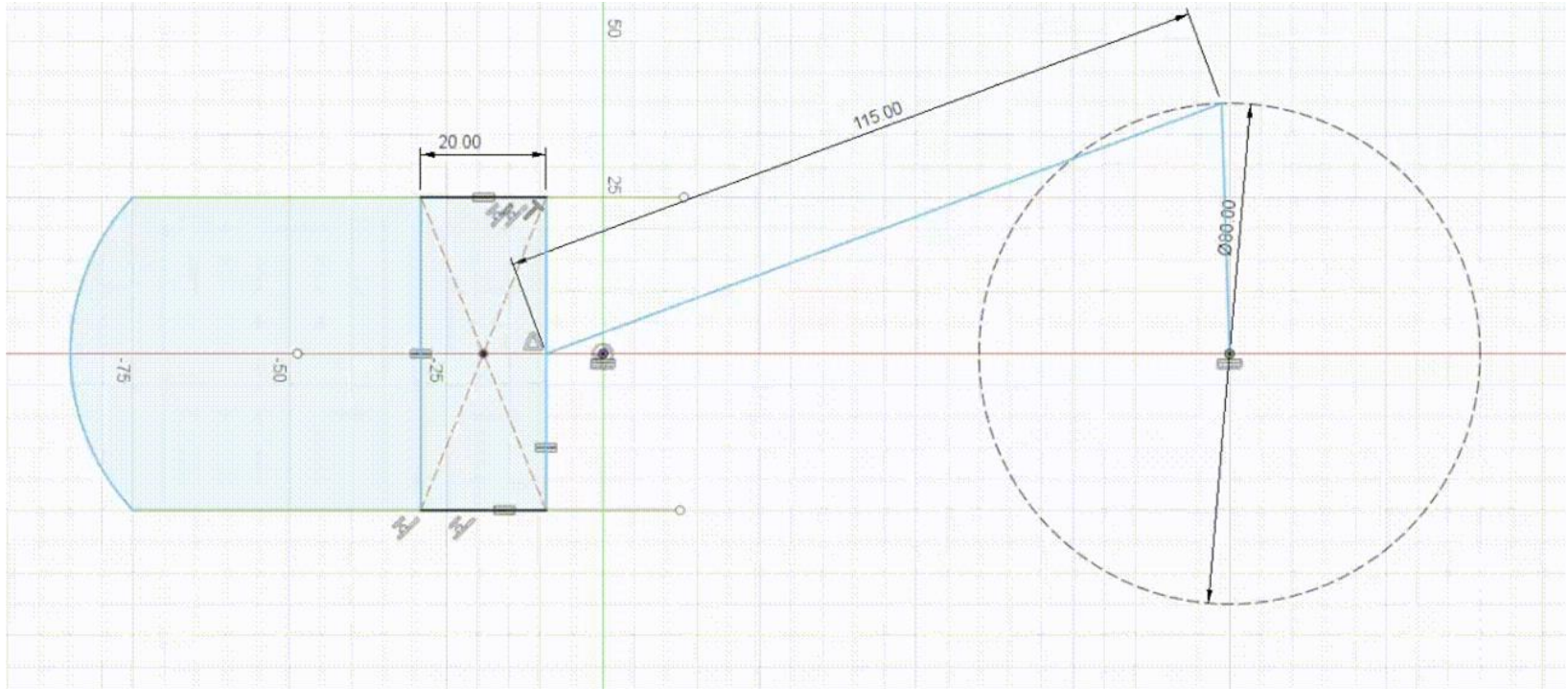
- ☐ Choose Plane
- ☐ Construction
- ☐ Toolbar
- ☐ Constraints
- ☐ Change Parameters



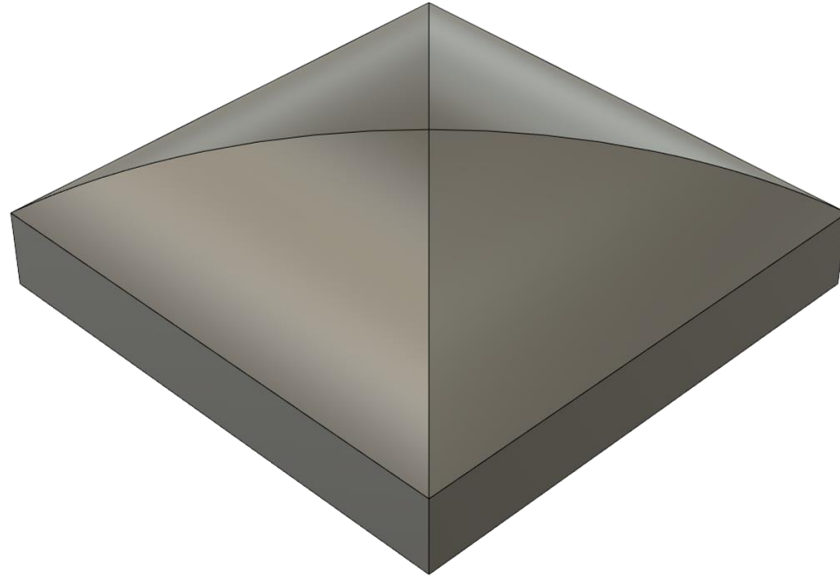
Task 1: make CAD model of detail below



Task 2: make an animated sketch



Task 3: make CAD model of detail below



Hint: It can be solved making 2 equal sketches perpendicular to each other, extruding them and using “combine” command

References

- [NX interface](#)
- <https://urokinx.ru/>



Deserve “A” grade!

– Oleg Bulichev

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📍 @Lupasic

🏠 Room 414