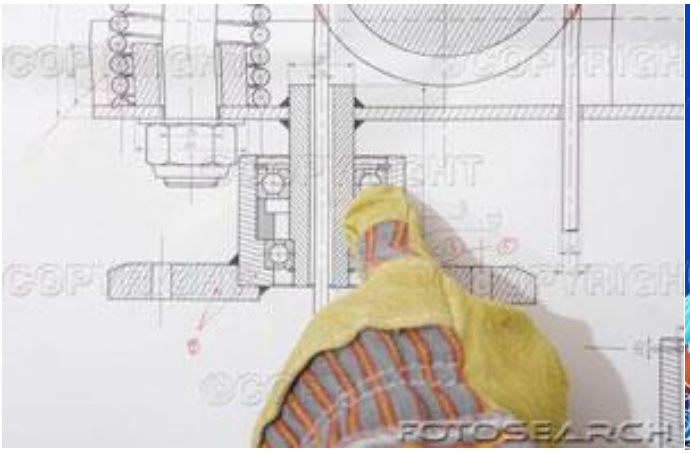
Roles of an Engineering Drawing



TOPICS

- Graphics language in Engineering Design Process
- Computer-Aided Drafting & Design (CADD)

Graphics Language in Engineering Design Process

What is “Engineering Design” ?

Bertoline et al.

“**Design** is the *process* of conceiving or inventing ideas and communicating those ideas to others in a form that is understood easily.”

Eide

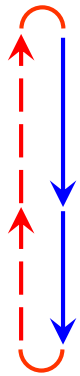
“**Engineering design** is a *systematic process* by which solutions to the needs of humankind are obtained.

Lockhart et al.

“**Design** is the act of creating the specifications for a product or process that best satisfies the design criteria.

Simplified Definition

Needs → Design Process → solutions



1. Write down the problem statement.
2. Generate possible solutions.
3. Evaluate each solution against the criteria and select the best one.
4. Document the solution.

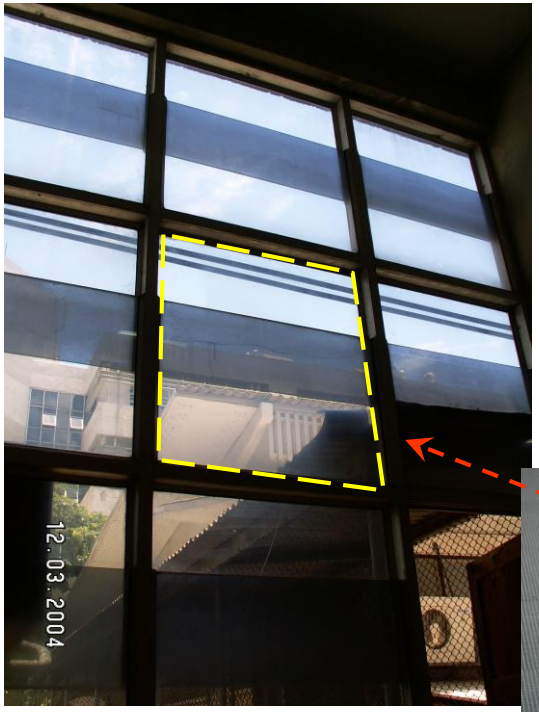
The Role of Graphics

- Visualization
- Communication
- Documentation

Let’s try to think together…

Yesterday, I went to ME department to **buy a textbook**.

I saw the window panels are very dirty.



Let’s try to think together…

Maybe, a person responsible to this job is lazy.

I don’t think so. I saw she worked diligently.

…..

Let’s try to think together…


I asked her, why don’t you clean those windows ?


What did she answer you ?


She said it it is impossible to clean those windows.


So, what do you think ?

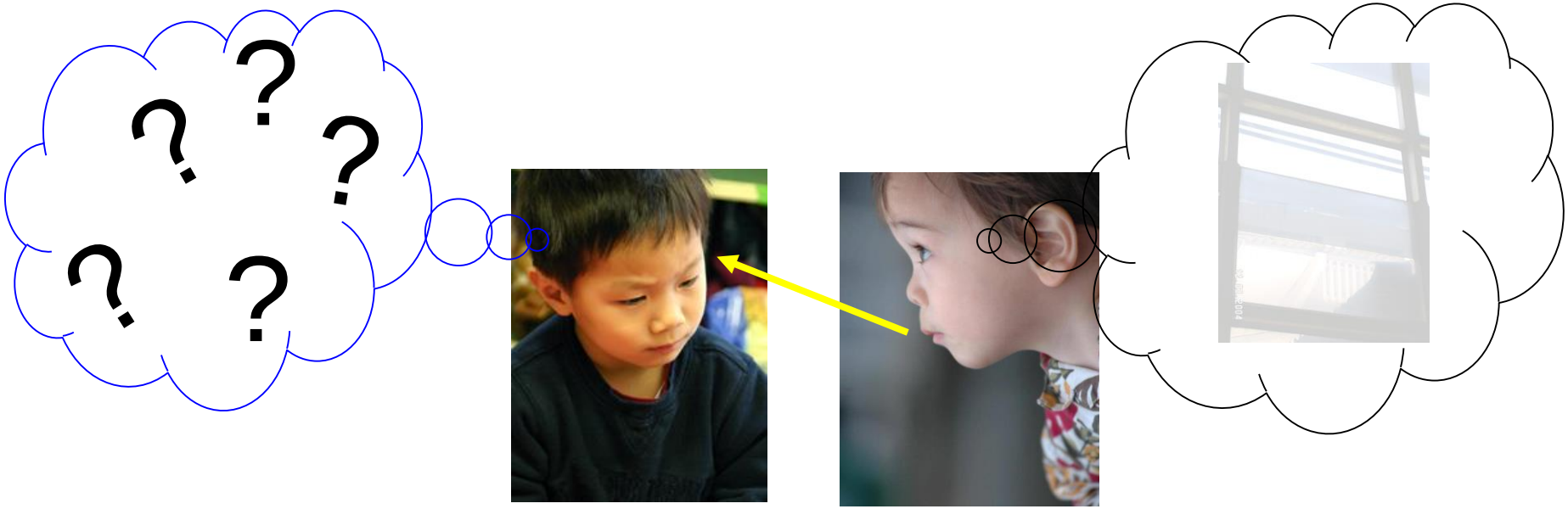

I looked at the windows again, then I understood her answer.


What are your findings ?

Let’s try to think together…

I founded that the windows have two glass panels. One is fixed to the top, another one is fixed to the bottom of a window frame.

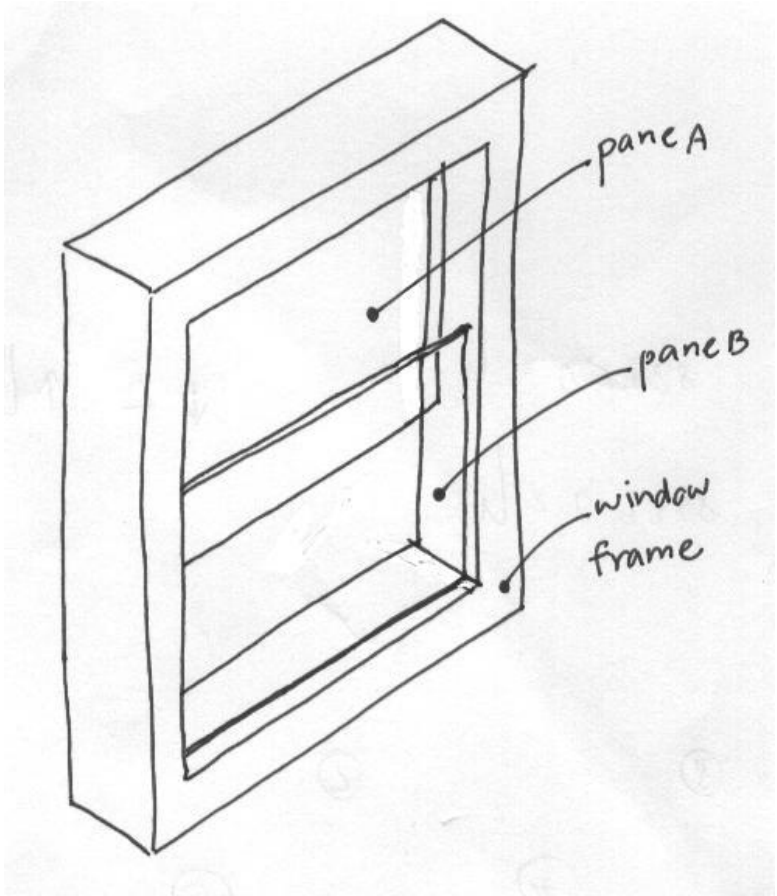
Both panels place offset with each other and their free edge overlap about mid of the window’s height.



Let’s try to think together…

Sorry, I cannot imagine about the window you have explained.

Okay, I will show you a sketch of the windows.

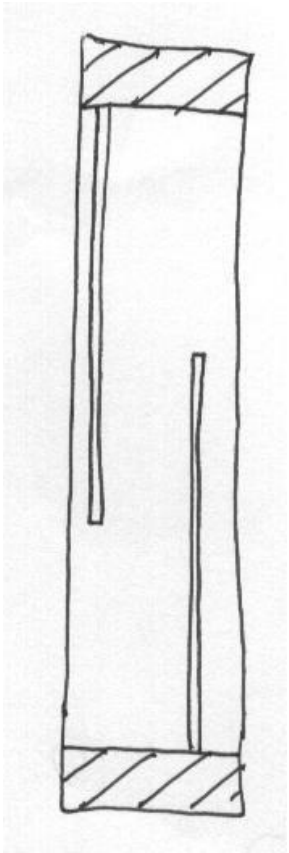


Visualization
&
Communication

Let’s try to think together…

Sorry, I still do not understand why it is hard to clean the window.

Um.. . I will show you the side view of this window.



The glass panel is thin, so he ***omits*** *section lines !*

Let’s try to think together…

Ah.. I see. The offset distance is small, so she can not access the opposite side of the window and the overlapped zone.

That is right !. If we do not solve this problem, learning environment will become worse and …….

STEP 1 : Write down a *broad* problem statement.

STEP 2 : Generate possible solutions.

Individual Teamwork

1. Hire a cleaning service company.
2. Buy a usable device.
3. Redesign the window construction.
4. Change the window to concrete wall.
5. Design a homemade cleaning device.
6. .....

STEP 3 : Evaluate the solutions

	Criteria				
	Availability	Cost	Simplicity	Aesthetic	…
1. Hire a cleaning service company.					
2. Buy a usable device.					
3. Redesign the window construction.					
4. Change the window to concrete wall.					
5. Design a homemade cleaning device.					
6. …….					

Assume you (or your team) make a decision that

"Design a homemade cleaning device"

is the best solution under listed criteria.

STEP 1 : Write down a *specific* problem statement.

STEP 2 : Generate possible solutions.

1. Modify from an existing solution.

Patent

Book

Ideation

Solutions A, B …

2. Ad hoc solution.

Use a ***freehand sketch*** to record the solutions

STEP 2 : Generate possible solutions.

Major functions of a device

1. Wash & Polish (the panel)
2. Wipe

Would you like to combine both functions into a single device ?

Yes Single device.

Assume you (or your team) choose this choice.

No

1) Two devices: *One for wash & polish another one for wipe*.

2) Single device but has *a changeable part*.

STEP 1 : Write down a *specific* problem statement.

STEP 2 : Generate possible solutions.

Function

- Wipe
- Hold (by user)
- How parts are ***assembled*** ?
- ...

- What should be an appropriate ***form*** of part(s) to do the required functions?
- What ***material*** is the part should be made of ?
- Easy to use.
- Should not rust.
- Not too expensive.
- Not too heavy.
- Can insert between the panels.
- ...

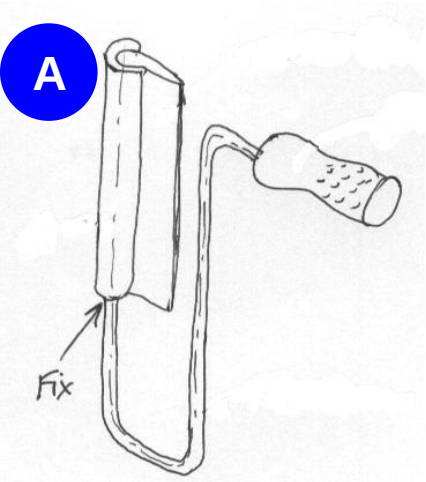
STEP 3 : Evaluate the solutions

Solutions

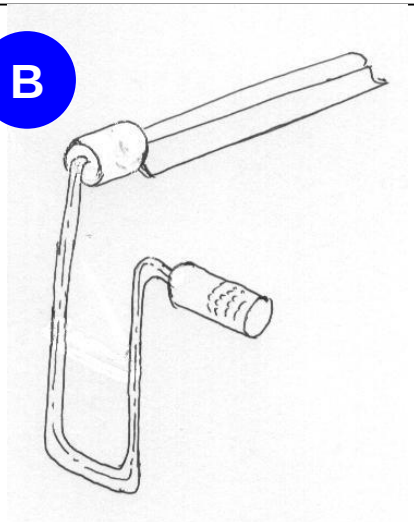
Criteria

Cost Weight Size Ease of operation …

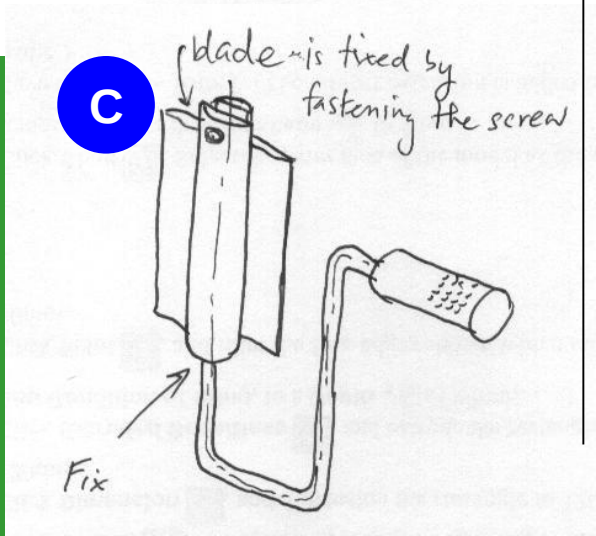
A



B



C



Freehand sketching is used to represent rough ideas.

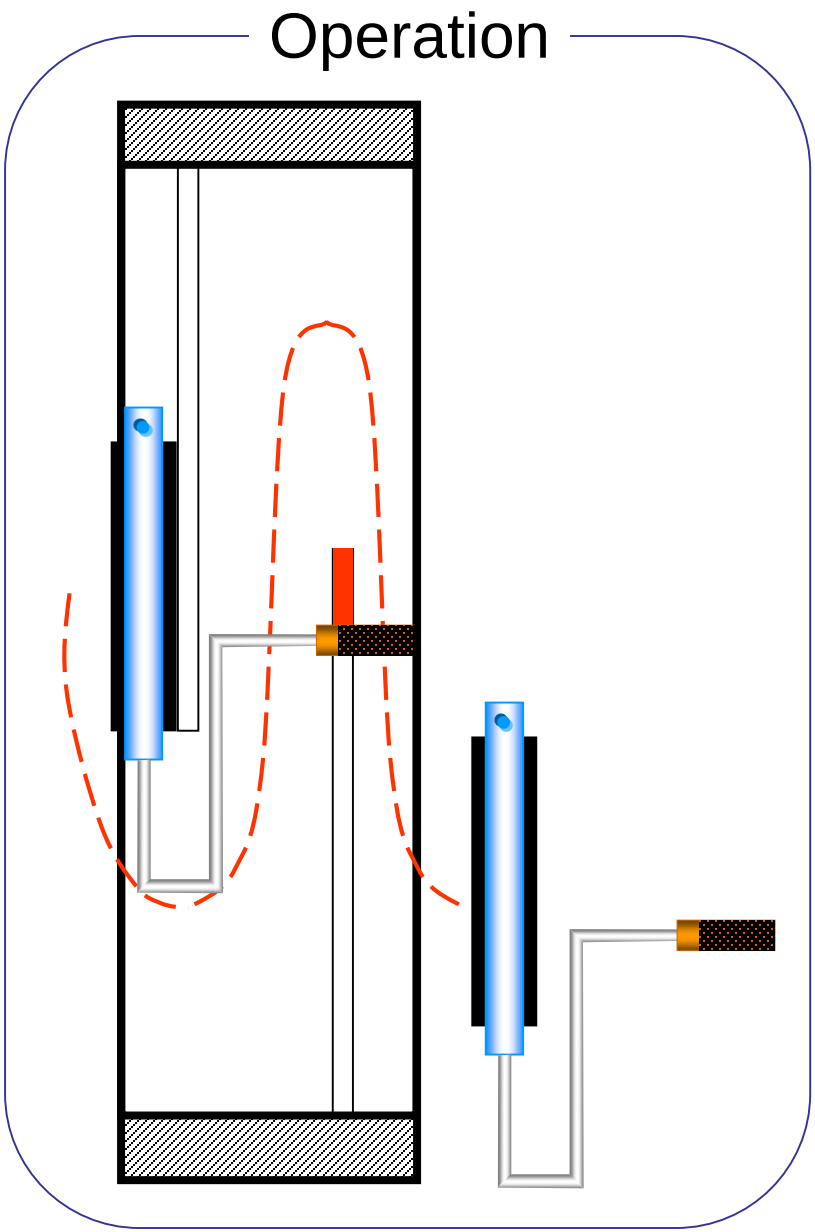
Assume you (or your team) choose the solution **C**

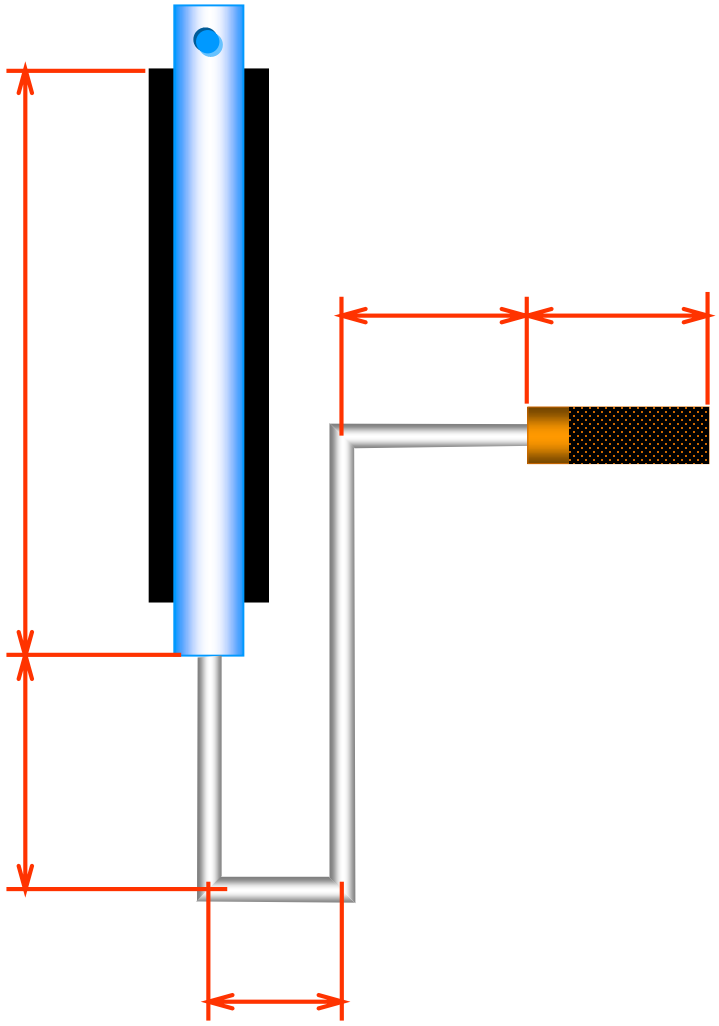
STEP 3 : Evaluate the solutions : Refined

- Mathematical analysis
- Computer simulation
- Build and test a prototype

If this final results are ***unsatisfactory***,
the selected solution will be modified.

Example of mathematical analysis



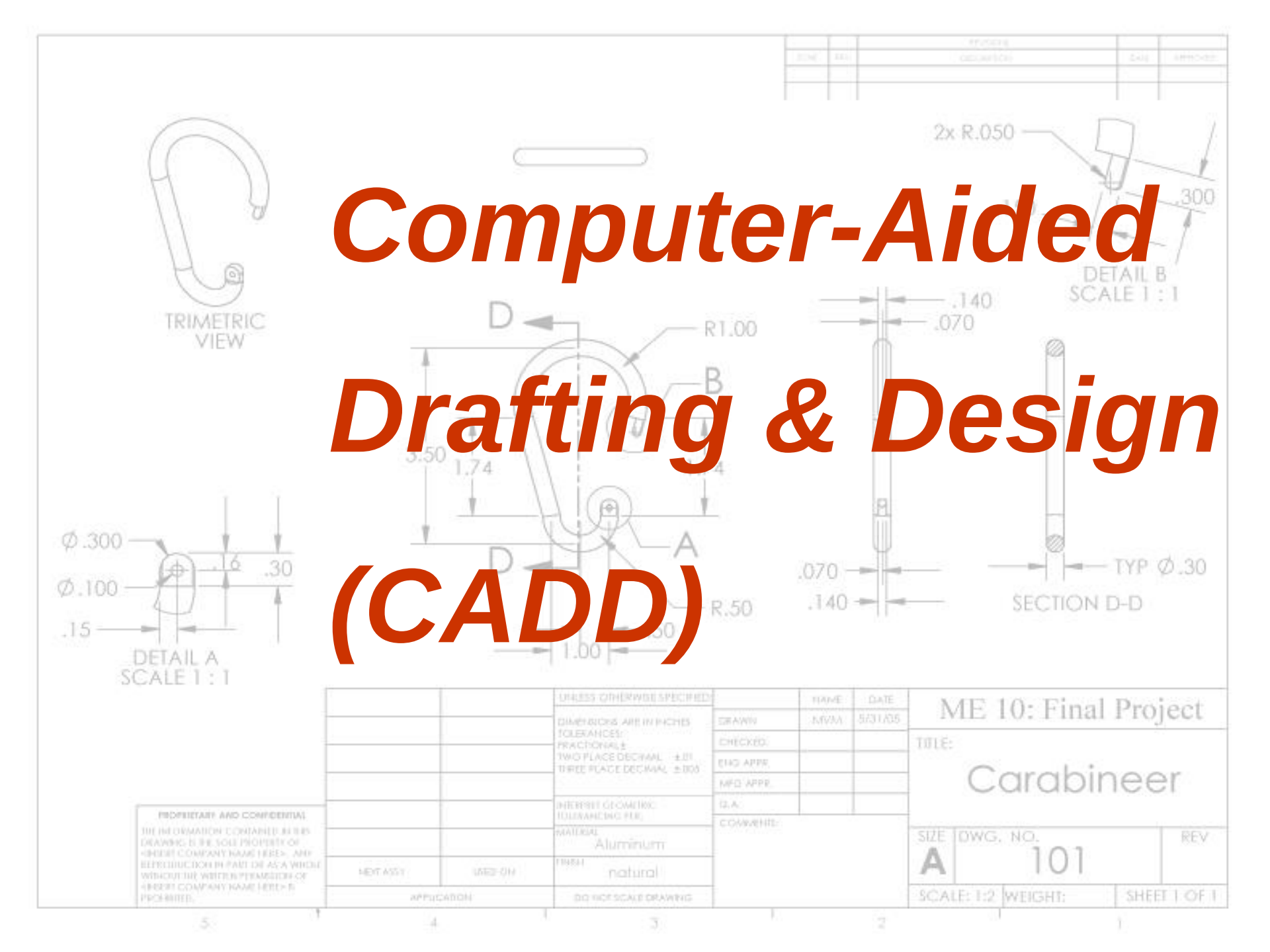


STEP 4 : Document the solutions

Documentation = Write a technical report

- Text
- Working drawing

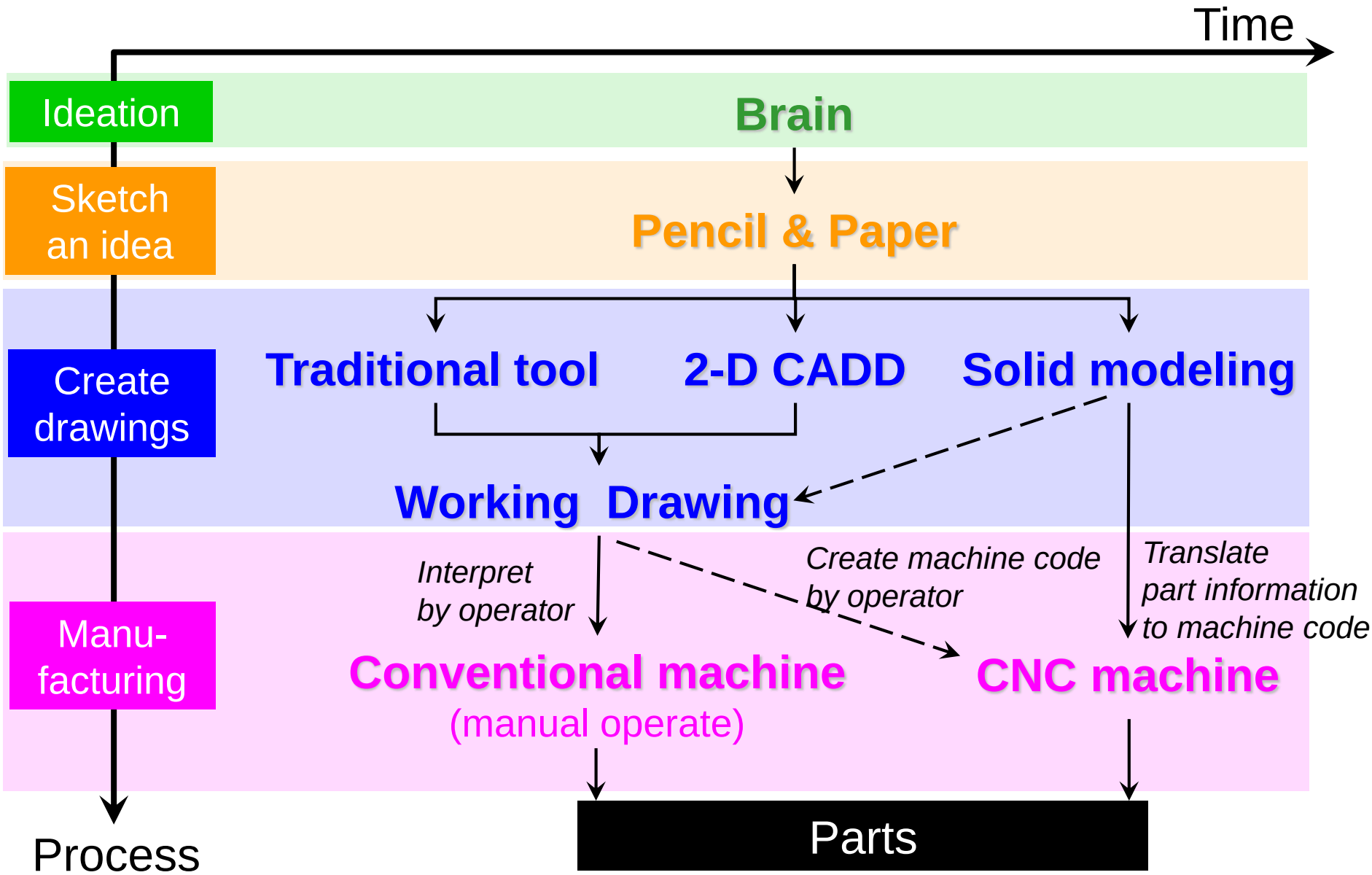
Computer-Aided Drafting & Design (CADD)



Definition

Computer-aided drafting and design (CADD) is the *computer process* of making engineering drawings and technical documents more closely related to drafting.

Evolution of Engineering Drawing



Advantages of CADD

Drafting stage

1. Increased accuracy
2. Increased drawing speed
3. Easy to revise
4. Availability of drawing libraries

Design stage

1. Built-in several analysis tools
2. Better presentation (Easy to visualize)
   - Pan, rotate, animate, shade, texture

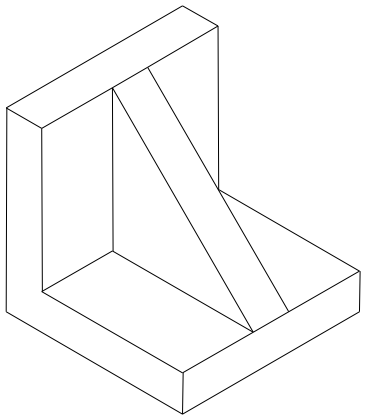
CADD Capability

1. Draw
2. Modify
3. Dimension
4. Object snap
5. Layer concept

Concepts in Working Drawing Creation

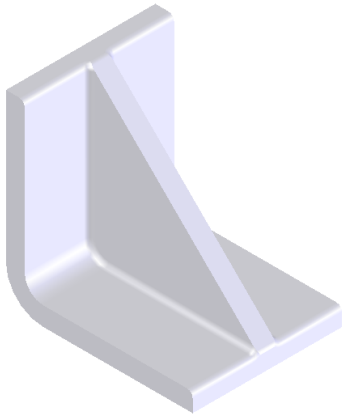
2-D CADD

- Draw a group of lines that are connected and present
  - Orthographic multiview
  - Pictorial view



Solid modeling

- Draw a closed contour and convert to surface.
- Modify this surface to solid object.
- Create an orthographic view from a solid object.



Limitation of CADD

(within scope of drawing creation)

Good engineering drawings must have the following characteristics.

- Parts or product information is ***completely*** given.
- Information is ***clearly*** presented .
- Information can be used in manufacturing of part.

Always remind yourself that

"Good drawing cannot be created by using CADD software alone without understanding the drawing concepts."

Limitation of CADD

(within scope of drawing creation)

To ***create*** a good engineering drawings **YOU MUST** do the following tasks yourself.

- **Apply** a proper line weight and style.
- **Select** a necessary view.
- **Decide** the appropriate places of dimensions.
- **Select** an appropriate section techniques (if necessary)

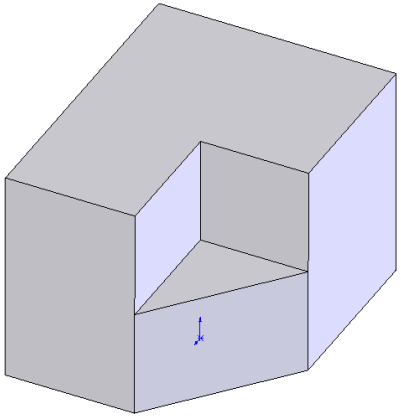
Limitation of CADD

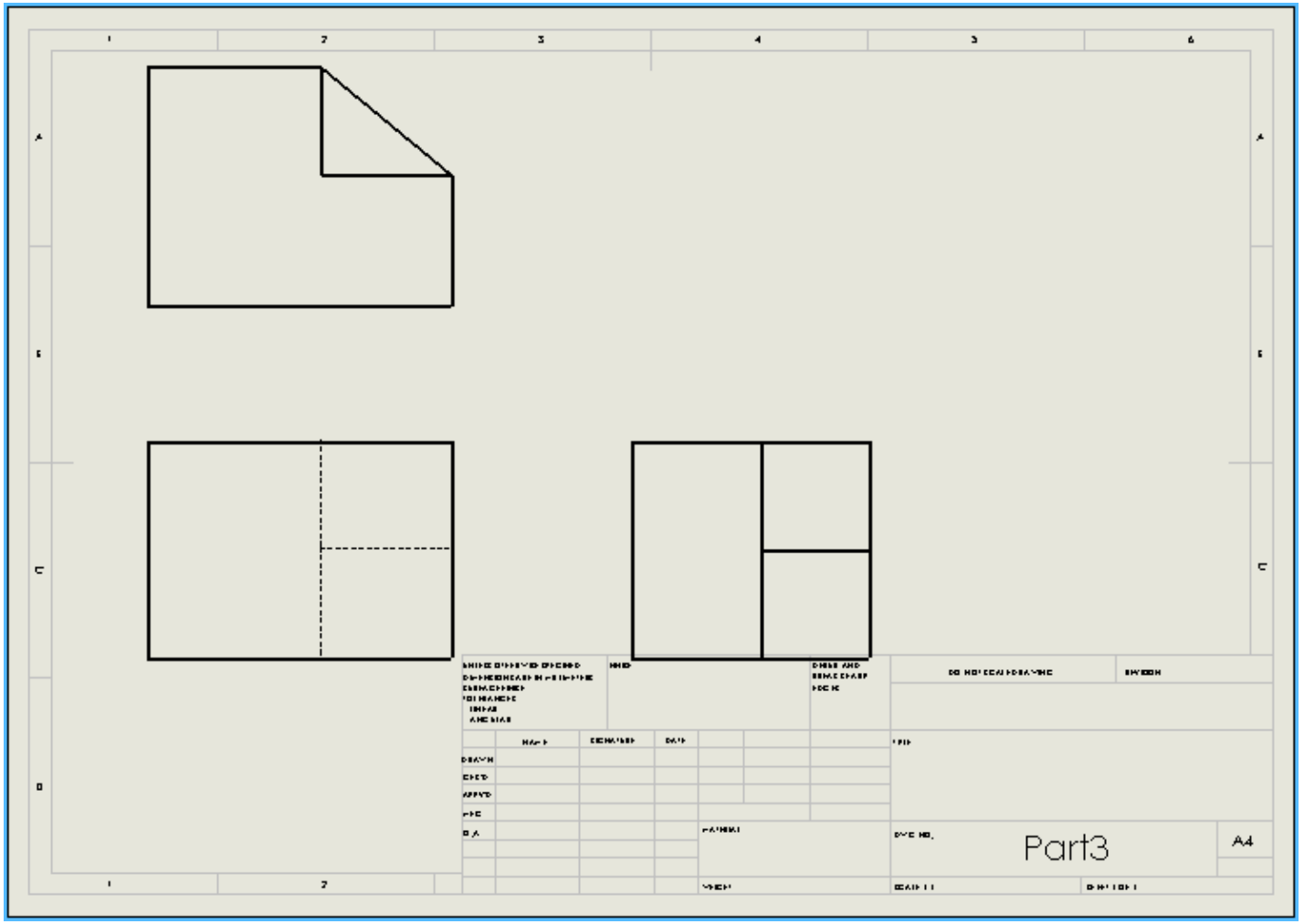
(within scope of drawing interpretation)

No CADD software can create a pictorial view from an orthographic multiview.

Because they are frequently used technical document. Therefore,**YOU MUST** prepare yourself for interpreting (or visualizing) them when you become **ENGINEER**.

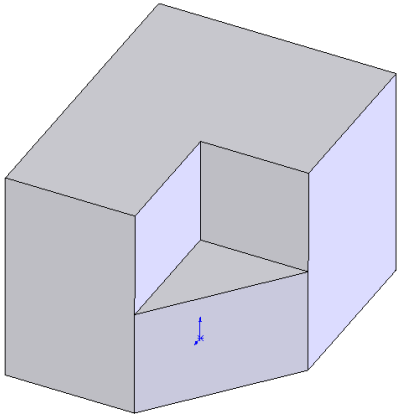
Example：Necessary view selected by software.

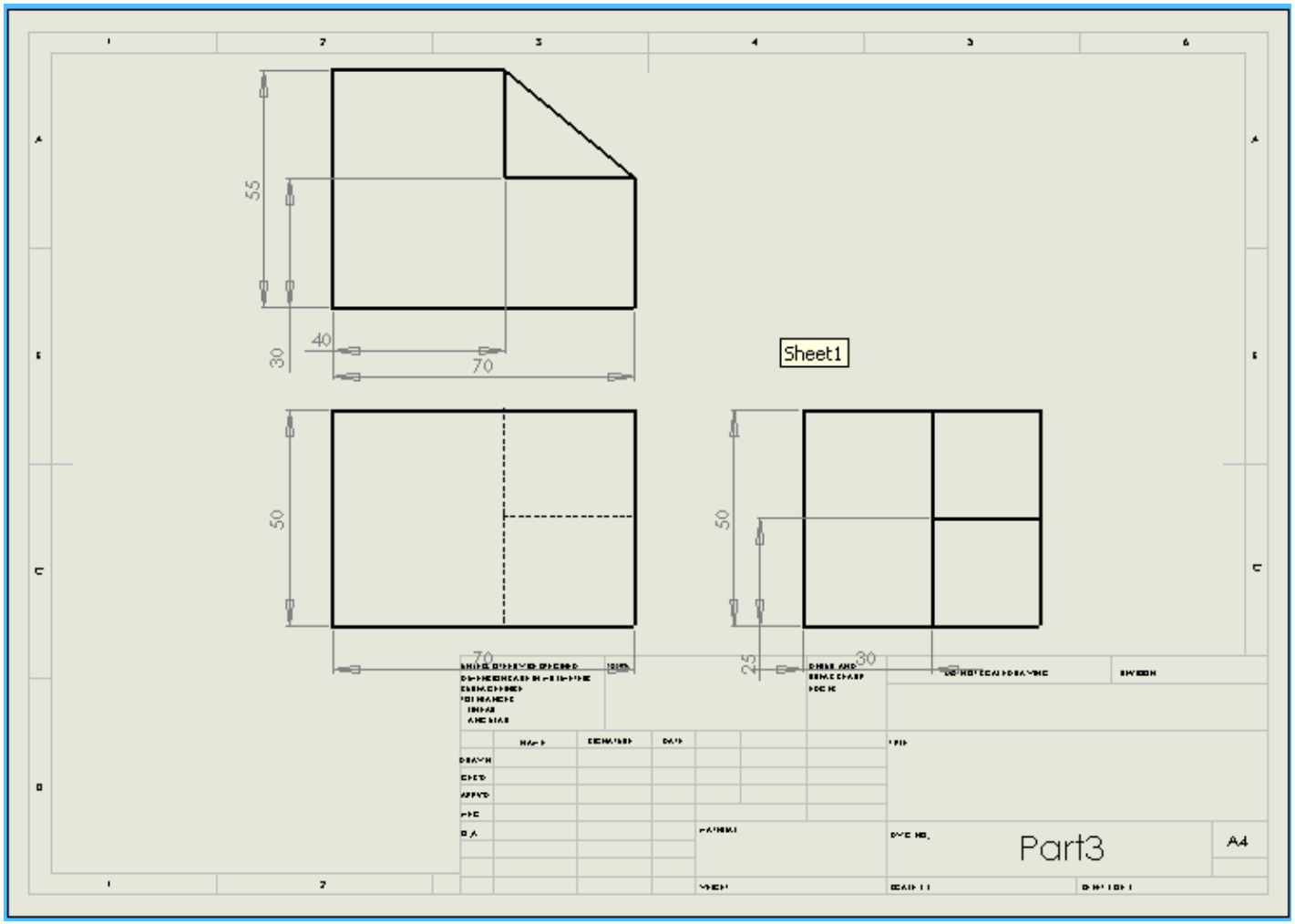




What do you think ? Good or Poor.

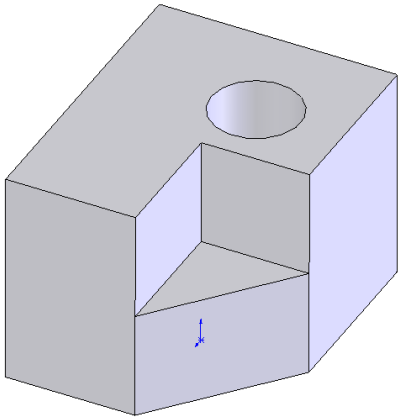
Example：Automatic dimension by software.

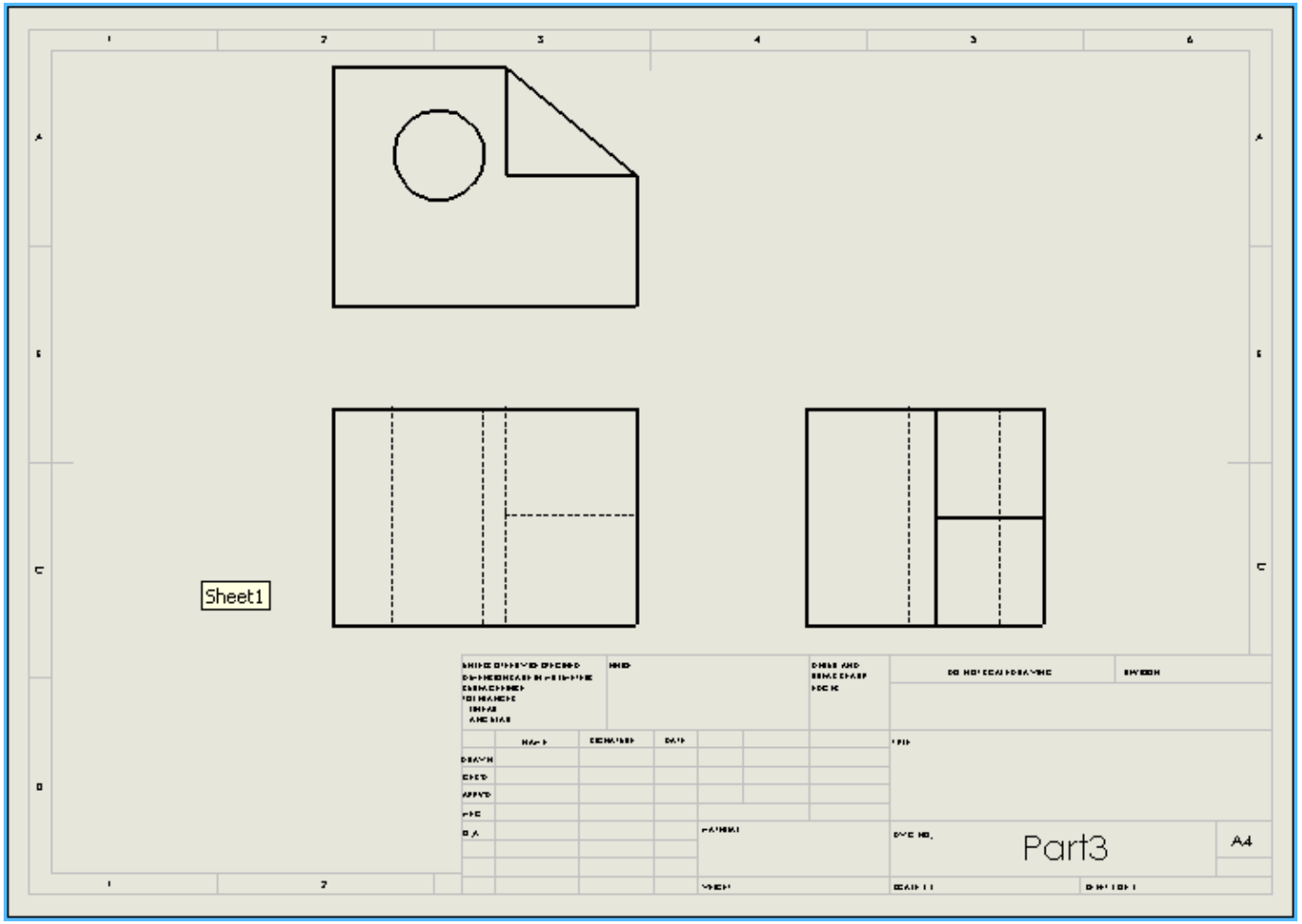




What do you think ? Good or Poor.

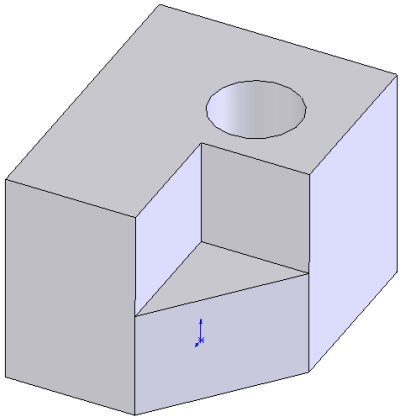
Example : Object with hole

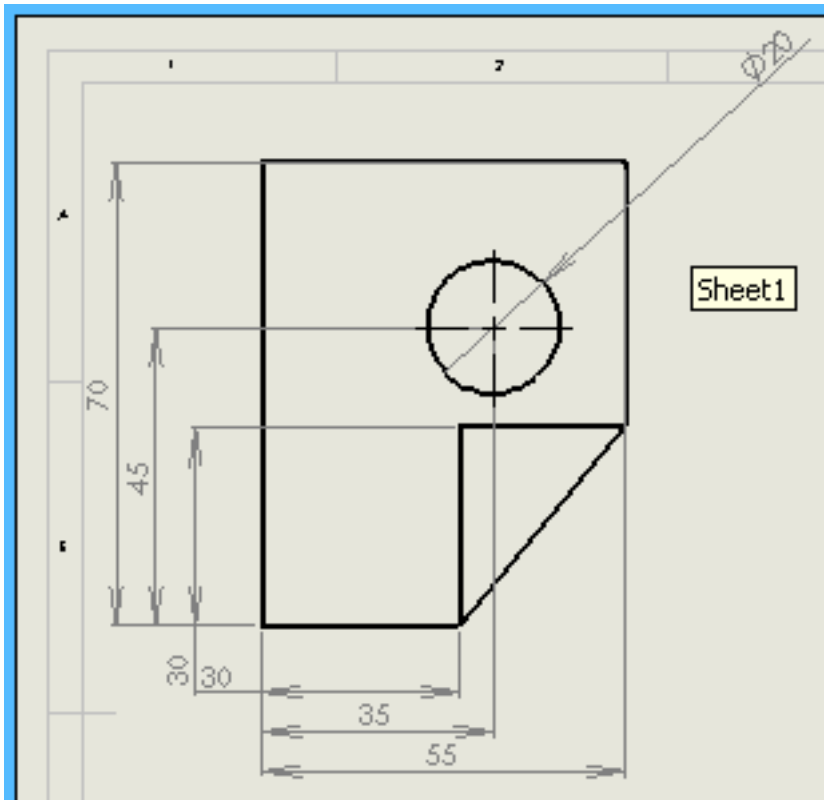




What do you think ? Good or Poor.

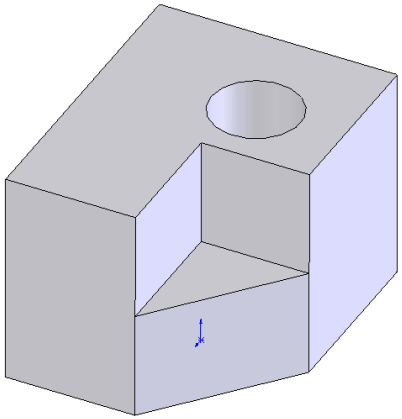
Example : Autodimension of selected view.

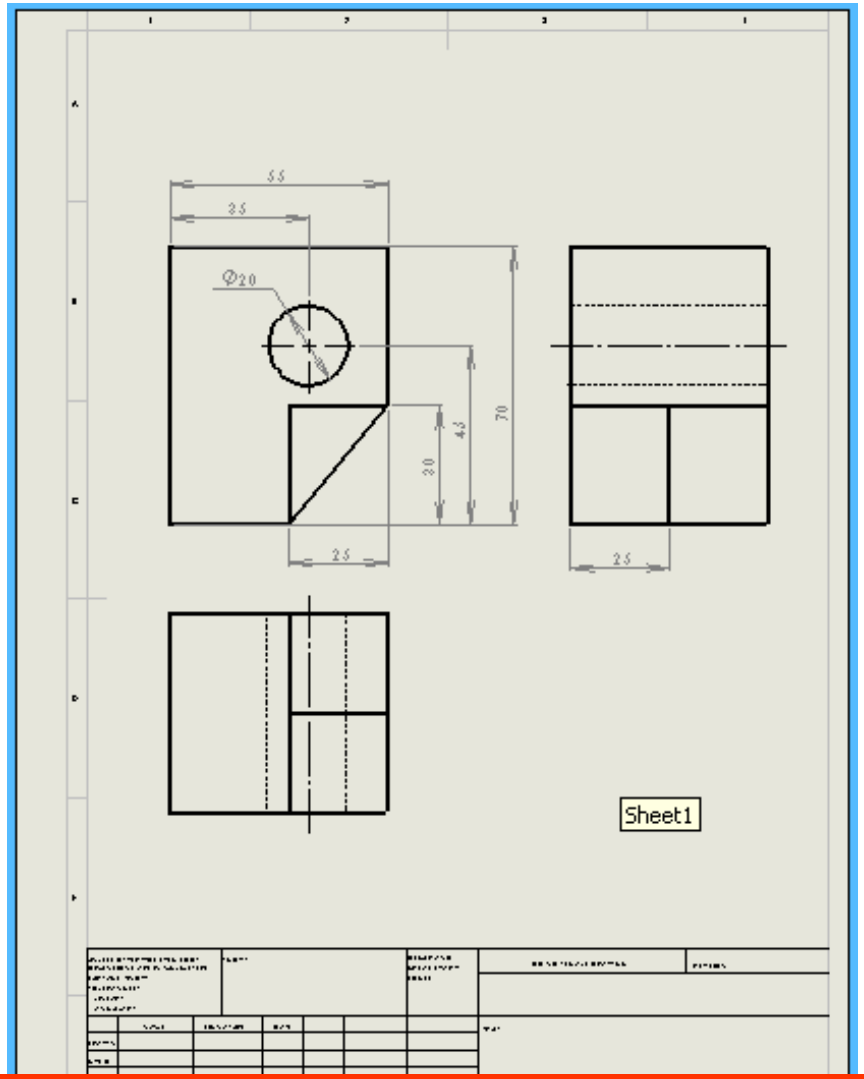




What do you think ? Good or Poor

Example : Object with hole





What do you think ? Good or Poor