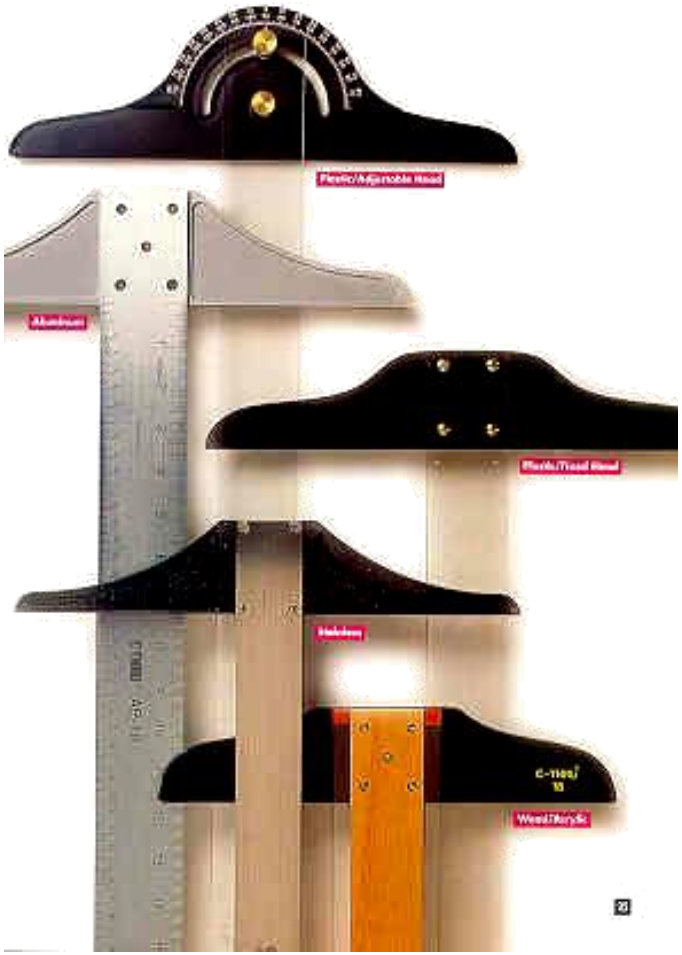
Engineering Drawing

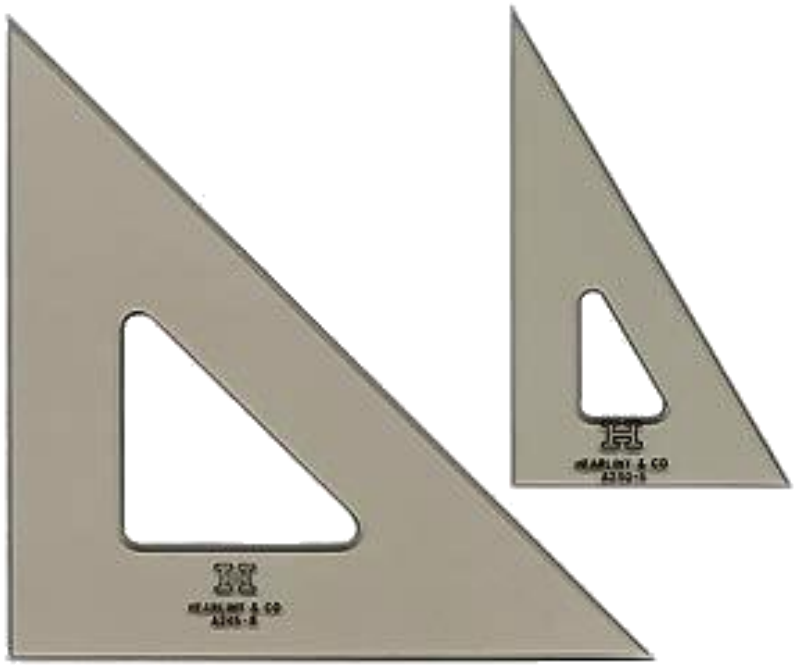
Traditional Drawing Tools

DRAWING TOOLS

DRAWING TOOLS



1. T-Square



2. Triangles

DRAWING TOOLS

HB for thick line

2H for thin line

3. Adhesive Tape

4. Pencils

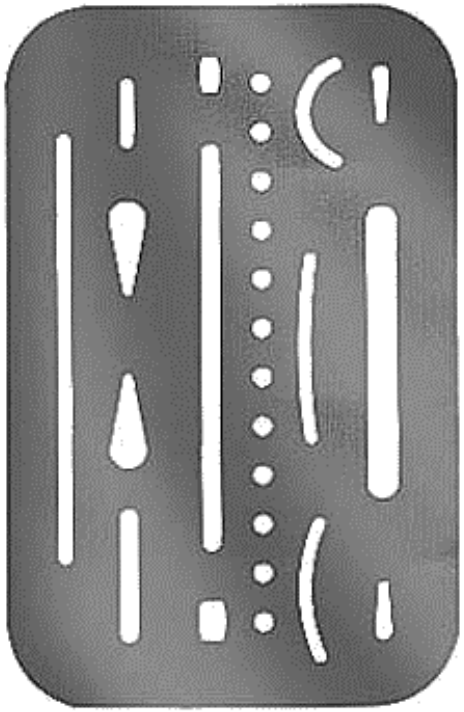
DRAWING TOOLS

5. Sandpaper

6. Compass

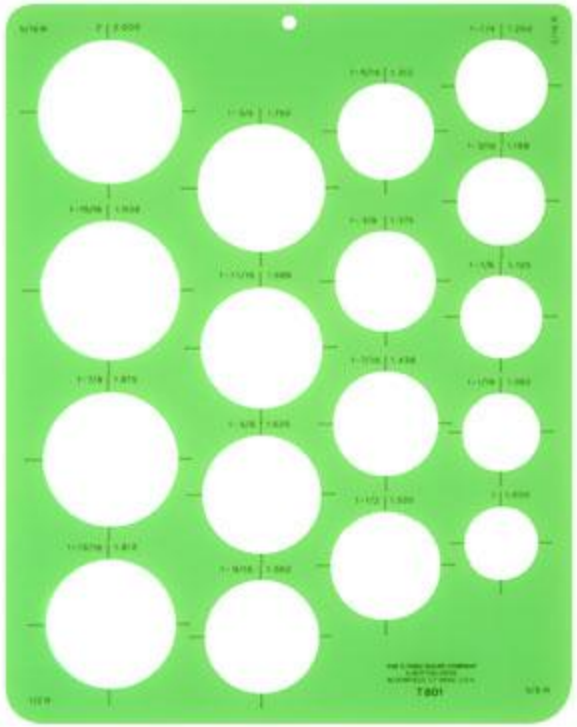
DRAWING TOOLS

7. Pencil Eraser



8. Erasing Shield

DRAWING TOOLS

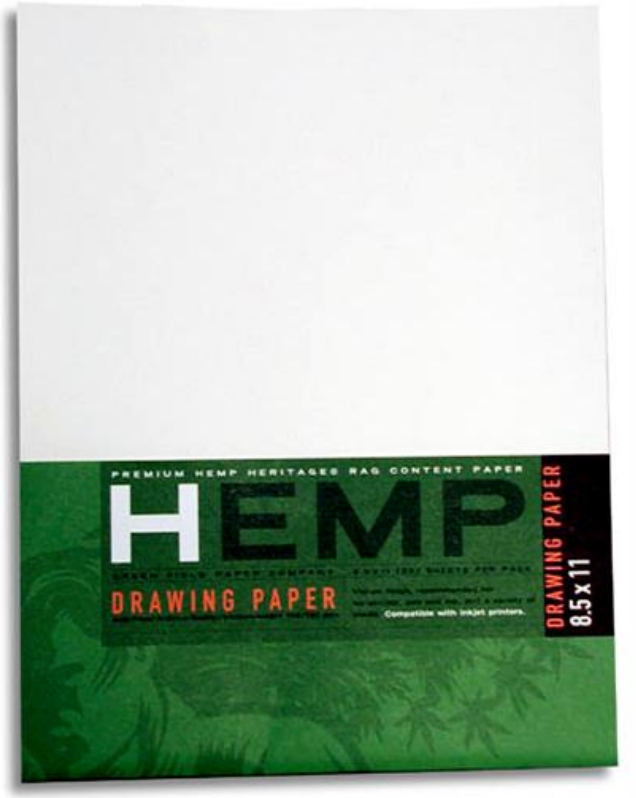


9. Circle Template

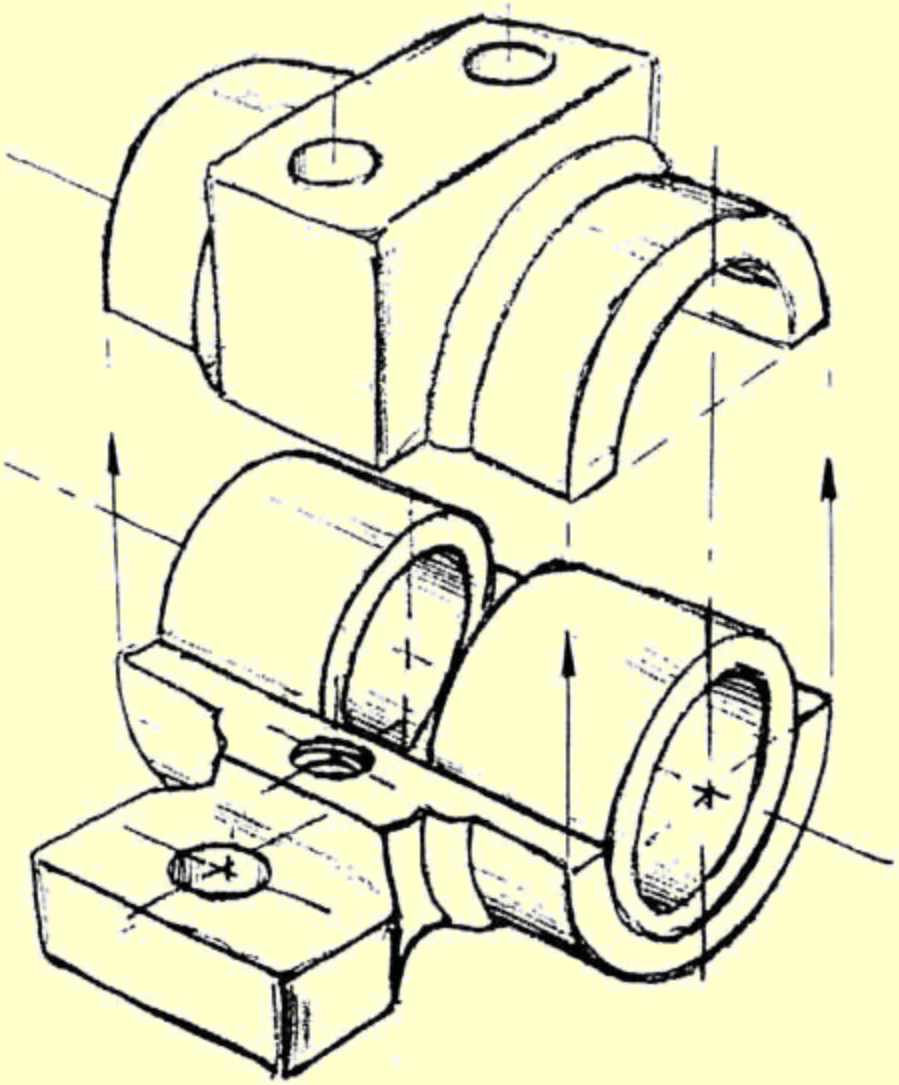
10. Tissue paper

DRAWING TOOLS

11. Sharpener



12. Clean paper



Freehand Sketching

Straight Line

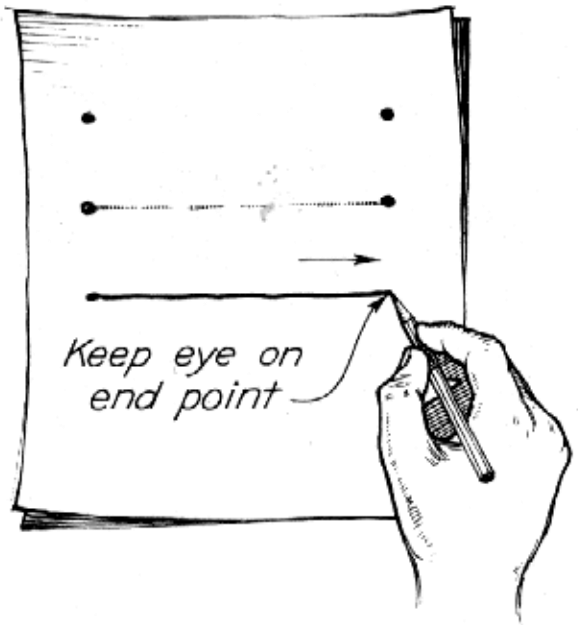
1. Hold the pencil naturally.

2. Spot the beginning and end points.

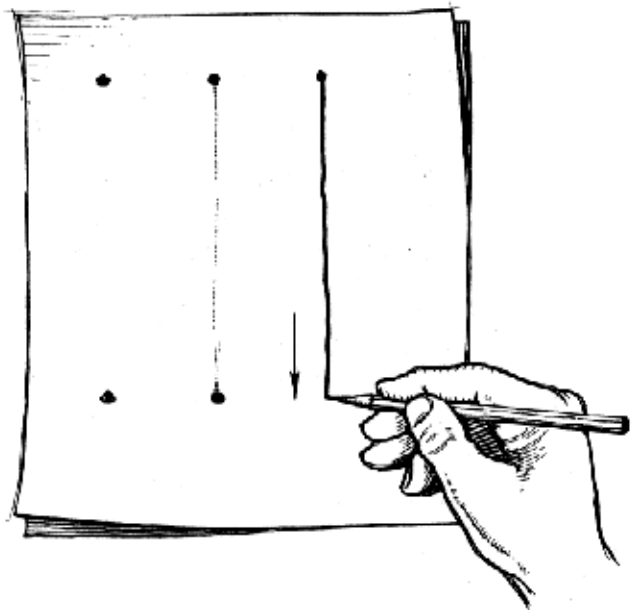
3. Swing the pencil back and forth between the points, barely touching the paper until the direction is clearly established.

4. Draw the line firmly with a free and easy wrist-and-arm motion

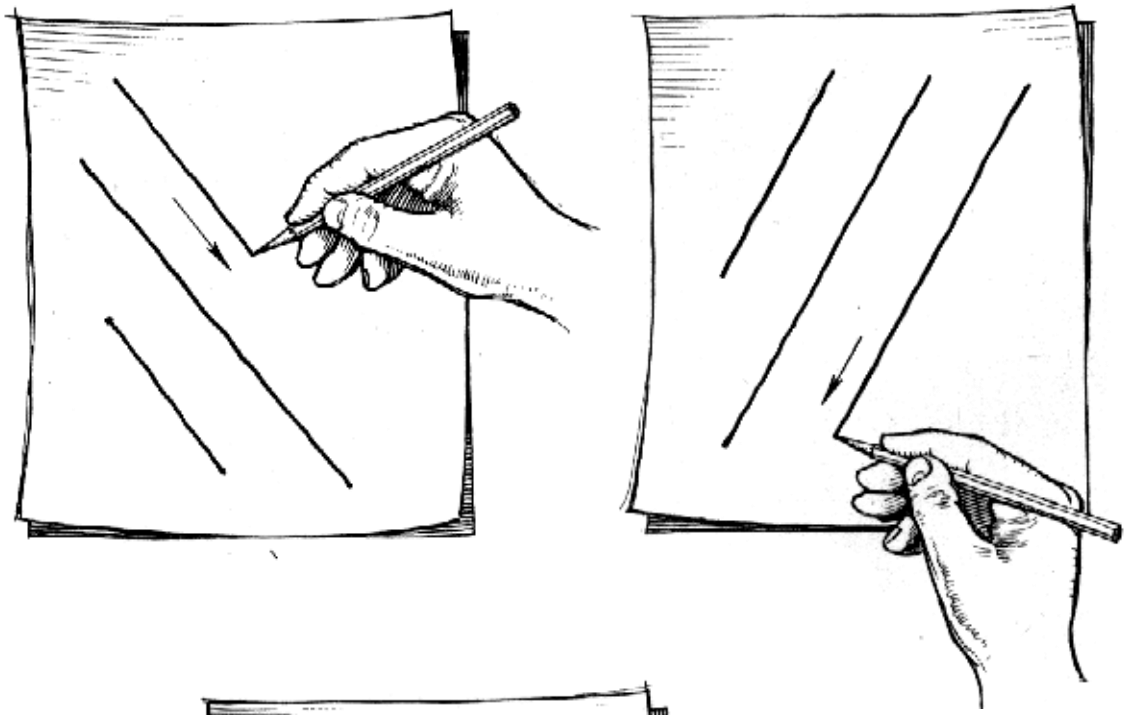
Horizontal line



Vertical line



Nearly vertical inclined line



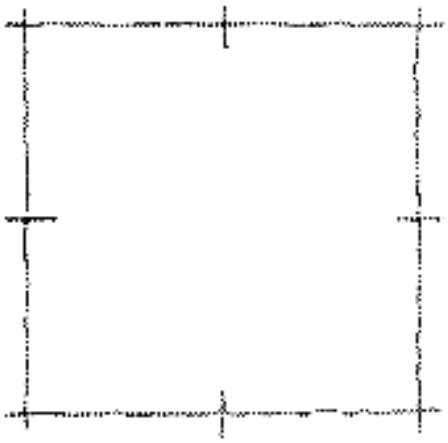
Nearly horizontal inclined line

Small Circle

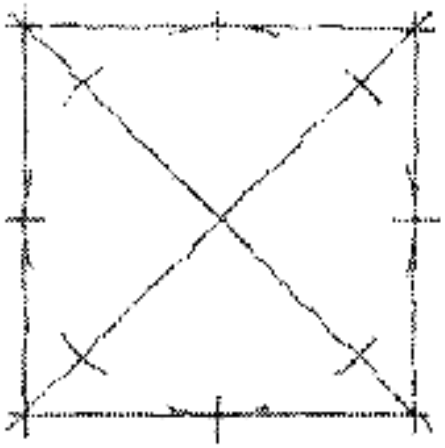
Method 1 : Starting with a square

1. Lightly sketching the square and marking the mid-points.
2. Draw light diagonals and mark the estimated radius.
3. Draw the circle through the eight points.

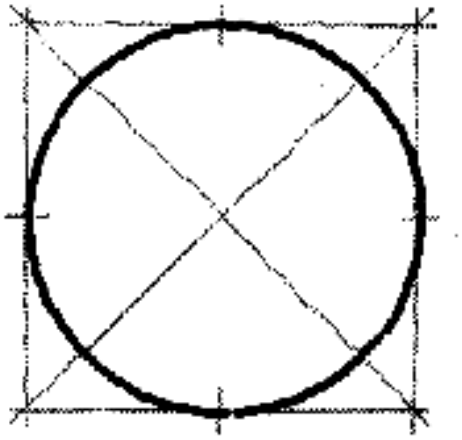
Step 1



Step 2



Step 3



Small Circle

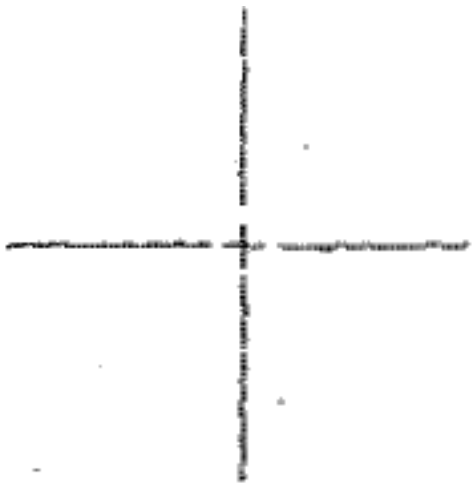
Method 2 : Starting with center line

1. Lightly draw a center line.

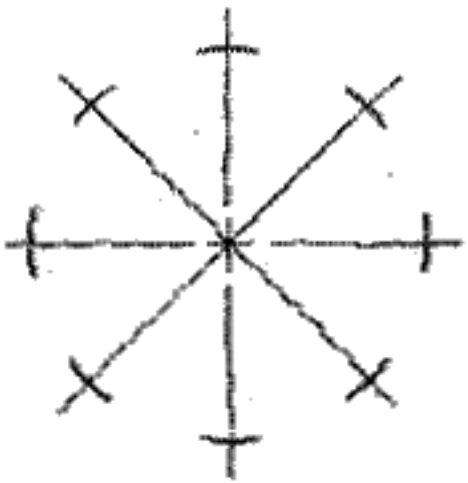
2. Add light radial lines and mark the estimated radius.

3. Sketch the full circle.

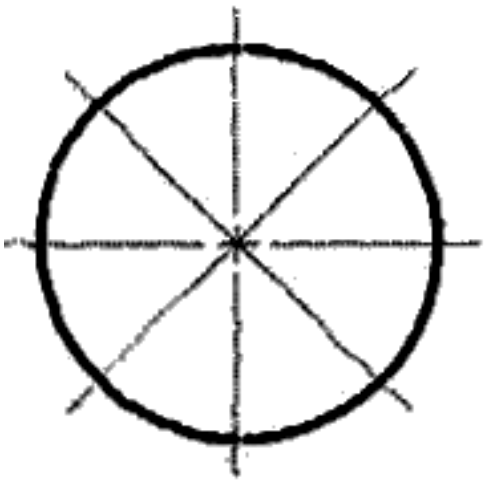
Step 1



Step 2

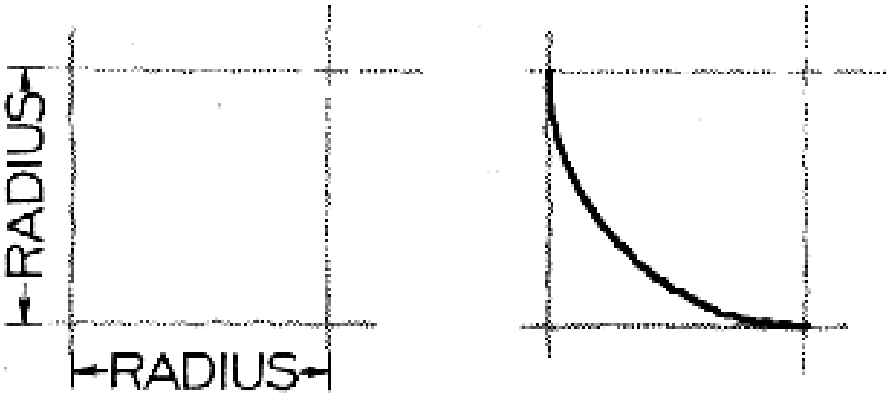


Step 3

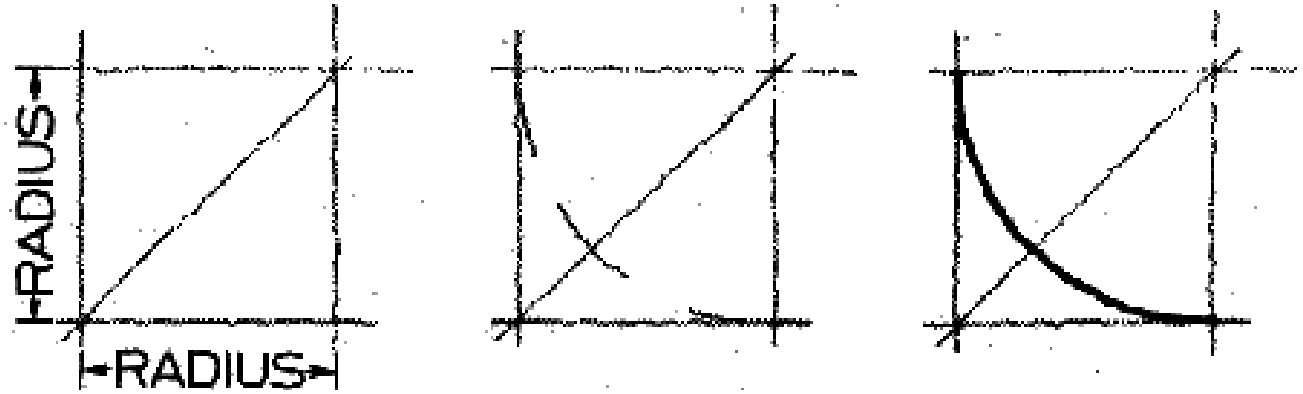


Arc

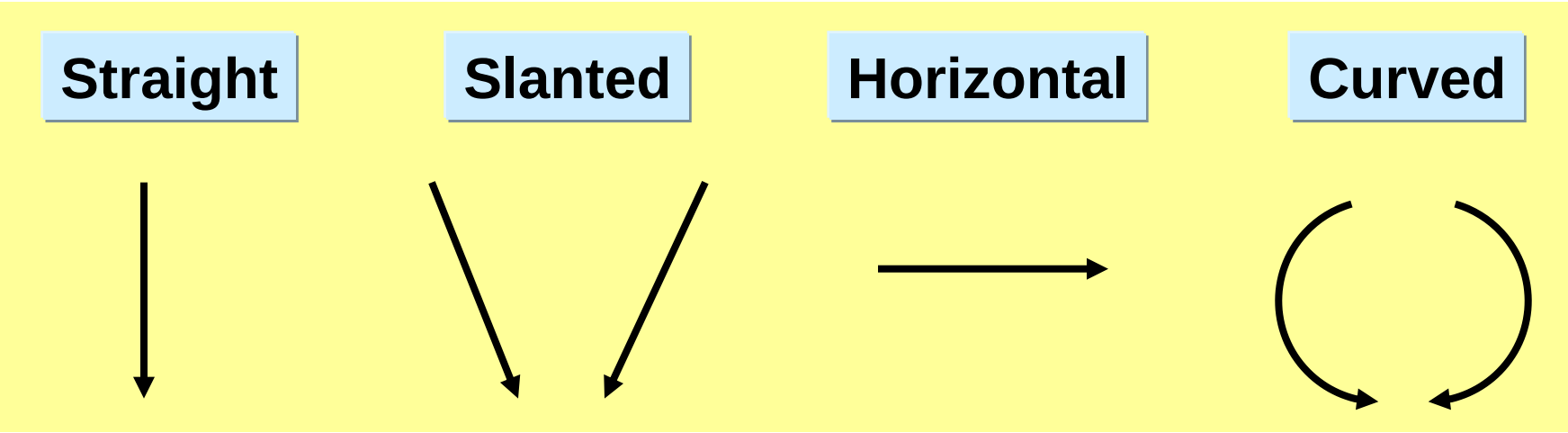
Method 1 : Starting with a square



Method 2 : Starting with a center line



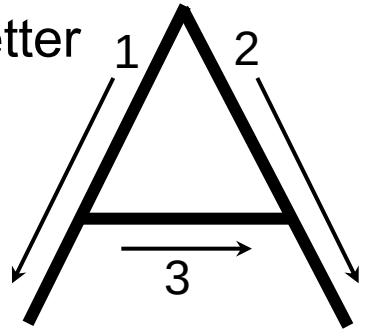
Basic Strokes



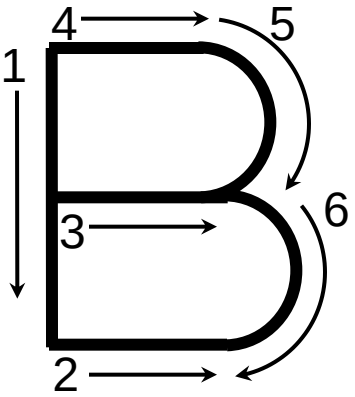
Examples : *Application of basic stroke*

"**I**" letter

"**A**" letter



"**B**" letter

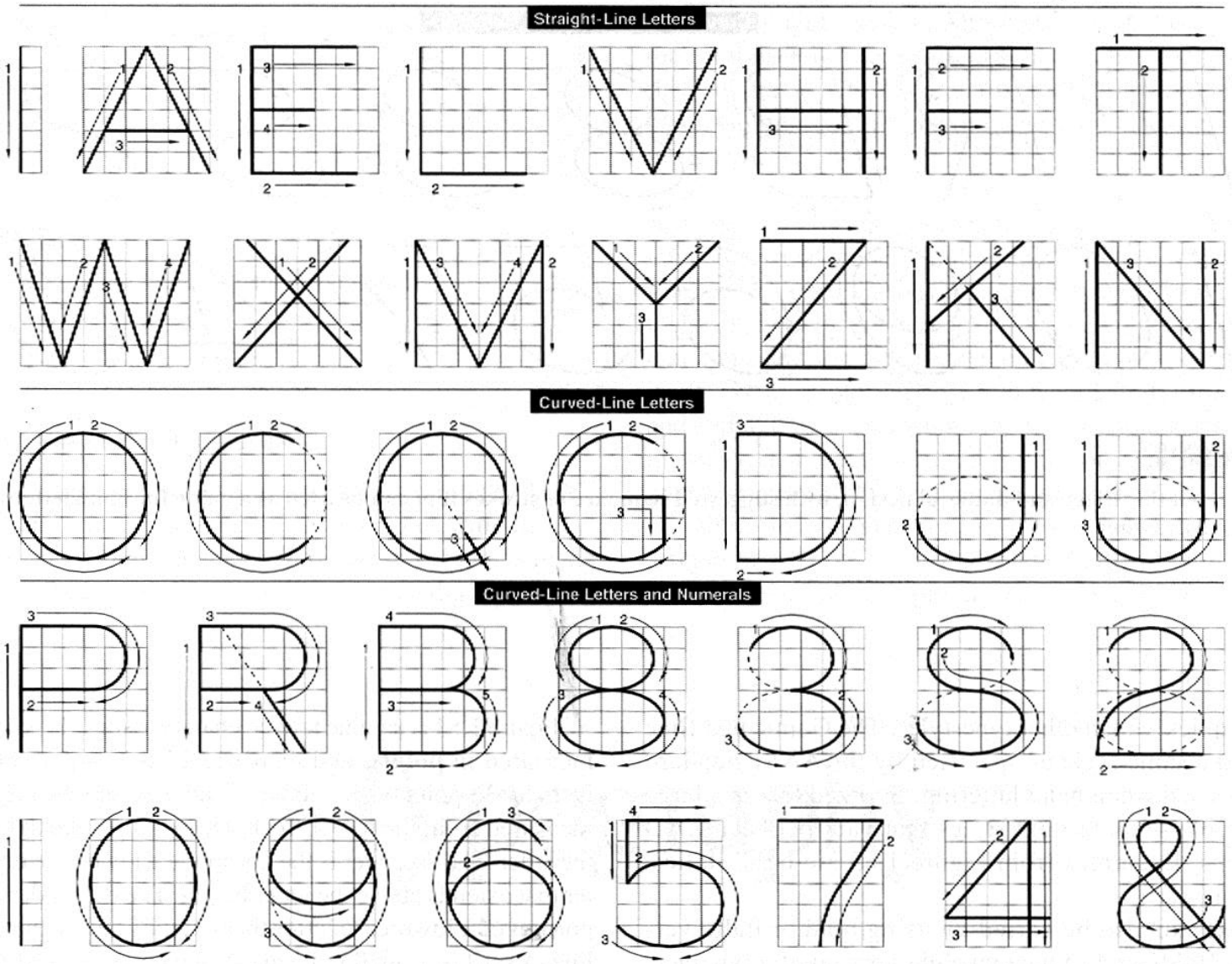


Upper-case letters & Numerals

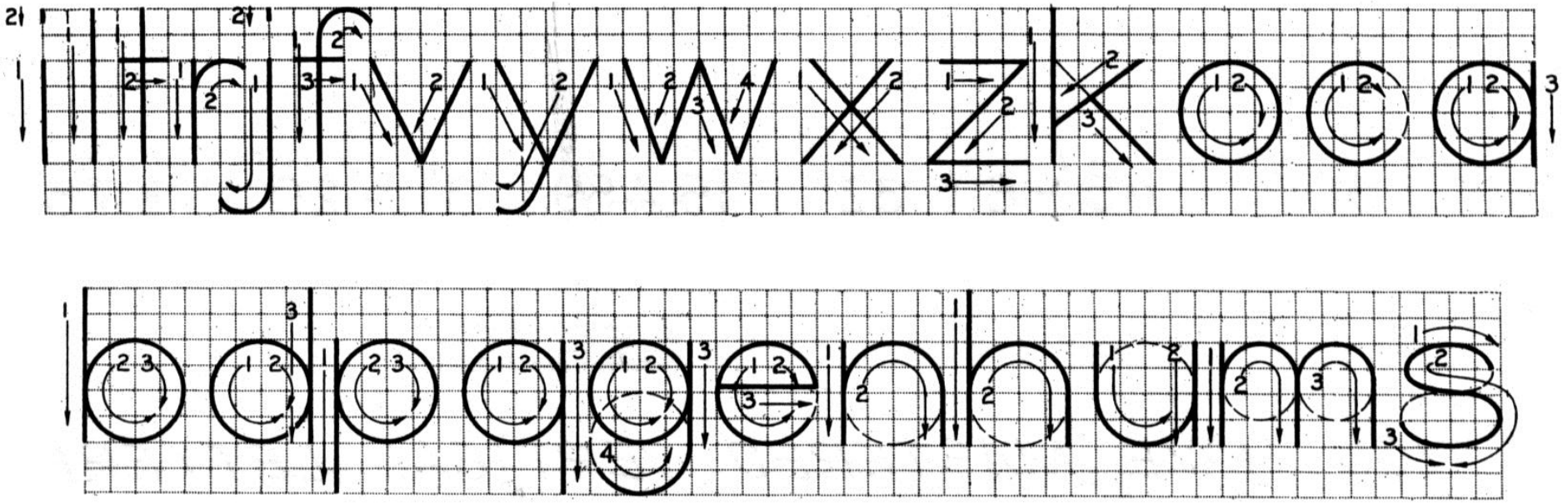
Straight line letters

Curved line letters

Curved line letters & Numerals



Lower-case letters



- The text’ s body height is about 2/3 the height of a capital letter.

Example : *Good and Poor Lettering*

GOOD

Not uniform in style.

Not uniform in height.

Not uniformly vertical or inclined.

Not uniform in thickness of stroke.

Area between letters not uniform.

Area between words not uniform.

Sentence Composition

- Leave the space between words equal to the space requires for writing a letter “O”.

Example

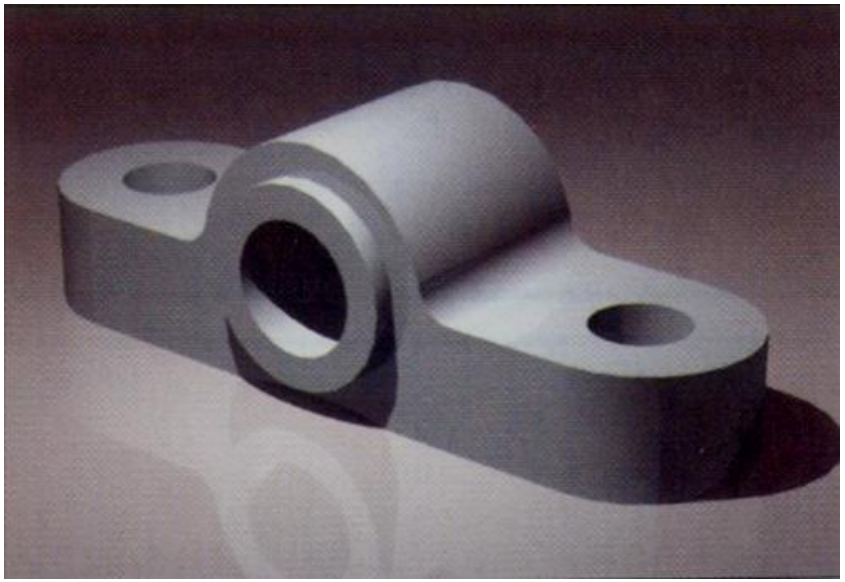
ALLODIMENSIONSOAREOIN
MILLIMETERSOUNLESS
OTHERWISEOSPECIFIED.

GRAPHICS LANGUAGE

Effectiveness of Graphics Language

1. Try to write a description of this object.

2. Test your written description by having someone attempt to make a sketch from your description.



You can easily understand that …

The word languages are <u>inadequate</u> for describing the ***size***, ***shape*** and ***features*** completely as well as concisely.

Composition of Graphic Language

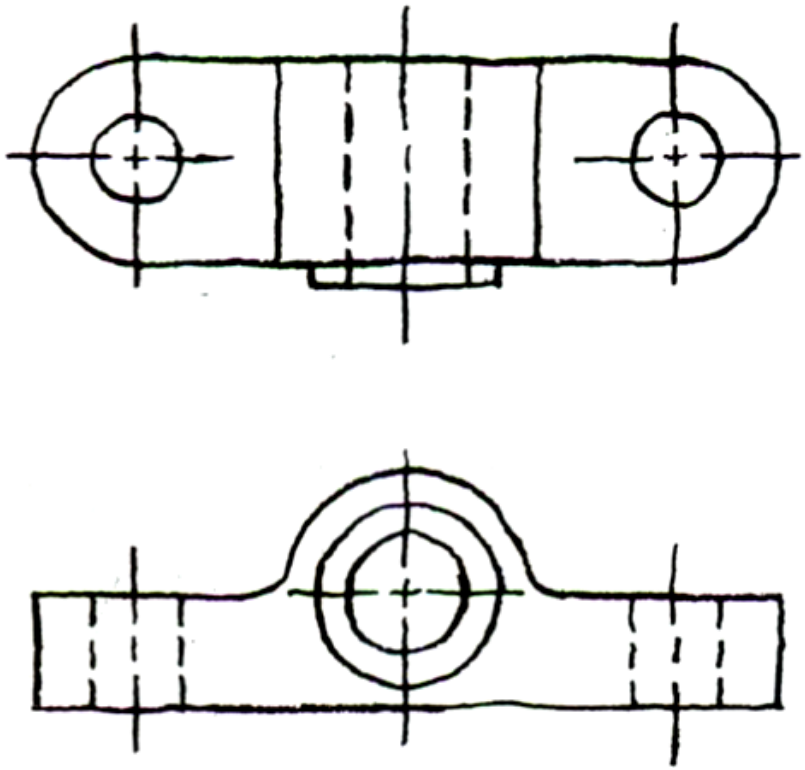
Graphic language use ***lines*** to represent the ***surfaces***, ***edges*** and ***contours*** of objects.

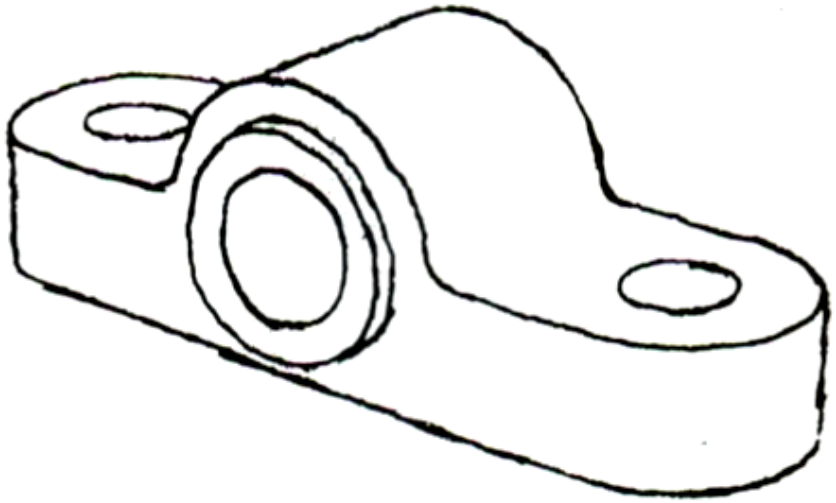
- The language is known as "***drawing***" or "***drafting***" .
- A drawing can be done using ***freehand***, ***instruments*** or ***computer*** methods.

Freehand drawing

The lines are sketched without using instruments other than pencils and erasers.

Example

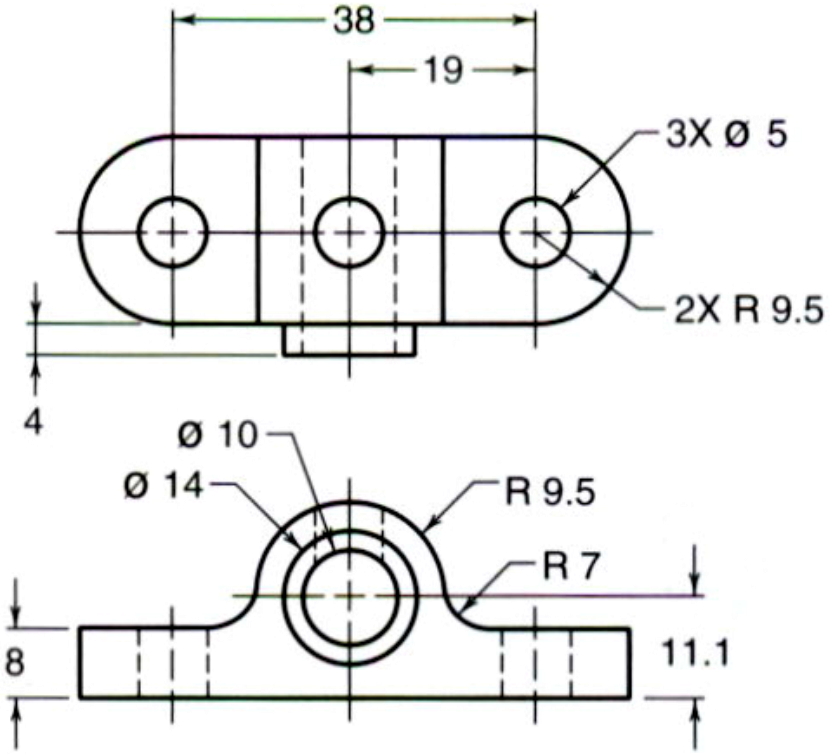




Instrument drawing

Instruments are used to draw straight lines, circles, and curves concisely and accurately. Thus, the drawings are usually made to scale.

Example



Computer drawing

The drawings are usually made by commercial software such as AutoCAD, solid works etc.

Example

Architectural Graphics

Elements

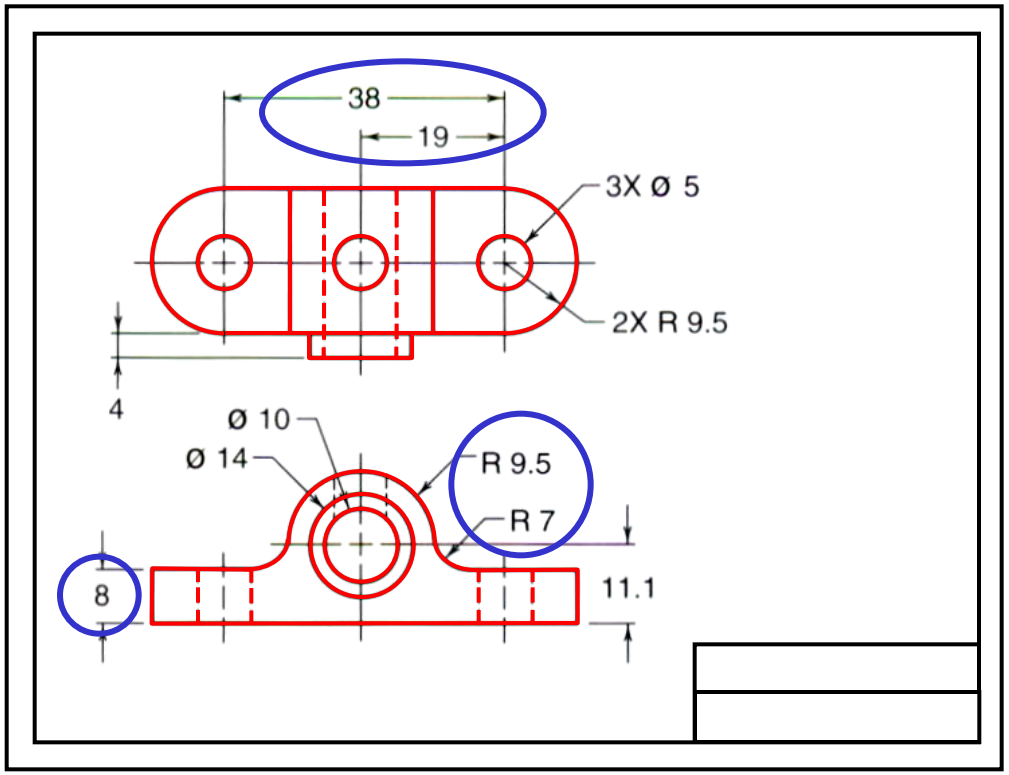
Drawing comprises of ***graphics language*** and ***word language***.

Graphics language

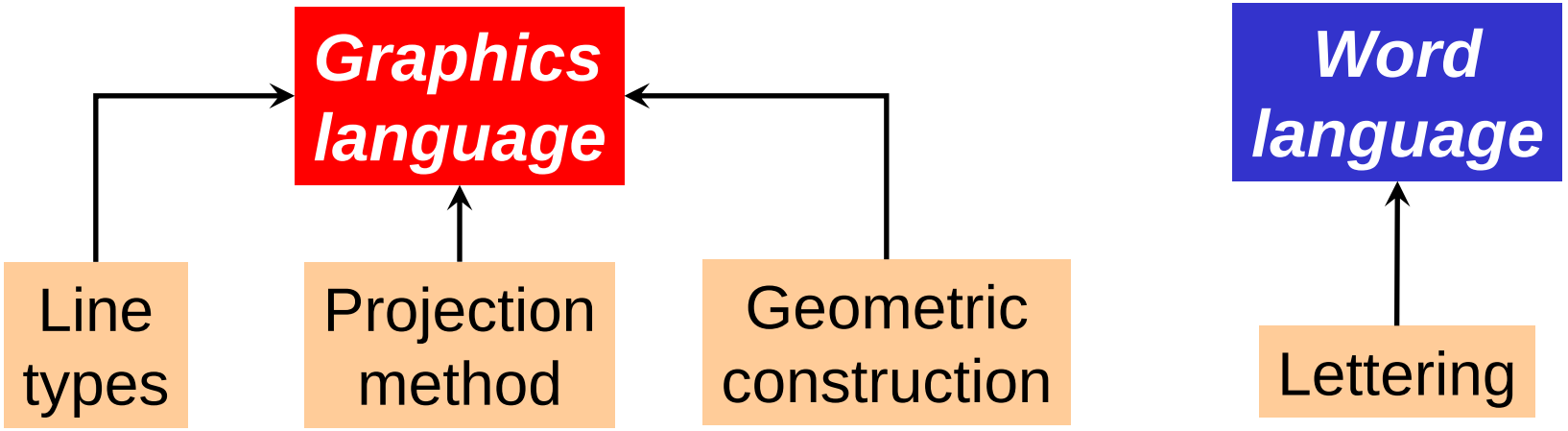
Describe a shape (mainly).

Word language

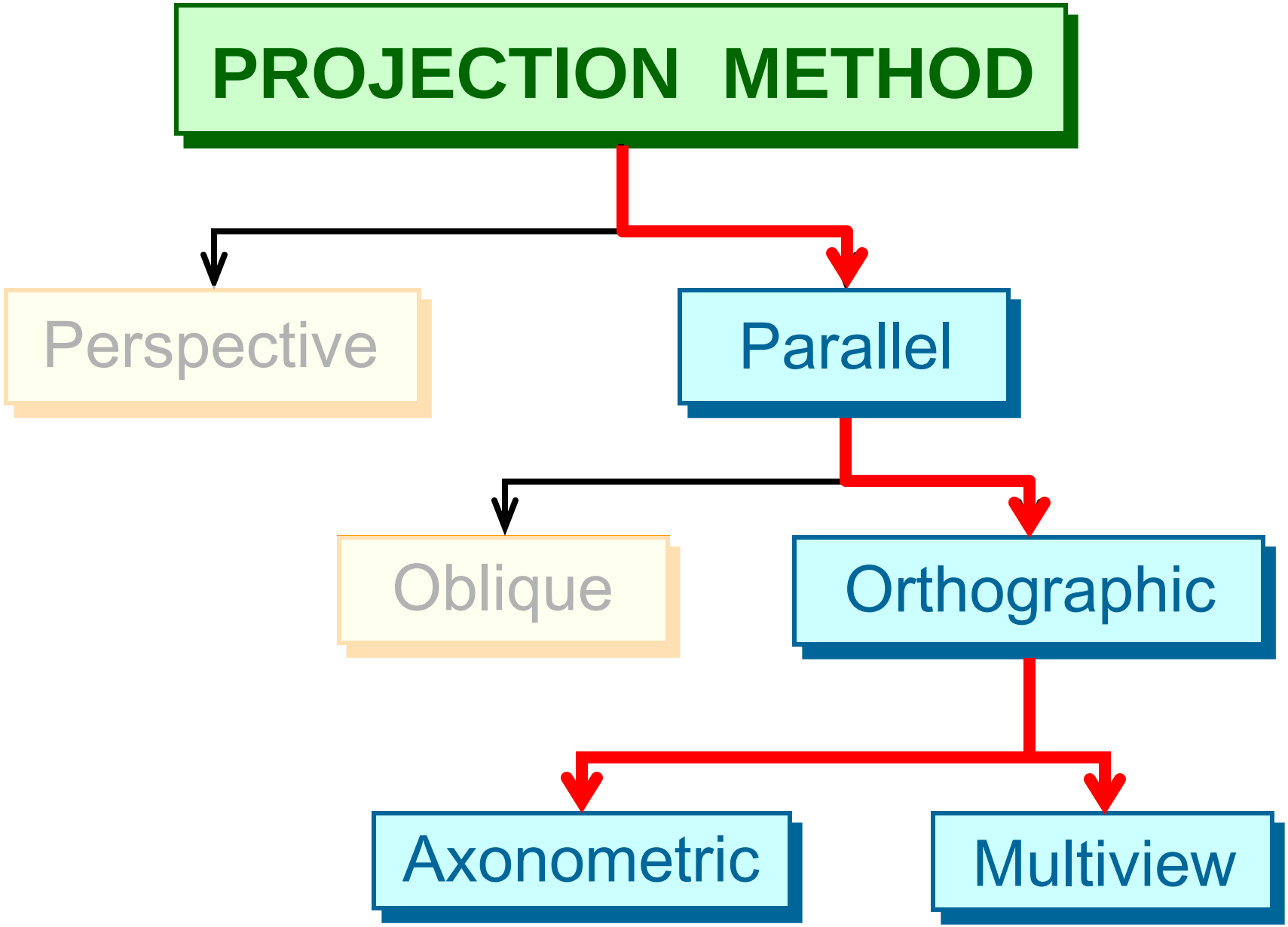
Describe size, location and specification of the object.



Basic Knowledge for Drafting



PROJECTION METHOD


PROJECTION METHOD
Perspective
Parallel
Oblique
Orthographic
Axonometric
Multiview

PROJECTION THEORY

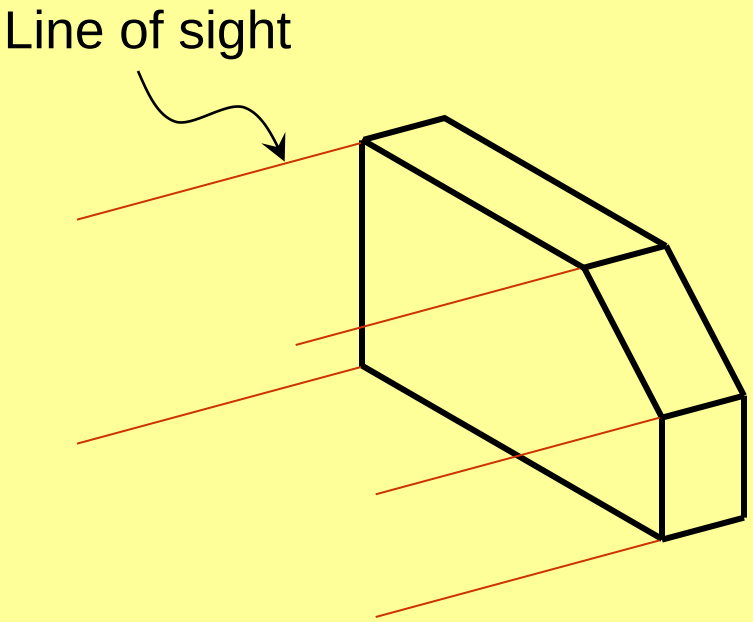
- The projection theory is used to graphically represent 3-D objects on 2-D media (paper, computer screen).

- The projection theory is based on two variables:
  1) Line of sight
  2) Plane of projection (image plane or picture plane)

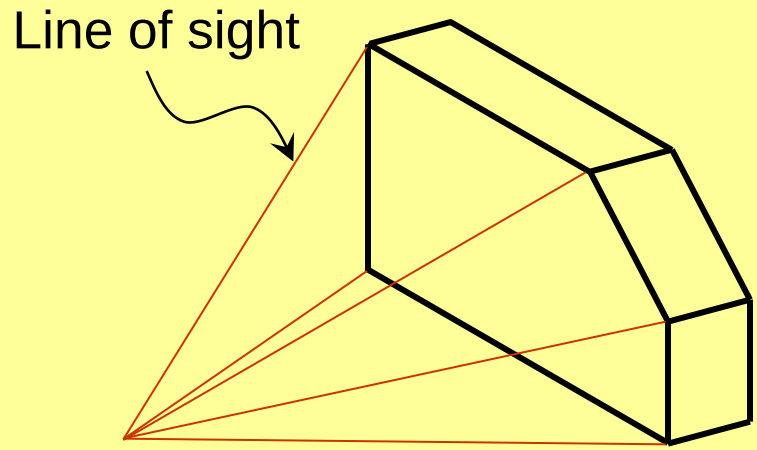
Line of sight is an imaginary ray of light between an observer's eye and an object.

- There are 2 types of LOS : parallel and converge

Parallel projection



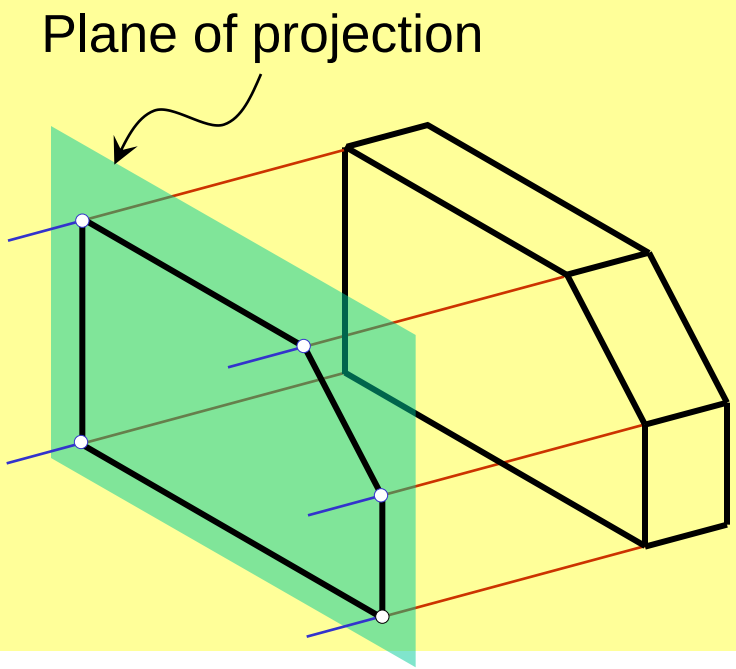
Perspective projection



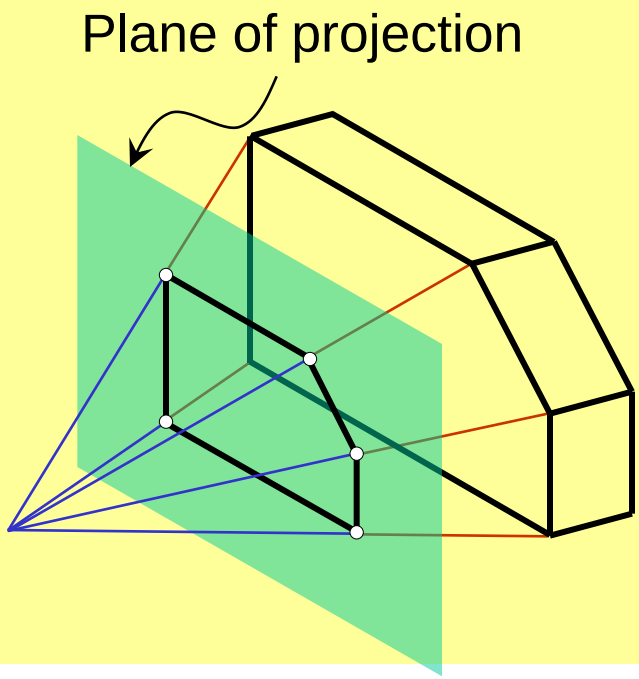
Plane of projection is an imaginary flat plane which the image is created.

- The image is produced by connecting the points where the LOS pierce the projection plane.

Parallel projection

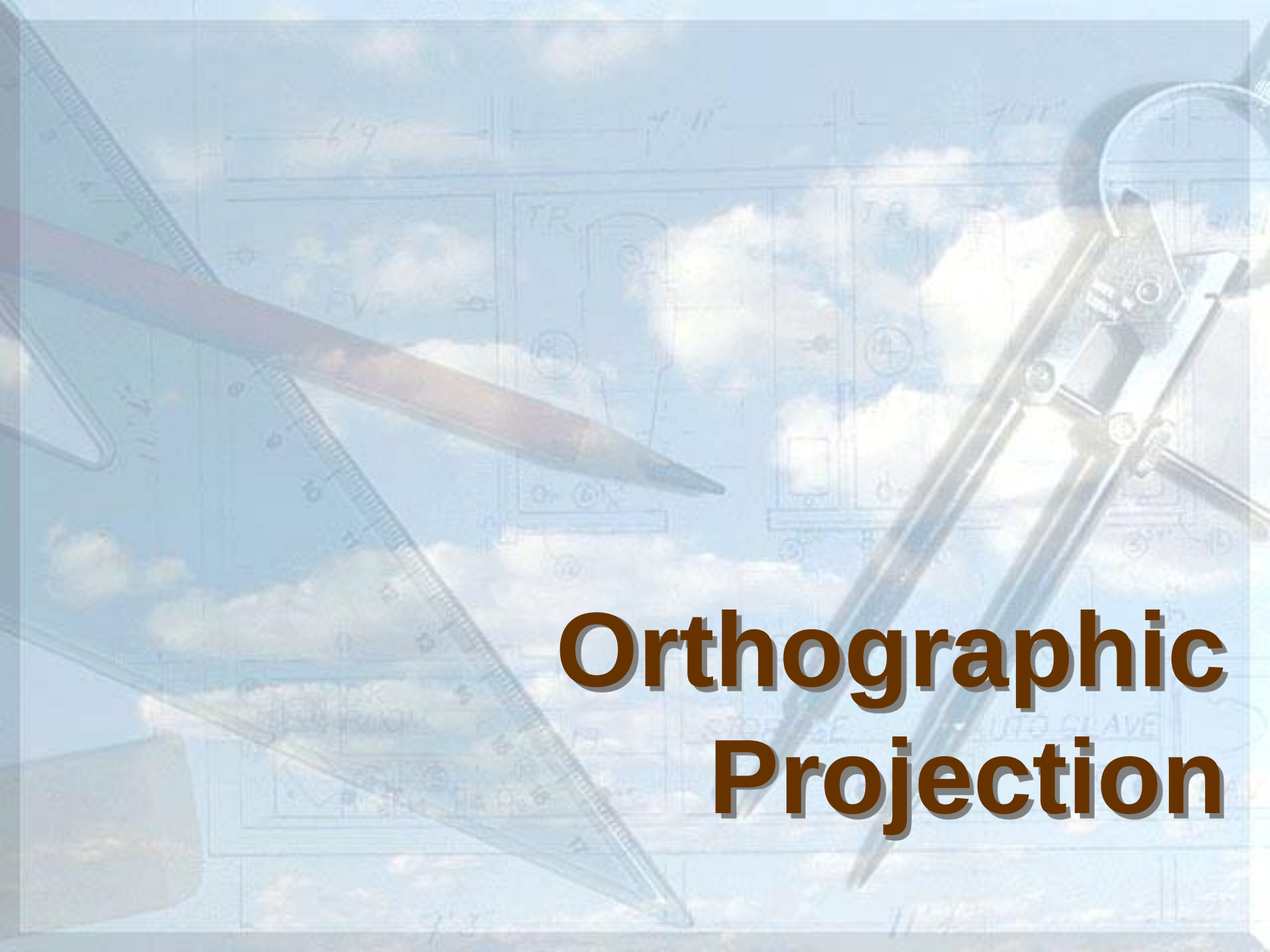


Perspective projection



Disadvantage of Perspective Projection

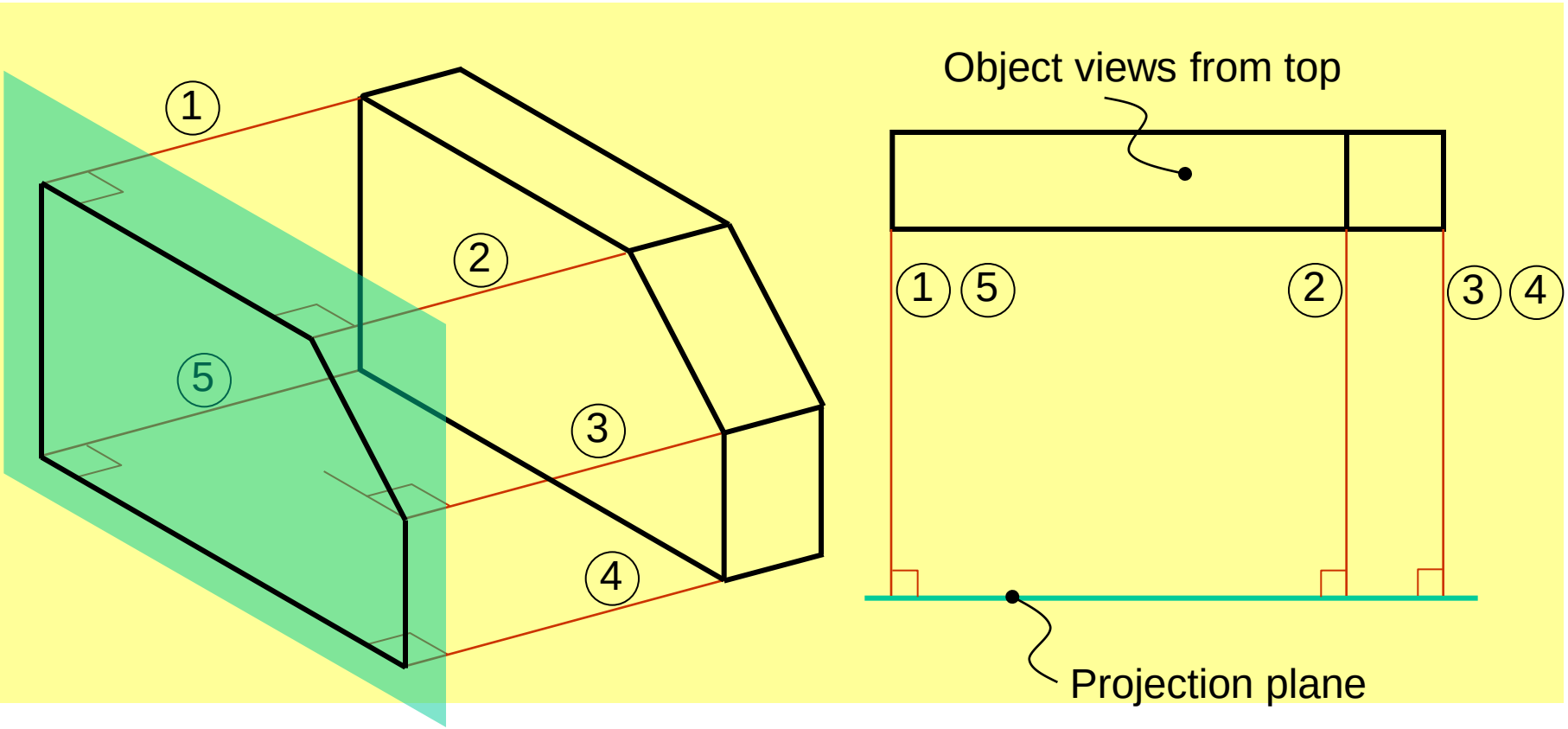
1) It is difficult to create.
2) It does not reveal exact shape and size.



Orthographic Projection

MEANING

Orthographic projection is a parallel projection technique in which the parallel lines of sight are ***perpendicular*** to the projection plane



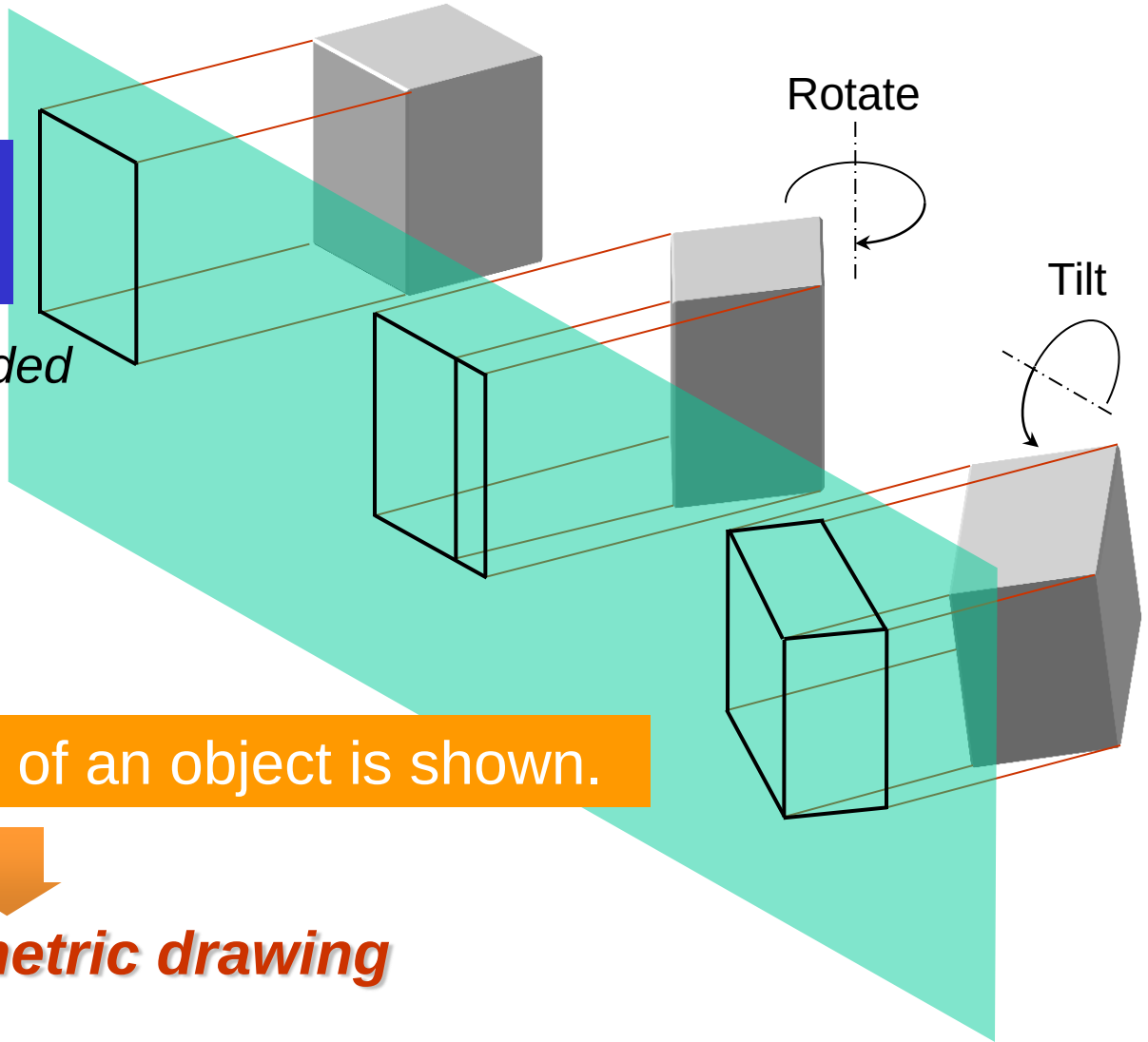
ORTHOGRAPHIC VIEW

Orthographic view depends on relative position of the object to the line of sight.

Two dimensions of an object is shown.

More than one view is needed to represent the object.

Multiview drawing



Three dimensions of an object is shown.

Axonometric drawing

ORTHOGRAPHIC VIEW

NOTES

- Orthographic projection technique can produce either

  1. ***Multiview drawing***
     that each view show an object in two dimensions.

  2. ***Axonometric drawing***
     that show all three dimensions of an object in one view.

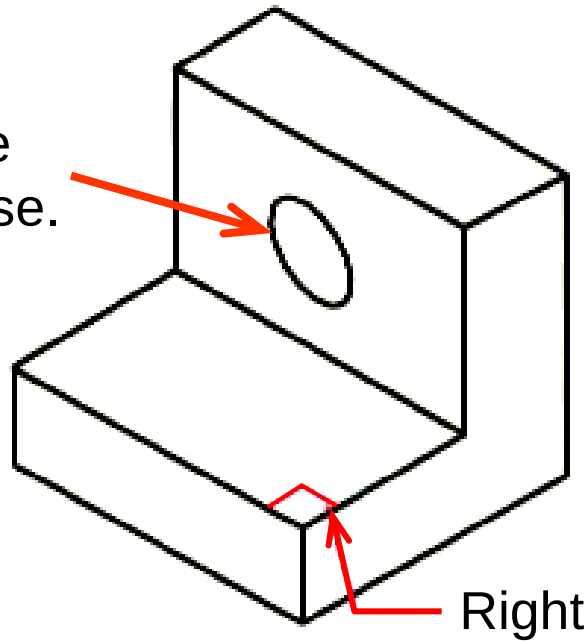
- Both drawing types are used in technical drawing for communication.

Axonometric (Isometric) Drawing

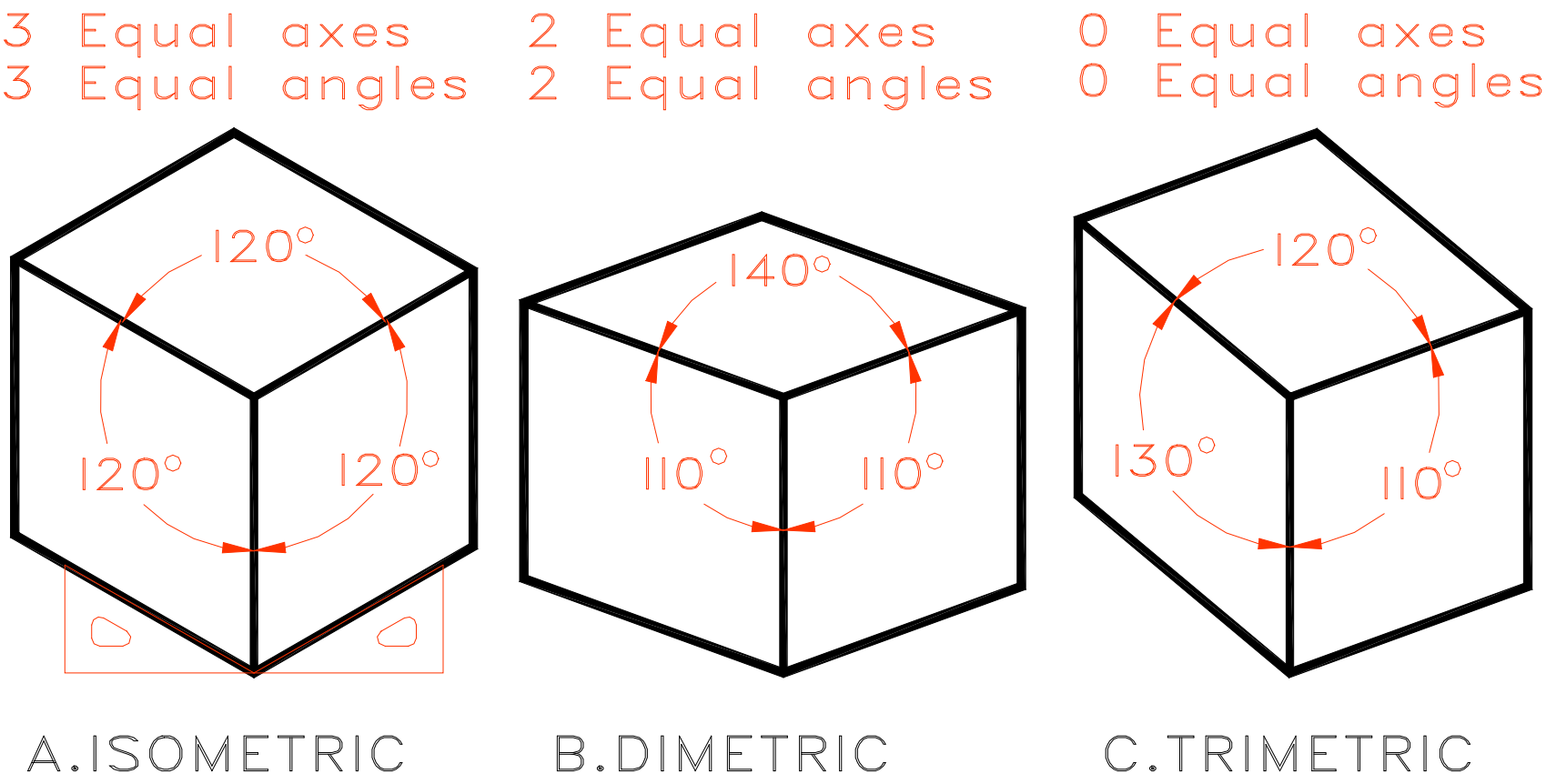
Advantage Easy to understand

Disadvantage Shape and angle distortion

Example Distortions of shape and size in isometric drawing



Types of Axonometrics

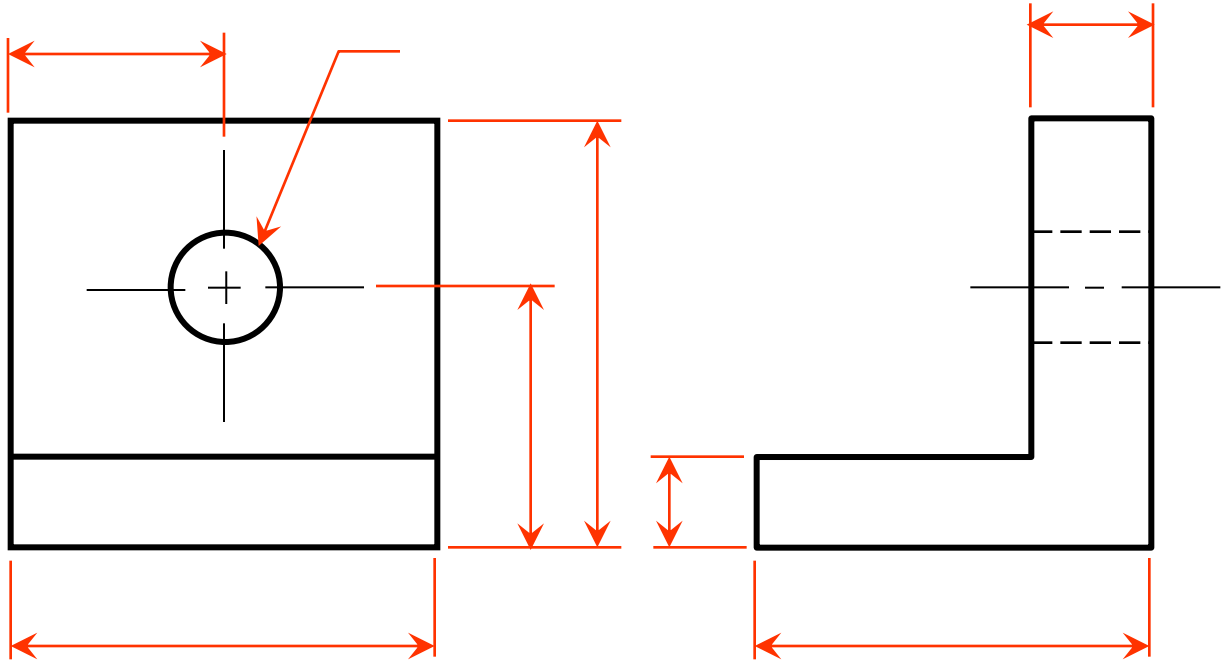


Multiview Drawing

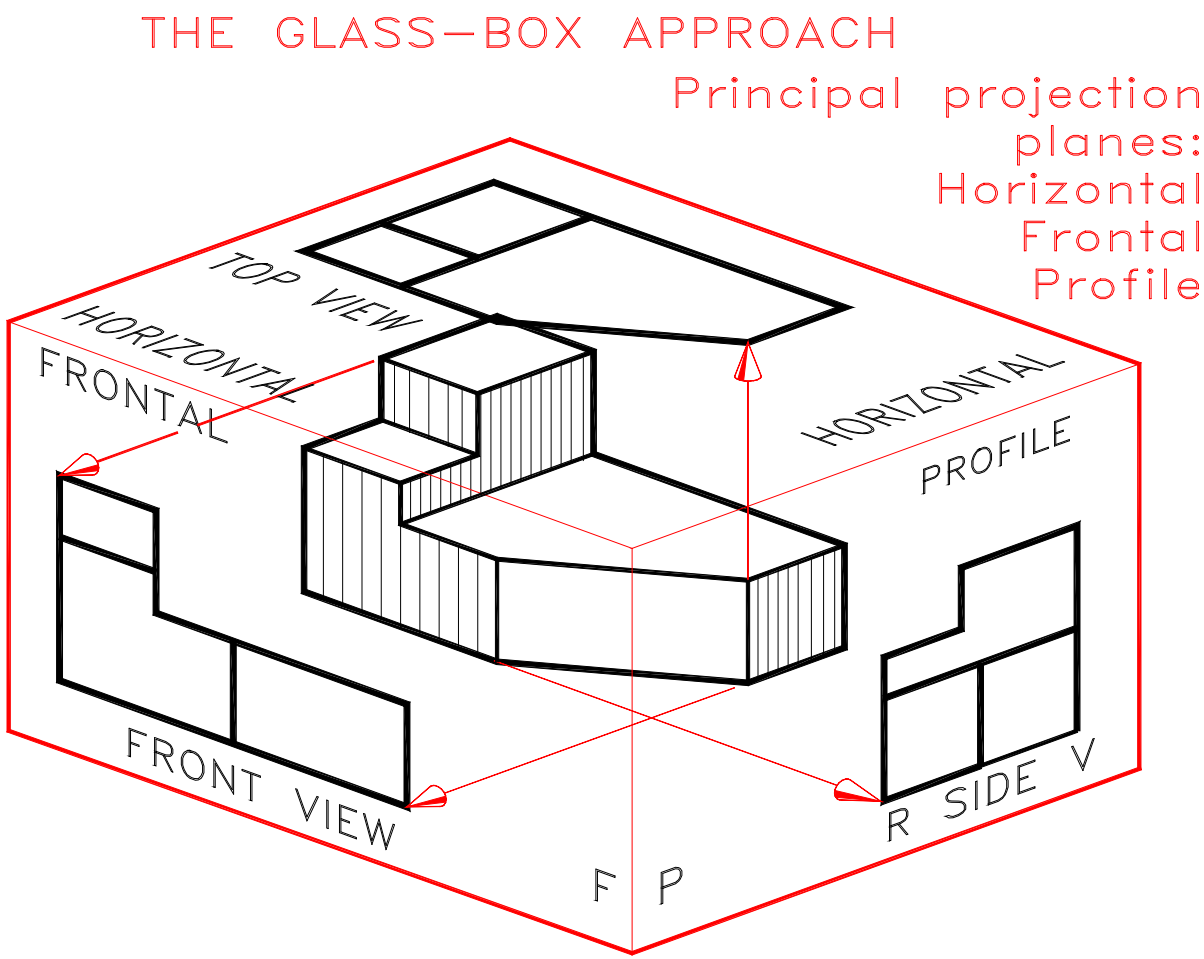
Advantage It represents accurate **shape and size.**

Disadvantage Require practice in writing and reading.

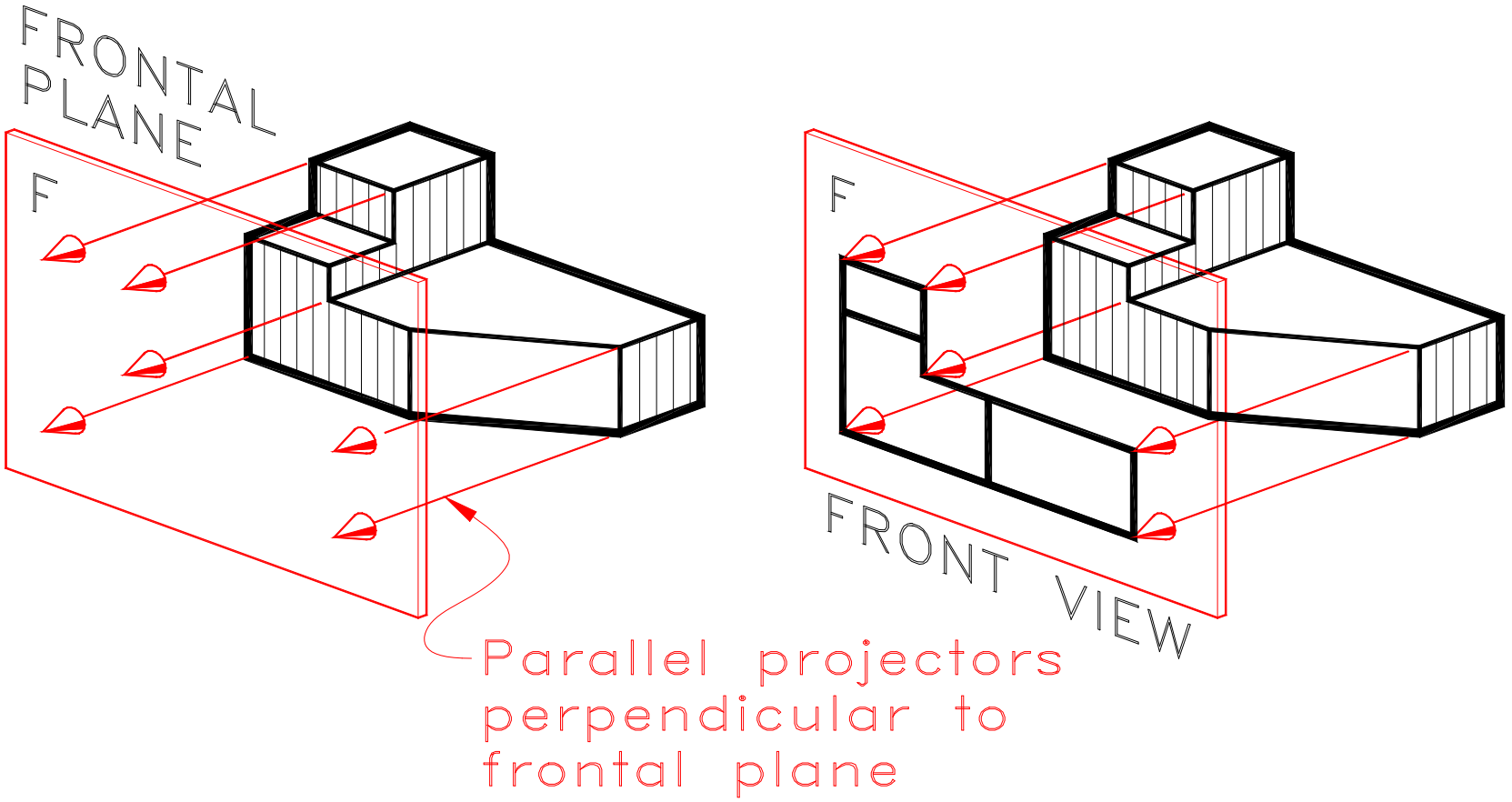
Example Multiviews drawing (2-view drawing)



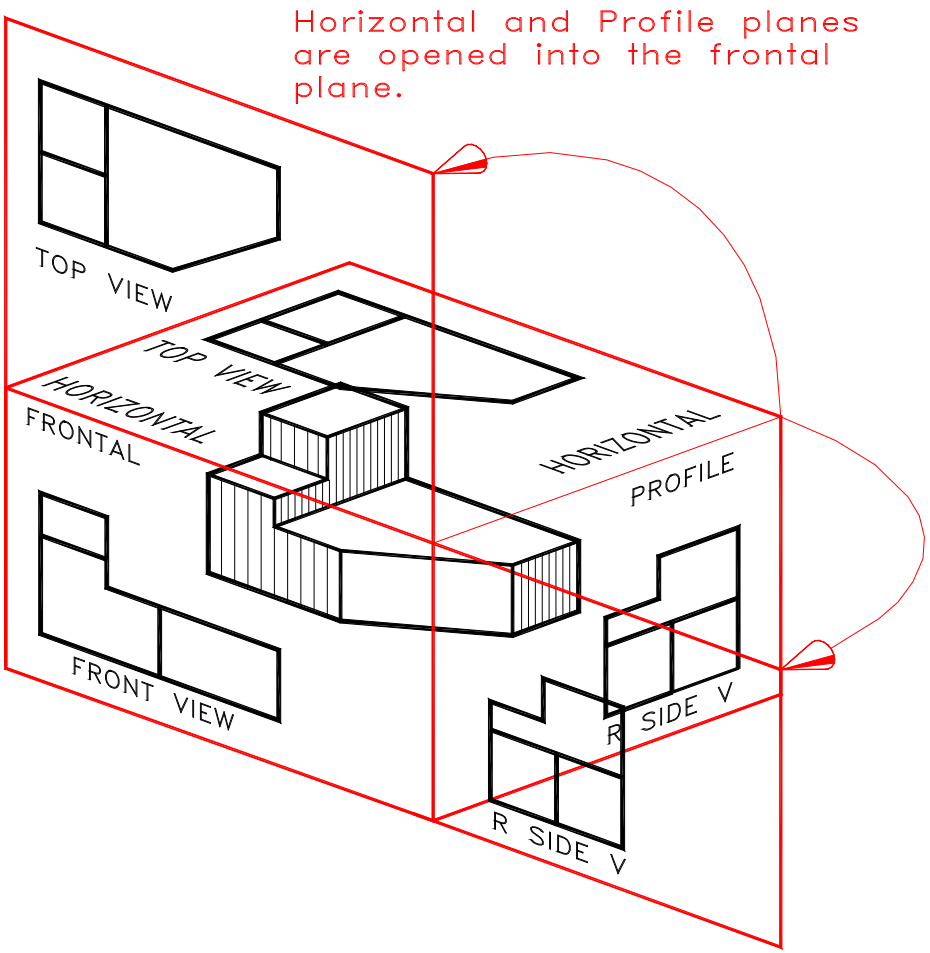
The Glass Box Approach



Orthographic Projection

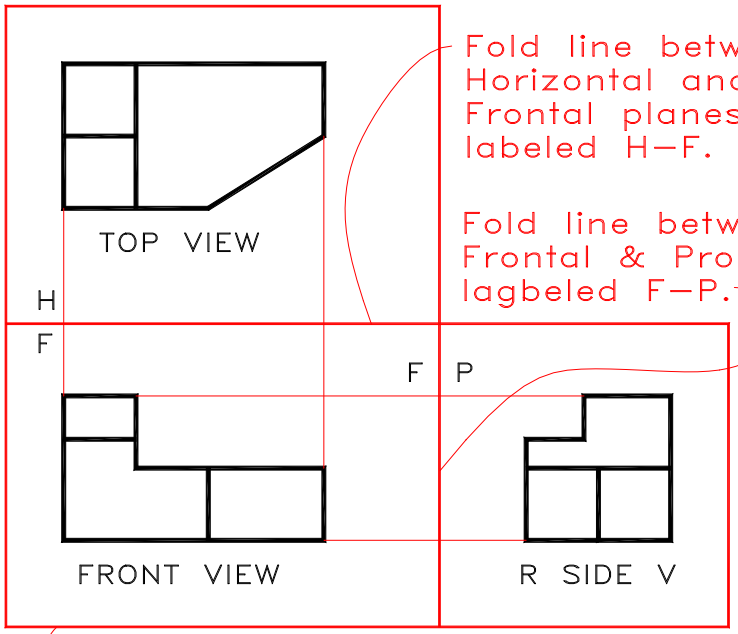


Opening the Box



Final Views

The standard arrangement of three orthographic views:
Top View above the Front View
R Side View right of the Front View



Fold line between Horizontal and Frontal planes labeled H–F.

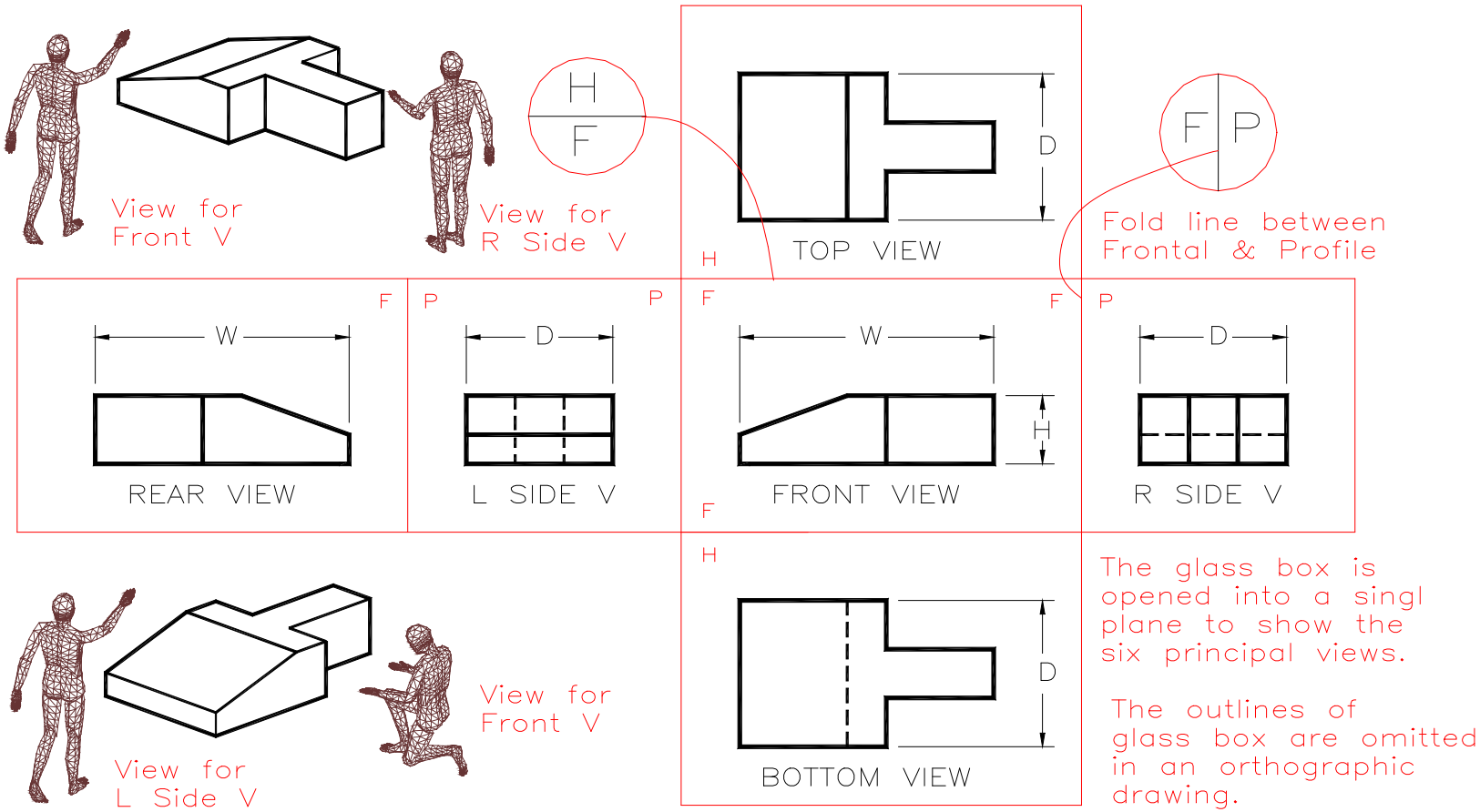
Fold line between Frontal & Profile lagbeled F–P.

Views project to adjacent views.

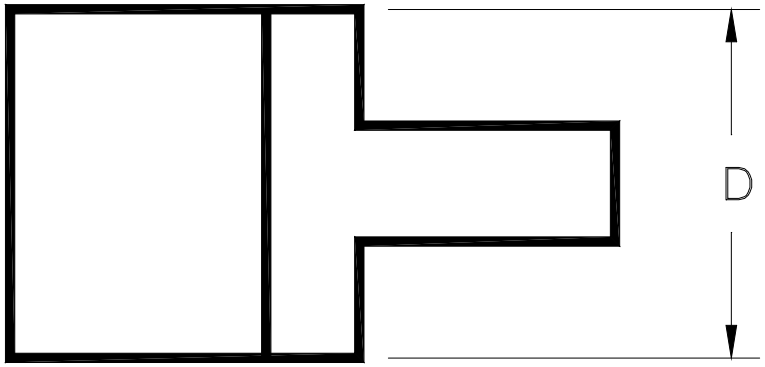
Outlines of projection planes are omitted in final drawings.

Six Orthographic Views

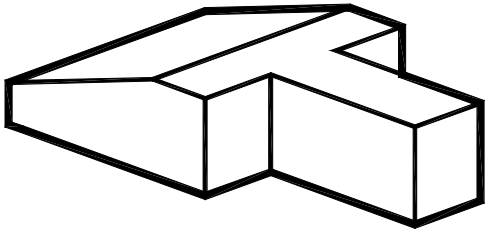
Laying Out All Six Views

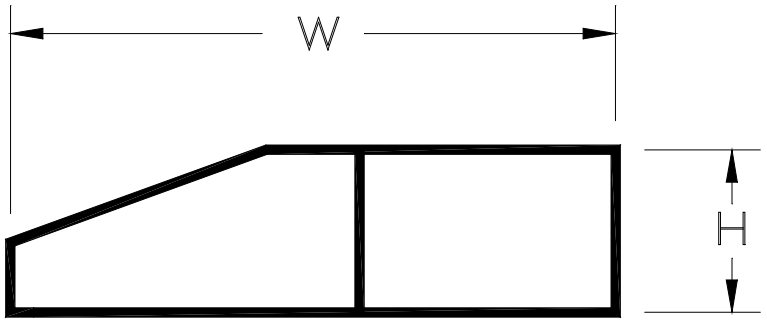


Three Primary Views

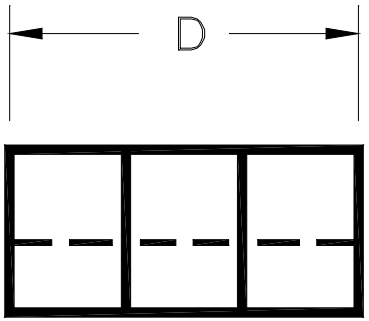


TOP VIEW



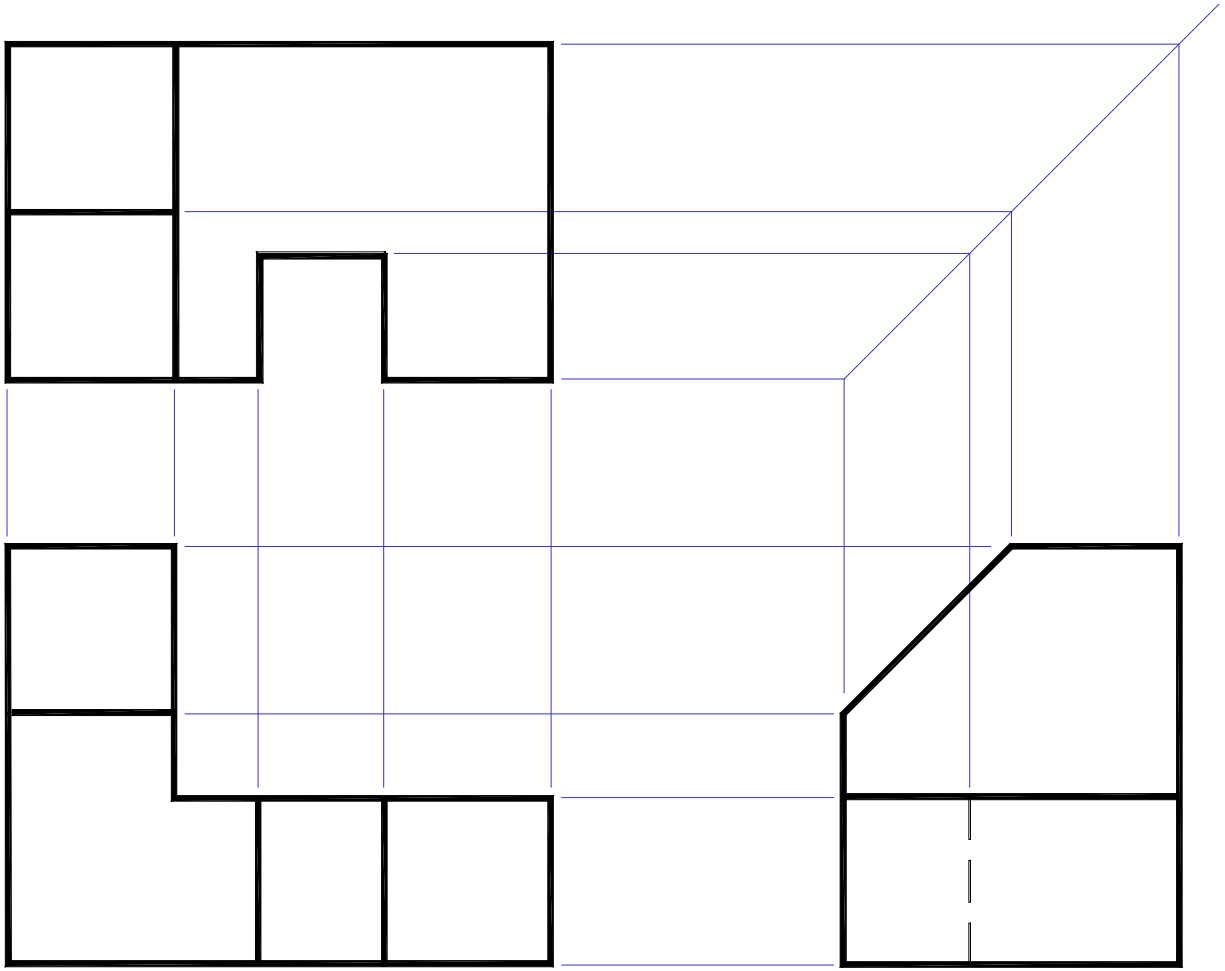


FRONT VIEW

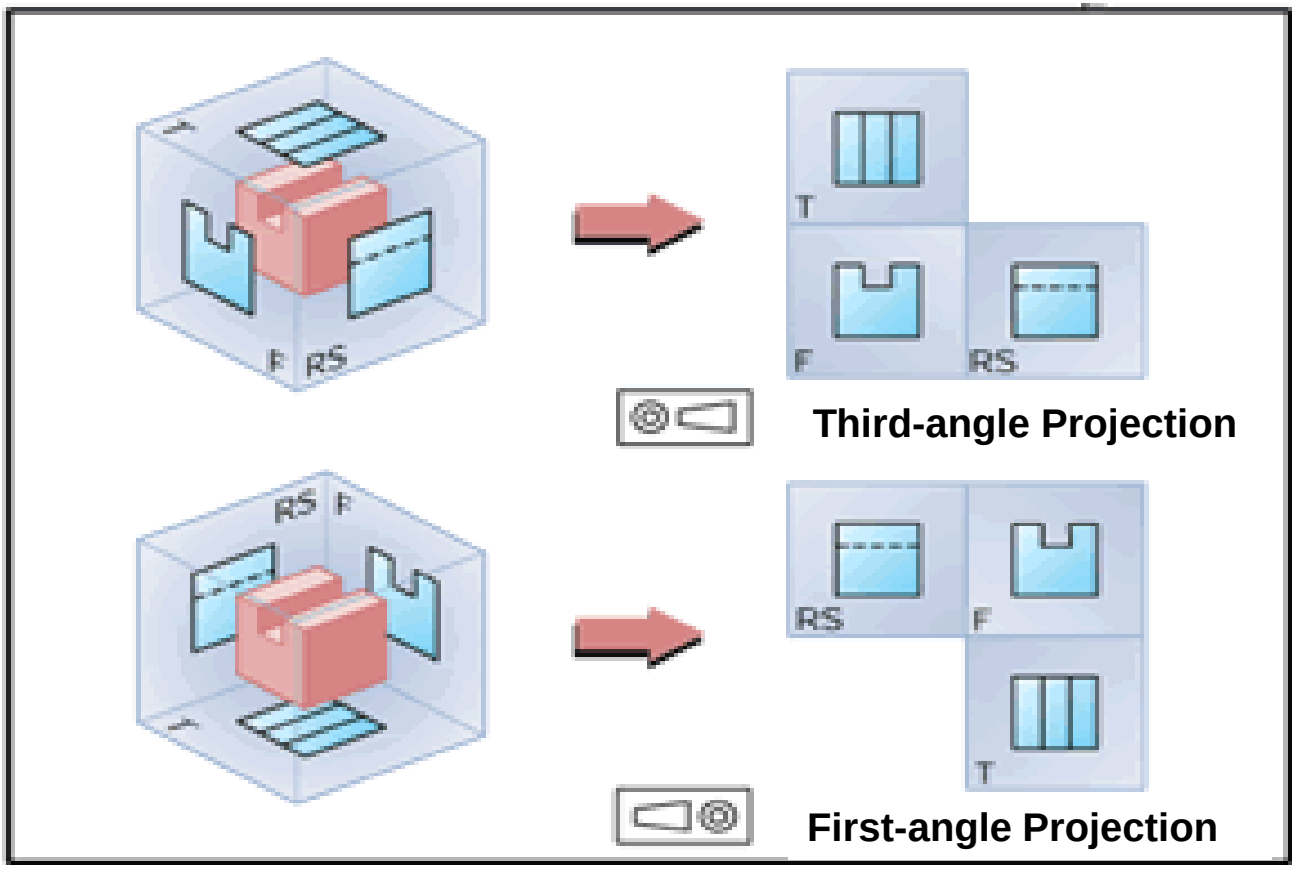


R SIDE V

Construction of Views



First and Third Angle Projections



- First Angle – International
- Third Angle – U.S.

Basic Line Types

Types of Lines	Appearance	Name according to application
Continuous thick line		Visible line
Continuous thin line		Dimension line Extension line Leader line
Dash thick line		Hidden line
Chain thin line		Center line

Meaning of Lines

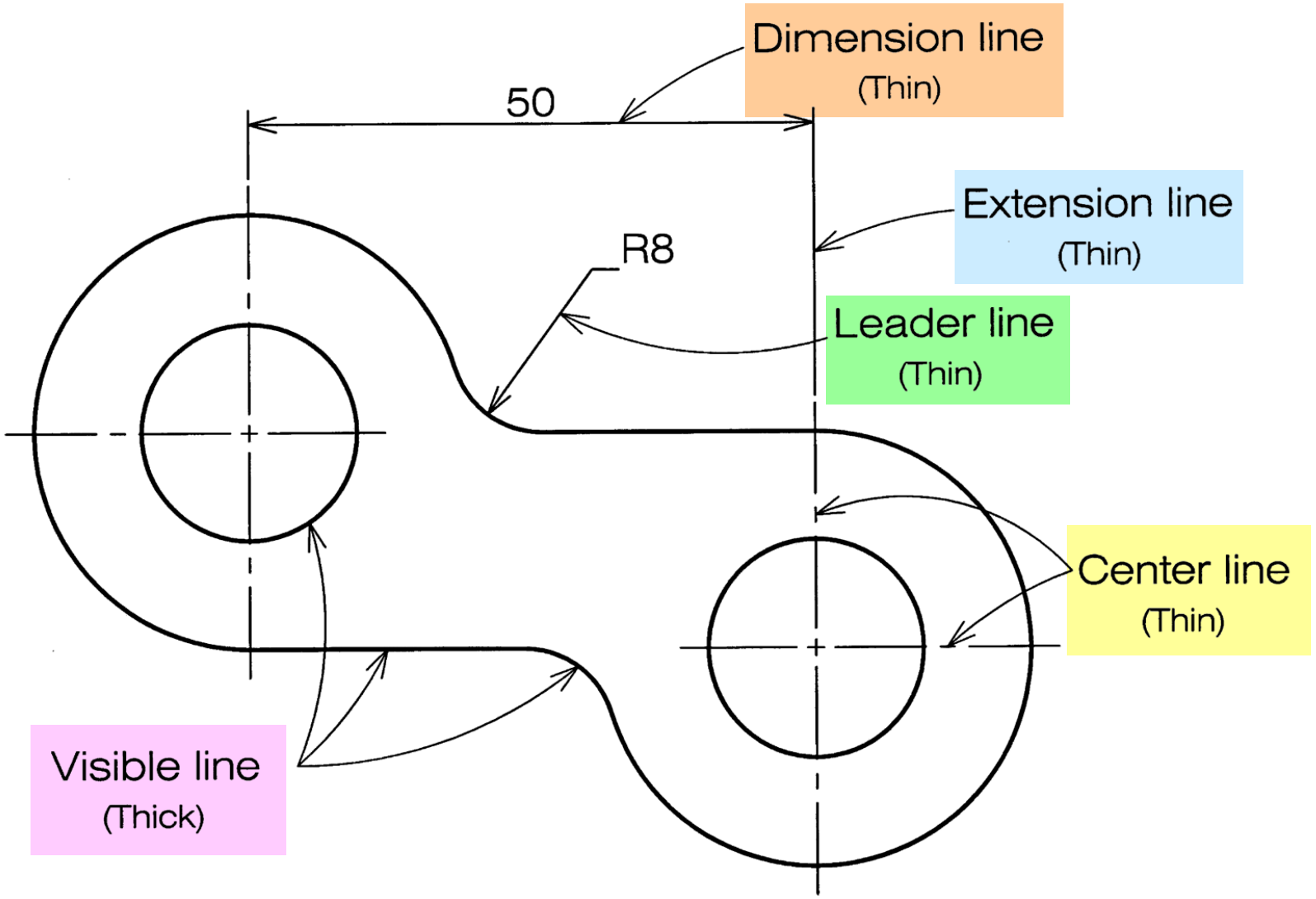
Visible lines represent features that can be seen in the current view

Hidden lines represent features that can not be seen in the current view

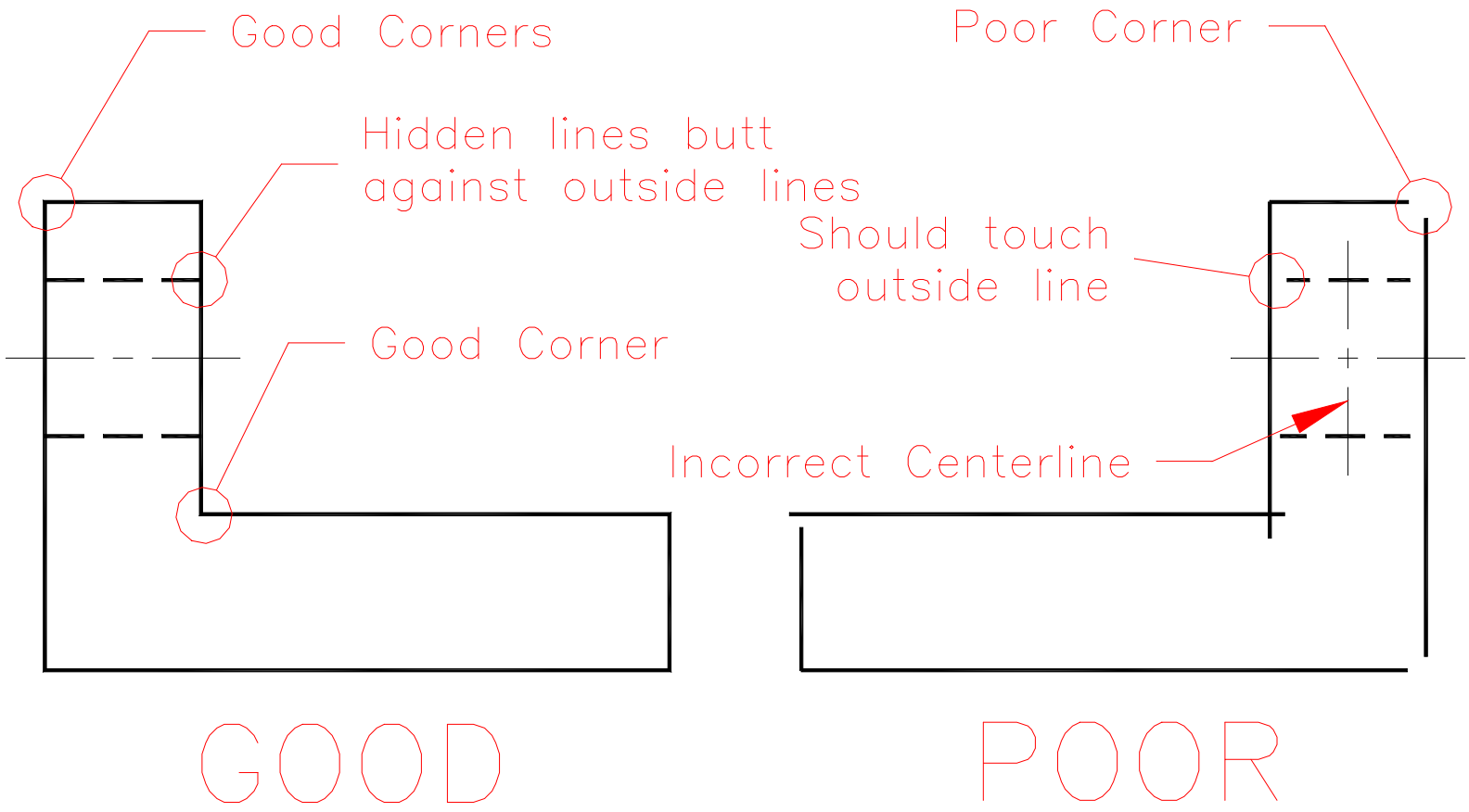
Center line represents symmetry, path of motion, centers of circles, axis of axisymmetrical parts

Dimension and Extension lines indicate the sizes and location of features on a drawing

Example : *Line conventions in engineering drawing*



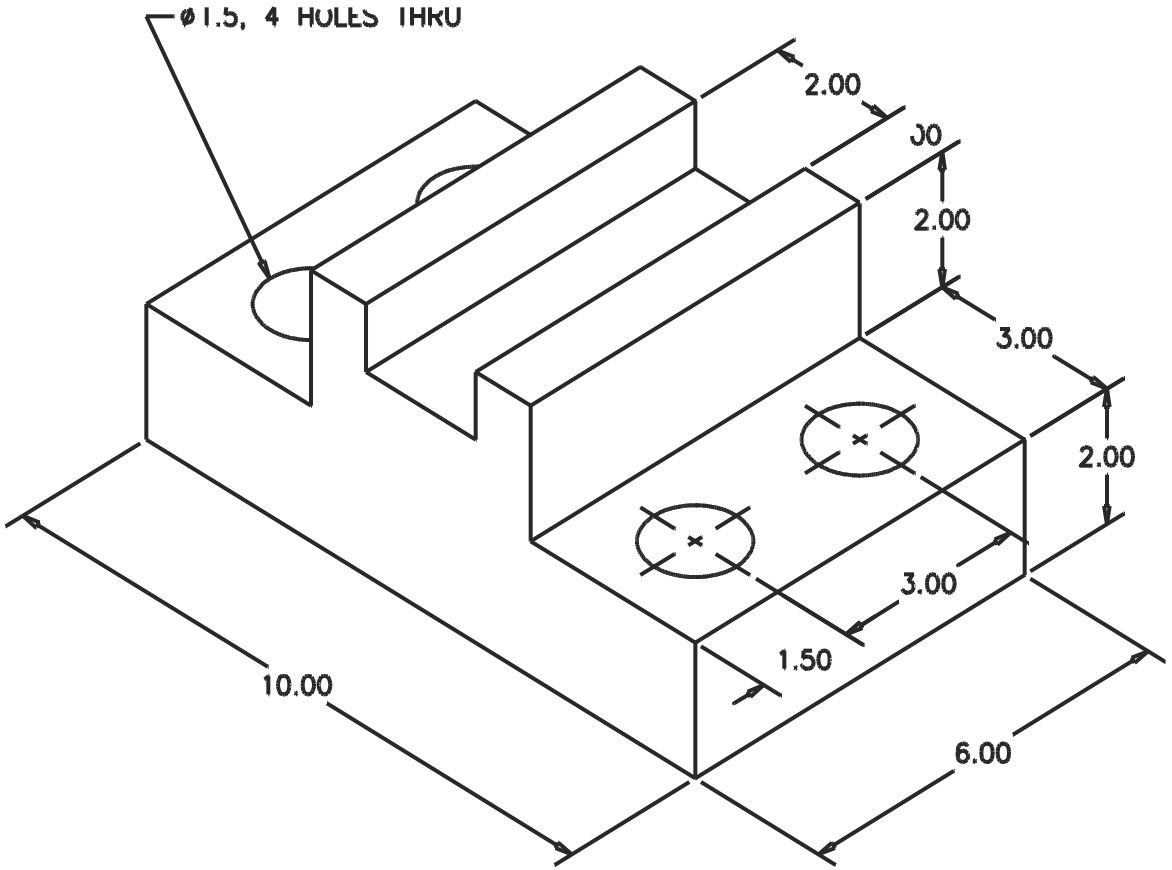
Good practice



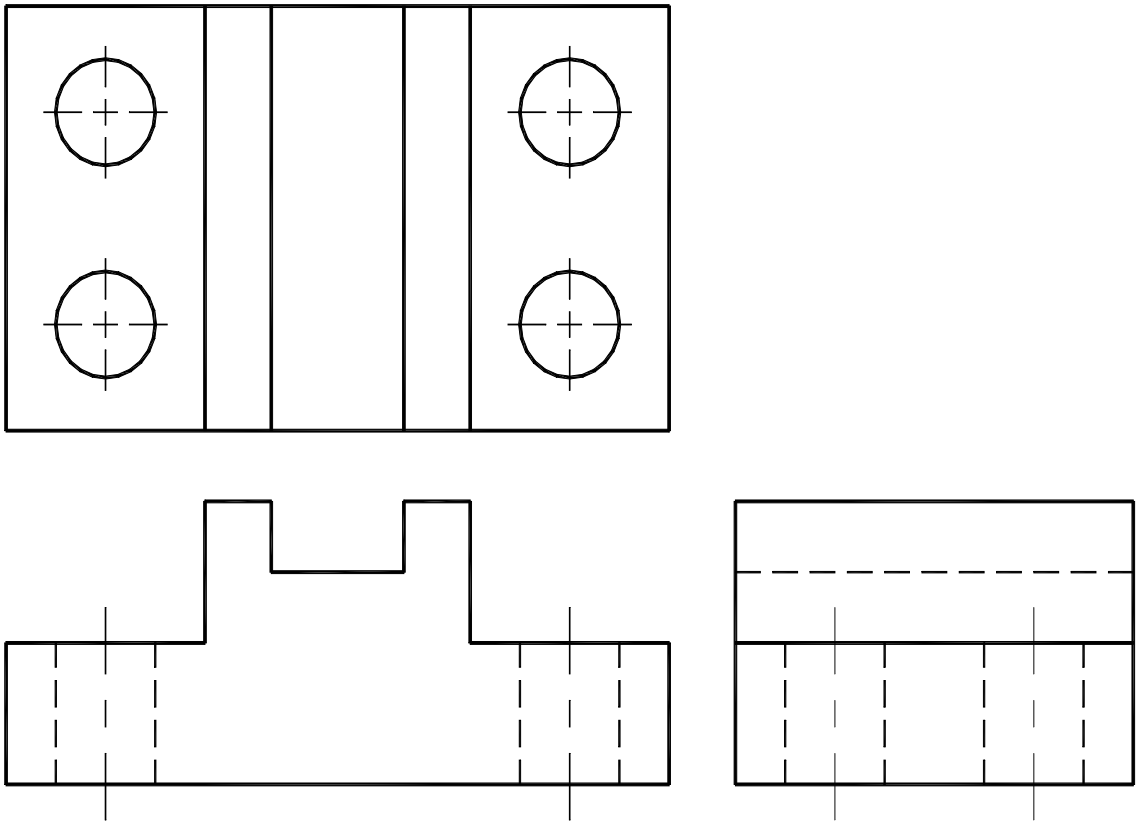
Exercise

- Complete three orthographic views of the object shown on the next slide.
- Include visible, hidden, and center lines where appropriate.
- You will be given 7 minutes.

Object for exercise



Solution



Drawing Standard

Introduction

Standards are set of rules that govern how technical drawings are represented.

- Drawing standards are used so that drawings convey the same meaning to everyone who reads them.

Standard Code

Country	Code	Full name
USA	ANSI	**A**merican **N**ational **S**tandard **I**nstitute
Japan	JIS	**J**apanese **I**ndustrial **S**tandard
UK	BS	**B**ritish **S**tandard
Australia	AS	**A**ustralian **S**tandard
Germany	DIN	**D**eutsches **I**nstitut für **N**ormung
	ISO	**I**nternational **S**tandards **O**rganization

Partial List of Drawing Standards

Code number	Contents
JIS Z 8311	***Sizes and Format of Drawings***
JIS Z 8312	***Line Conventions***
JIS Z 8313	***Lettering***
JIS Z 8314	***Scales***
JIS Z 8315	Projection methods
JIS Z 8316	Presentation of Views and Sections
JIS Z 8317	Dimensioning

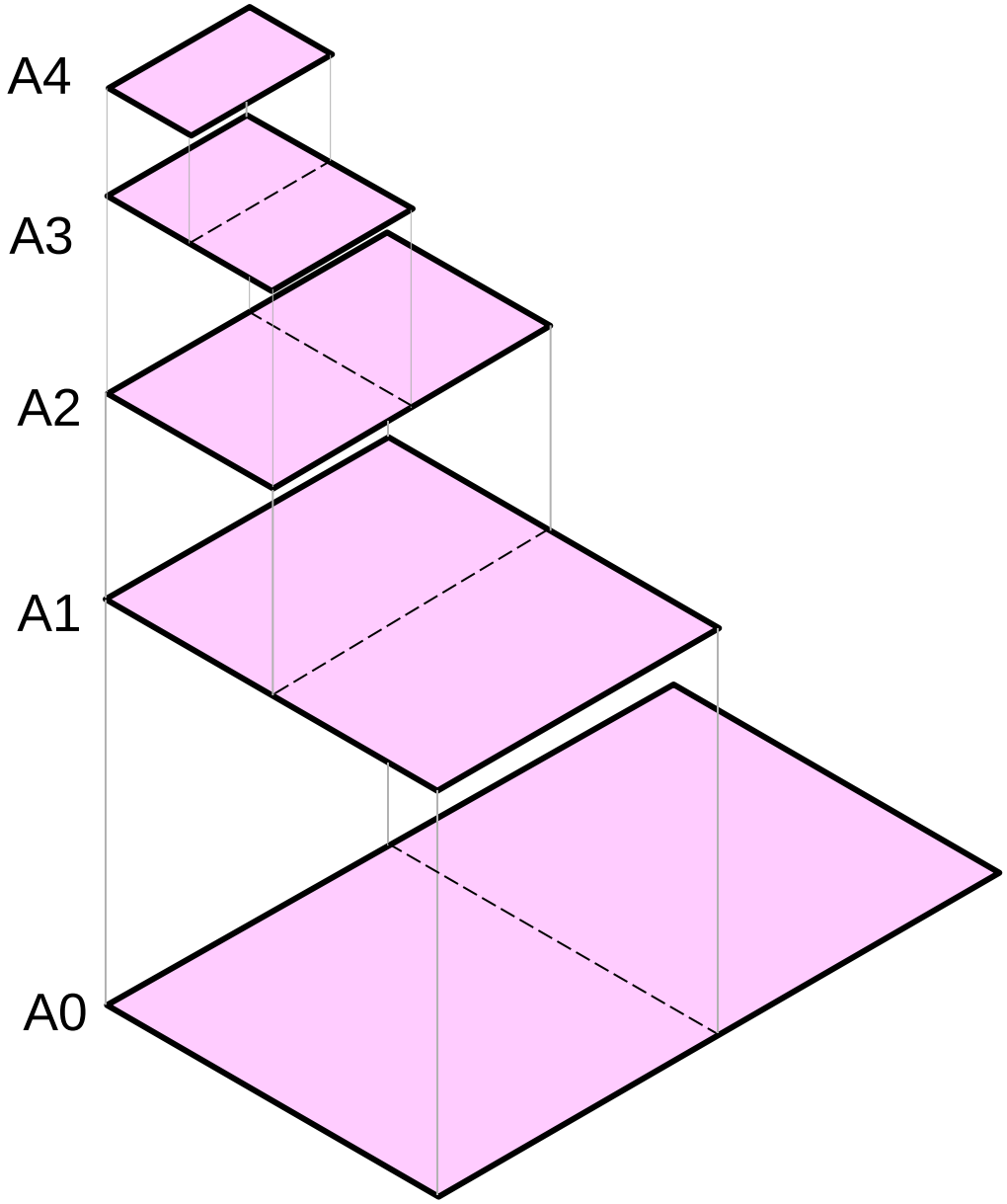
Drawing Sheet

- Trimmed paper of a size A0 ~ A4.

- Standard sheet size (**JIS**)

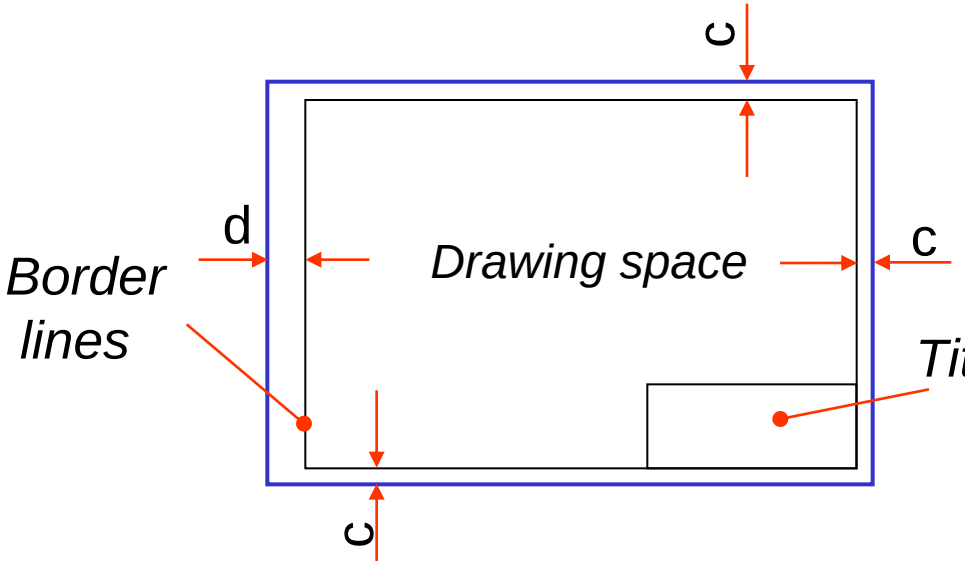
A4	210 x 297
A3	297 x 420
A2	420 x 594
A1	594 x 841
A0	841 x 1189

(Dimensions in millimeters)

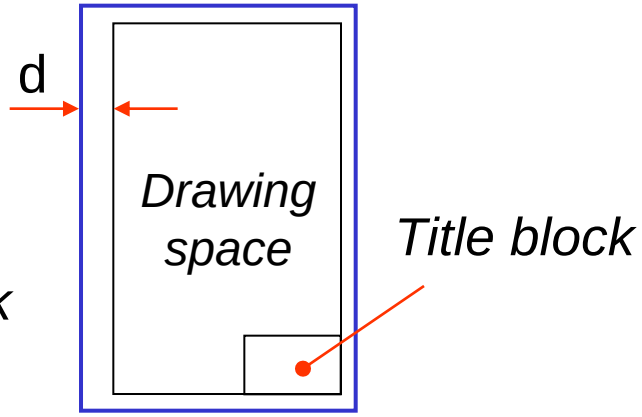


Orientation of drawing sheet

1. Type X (A0~A4)



2. Type Y (A4 only)

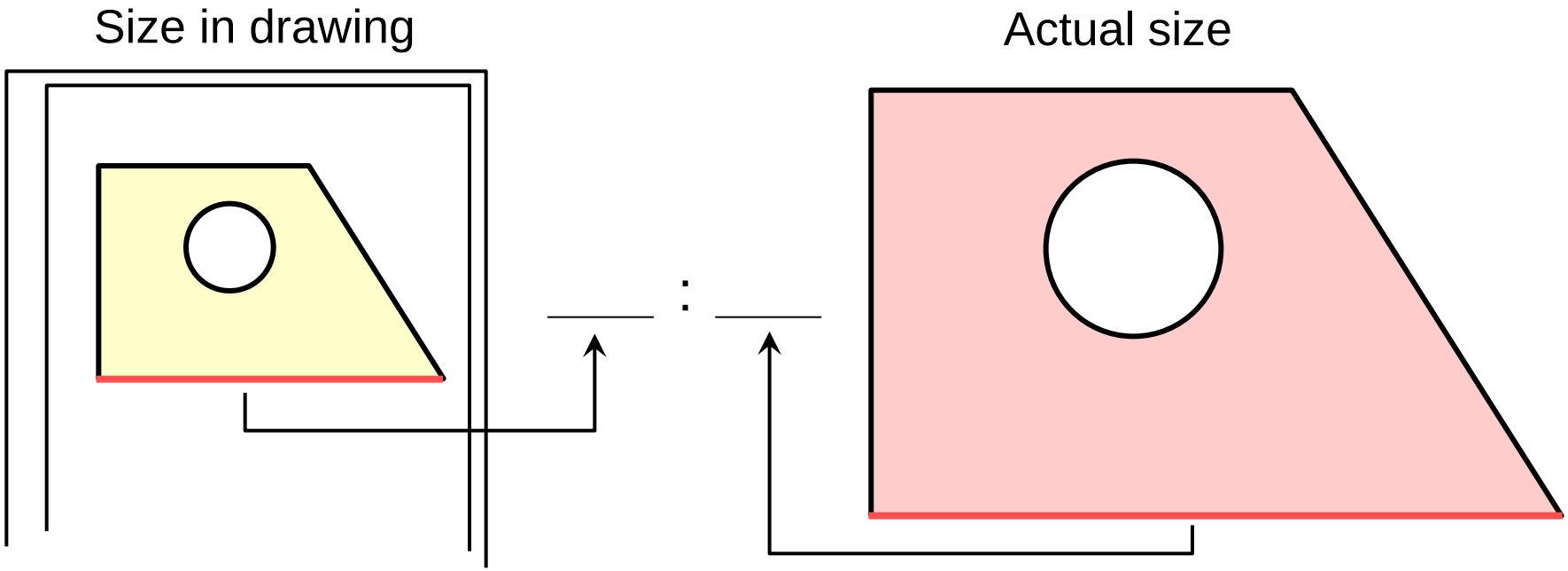


Sheet size	c (min)	d (min)
A4	10	25
A3	10	25
A2	10	25
A1	20	25
A0	20	25

Drawing Scales

Length, size

Scale is the ratio of the linear dimension of an element of an object shown in the drawing to the real linear dimension of the same element of the object.



Drawing Scales

- Designation of a scale consists of the word “SCALE” followed by the indication of its ratio, as follow

SCALE 1:1 for full size

SCALE **X**:1 for ***enlargement*** scales

SCALE 1:**X** for ***reduction*** scales