

CE-101

**CIVIL ENGINEERING  
DRAWING**

# CE-10L CIVIL ENGINEERING DRAWING

- Introduction of Engineering Drawing.
- Introduction to drawing instruments.
- Conceptual drawing, (Orthographic sketches).
- Sections of Structural components (beams of different types, columns, slabs etc), Architectural Symbols.
- Preparation of Plans, Elevations and Sections for simple buildings. Covered area specification of various development authorities.
- Foundations, DPC Roof, Floor and other parts of a simple building.
- Design of buildings, design of a single and Double storey house, Boundary wall, Check post, Low cost house, Stair case, Plumbing, sanitation and electrification plans for houses.

# COURSE BREAKUP

Week	Description	Task	Lab
1	Introduction of Engineering Drawing.		
2	Introduction to drawing instruments.		Instruments and stokes.
3	Introduction to drawing instruments.	A#1	Lines/Shapes
4	Conceptual drawing, (Orthographic sketches).		Soap Modeling
5	Conceptual drawing, (Orthographic sketches).		Soap Modeling
6	Sections of Structural components and Architectural Symbols.	Q#1	Symbols
7	Covered area specification of various development authorities.	A#2	Site Plan
8	Preparation of Plans, Elevations and Sections for simple buildings.	A#3	Scales/Sheet Setting
MID EXAM			

# COURSE BREAKUP

Week	Description	Task	Lab
9	Foundations, DPC Roof, Floor and other parts of a simple building.		Drawings
10	Boundary wall	Q#2	Drawings
11	Check post		Drawings
12	Low cost house,	A#4	Drawings
13	Design of a single storey house	A#5	Drawings
14	Stair case,	Q#3	Drawings
15	Plumbing and sanitation plans for houses.		Drawings
16	Electrification plans for houses.	A#6	Drawings
AND THEN FINAL EXAM			

# INTRODUCTION

- ⦿ Engineering drawing, also called technical drawing and engineering graphics, is the graphical representation of shape of any physical object which may be a part of a machine, a building, a dam, or any other complicated structure.
- ⦿ The shape of some simple objects like spheres, cubes, cylinder, etc., may be described in words and sentences but ordinary language fails for complicated objects.



**Language/System of Communication**

# INTRODUCTION

- Even if a thick book is written to describe the shape of a building, the reader will not be able to conceive the exact shape of that building with all its minor details.
- It can be safely said that it is almost impossible to describe the shape of an object in words and hence only three methods are left for the purpose namely camera photographs, models and drawings.

# Elements of Engineering Drawing

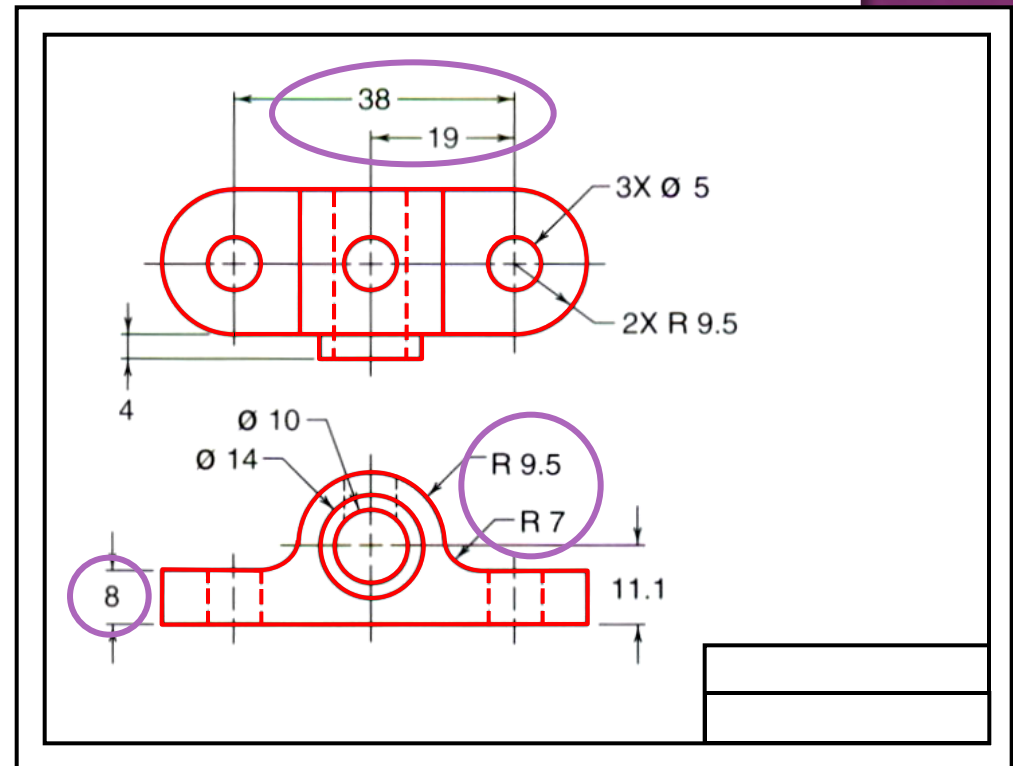
Engineering drawing are made up of **graphics language** and **word language**.

## Graphics language

Describe a shape (mainly).

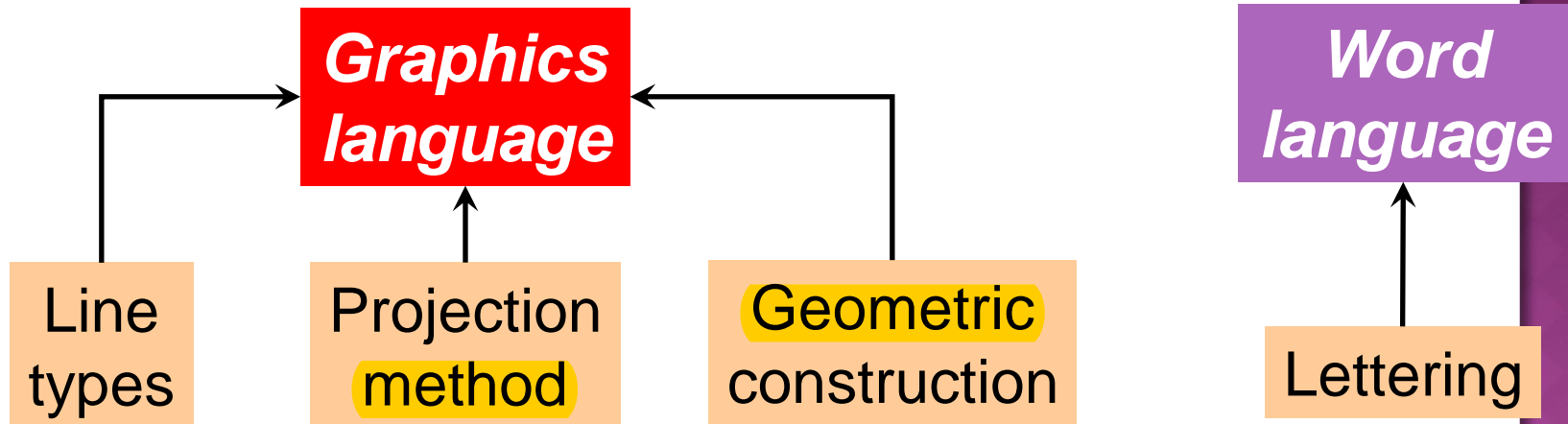
## Word language

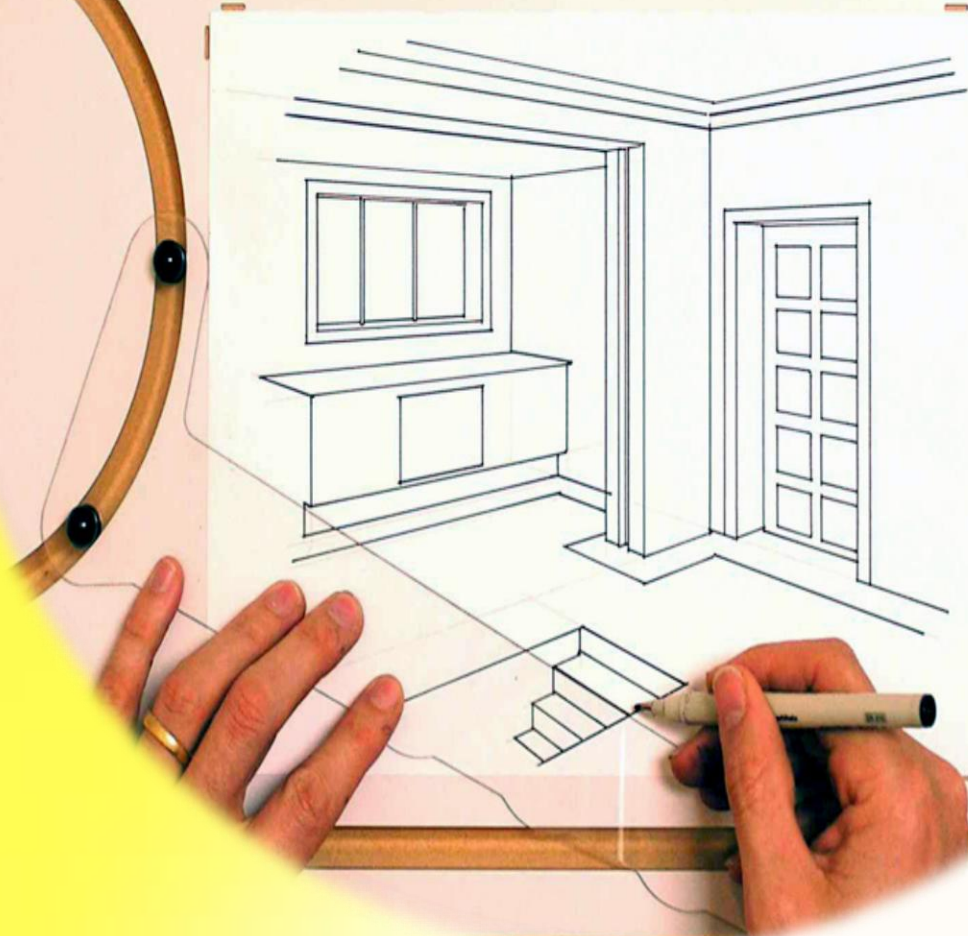
Describe size, location and specification of the object.





# Basic Knowledge for Drafting





- Camera photographs
- Models
- Drawing

**HOW!!!!!!!!!!!!**

# INTRODUCTION

- ⦿ Camera photographs can only be used to communicate the shape of existing structures but not the shape or design still in the mind of the designer. Further these photographs do not show all the inner details and actual dimensions are not communicated.

## INTRODUCTION

- ◎ Models, usually made up of wood, polystyrene, soap, plastic, etc., are perhaps the best tool for description of the shape but these are generally used for explaining finished outer shapes of the structures to non-engineering persons. Sometimes models, made smaller in size, are also used to carry out performance study of bigger structures like canals, dams and turbines.



# INTRODUCTION

- The easiest way left to describe an object is to make drawings; simply lines are drawn on a piece of paper according to certain fixed rules. The advantages of engineering drawing are a follows:
  - Complete shape of the object is represented.
  - Inner details may also be shown.
  - Actual time is consumed in making the drawings.

# INTRODUCTION

- Lesser times consumed in making the drawings.
- Relatively lesser training is required for making and understanding the drawings.
- Lesser space is consumed for their storage.
- Drawings may easily be transported from one office to the other. Further these are easy to be handled at the site.
- Once drawings are made, as many copies of these as required may easily be obtained.
- Lesser cost is involved in making drawings.


# INTRODUCTION

- ◉ Consider, for example, the construction of an ordinary house.
- ◉ First an architect will design the building architecturally meaning that sizes of all the component parts (like rooms, stores, kitchen, bathrooms, and almirahs) and their relative positions for easy and comfortable living are decided.
- ◉ This ideas, called design, are represented in some drawings.

# INTRODUCTION

- ⦿ These architectural drawings are then passed over to civil engineer who designs the building structurally meaning that the behavior of the building under *the worst possible loads is studied and thicknesses and materials of construction are specified for beams, roof-slabs, walls and floors, etc.*
- ⦿ A civil engineer has to read the architectural drawings and after some calculations, he has to make drawing to represent his design.



The image features a collection of traditional drafting tools including a T-square, a set square, and a compass, all rendered in a semi-transparent grey style. They are arranged on a background of a detailed architectural blueprint with various lines, text, and symbols. The text 'TRADITIONAL DRAWING TOOLS' is prominently displayed in the lower center in a bold, purple, sans-serif font with a slight drop shadow. A vertical purple bar with a diamond-patterned texture runs along the right edge of the image.

# TRADITIONAL DRAWING TOOLS

## MAIN DRAWING EQUIPMENTS

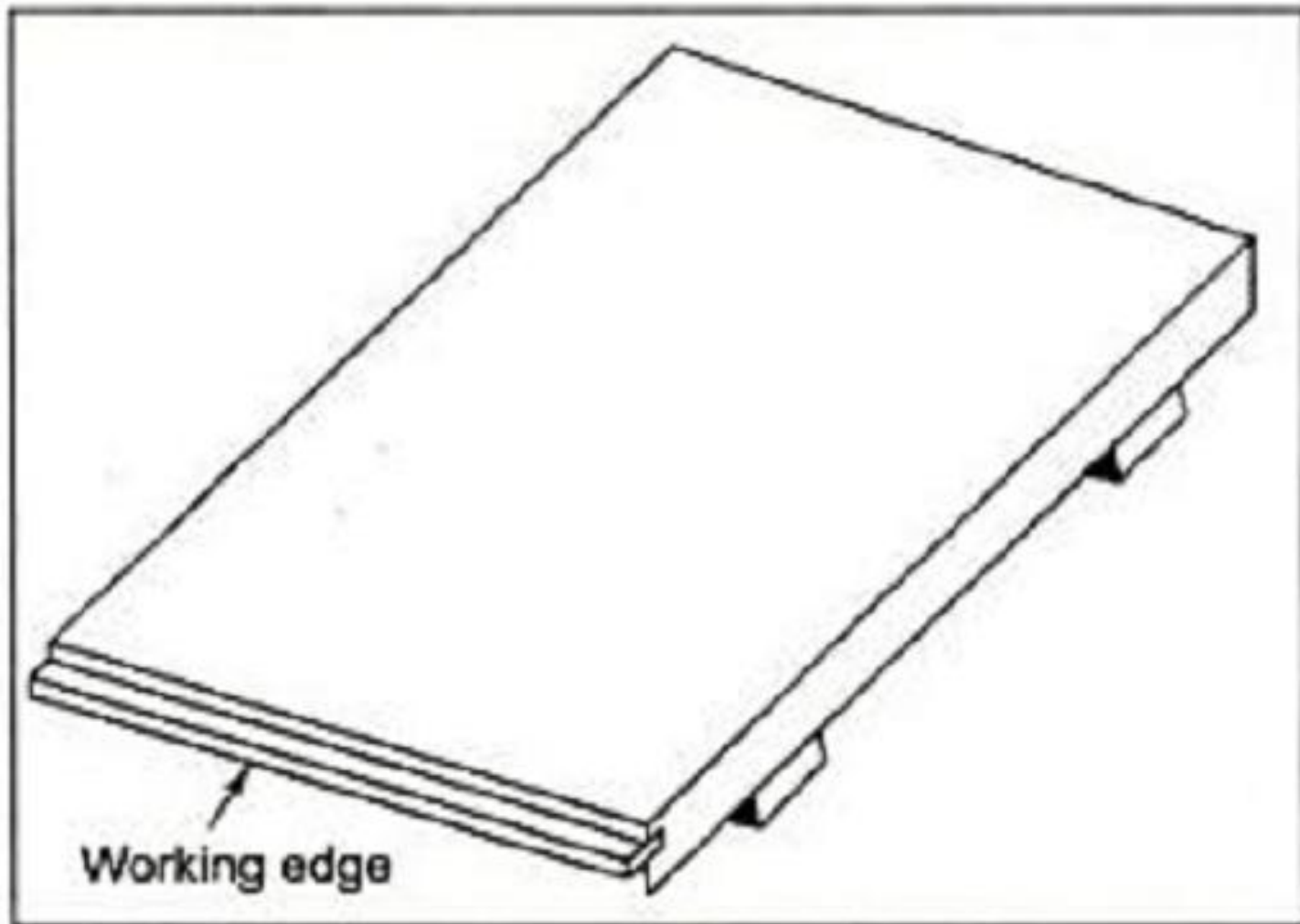
- Lead Pencils (2B and HB)
- Set squares (30° – 60° drawing triangle and 45° drawing triangle)
- Compass, Dividers and card board scale
- T square (i.e. “T” shape scale, 32" standard available in Bangladesh)
- Scale
- Drawing Paper (28" × 22")
- French Curve
- Scotch Tape

# DRAWING INSTRUMENTS

- ◉ In selecting instruments for drawing, secure the best you can afford. With reasonable care a set of good instruments will last a life-time, whereas poor ones will cause disturbance even in the start and will be unusable after a very short period.

# DRAWING BOARD

- ◉ The drawing surface may be the drafting table top itself or separate board. Drawing board is a rectangular wooden piece with two short and two long sides about 2.75 ft X 2 ft in size . One short edge is especially made straight and is called the working edge. This edge should be tested with an already tested T-Square blade and must be perfectly straight.



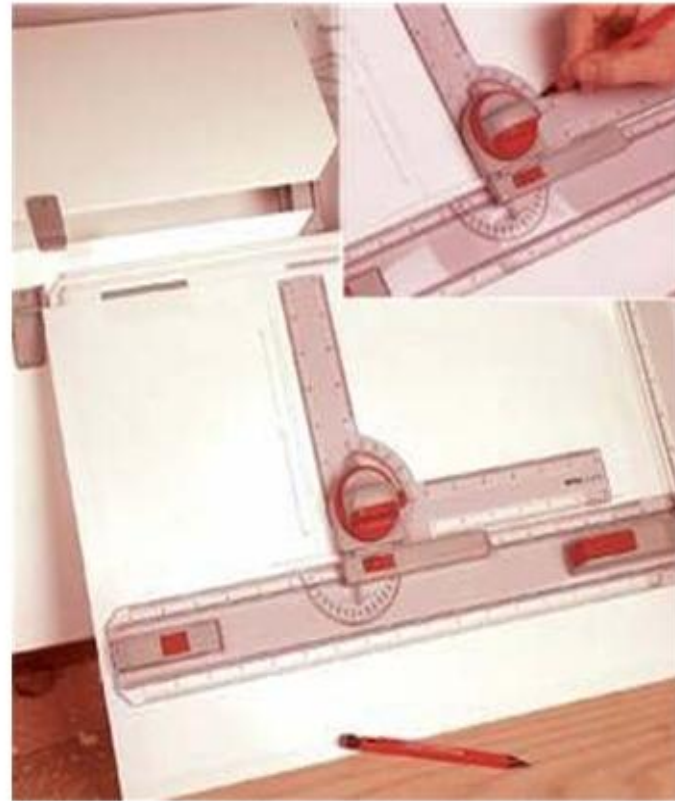
**Figure 1.1** *Drawing Board*



# Drawing Board



Drawing Table



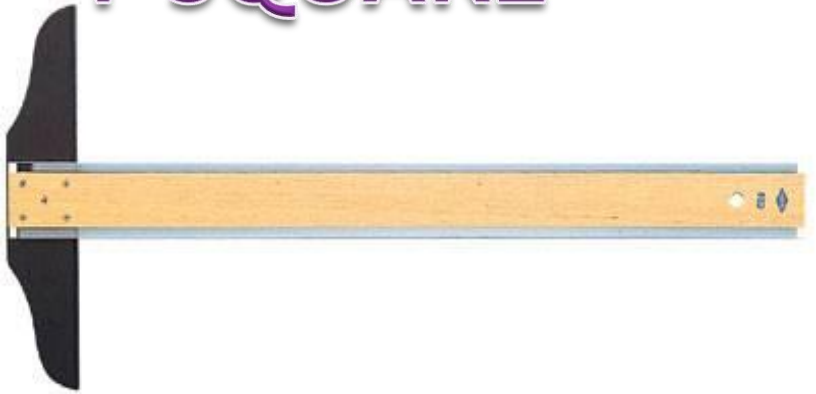
Drafting Board

# T-SQUARE

- ◉ The T-Square is composed of a long strip, called the blade, fastened rigidly at right angle to a shorter piece, called the head or stock. The upper edge of the blade and the inner edge of the head are working edges and must be straight. Transparent edge is recommended for top edge of the blade since it permits the working person to see the drawing underneath. T-square may be made up of wood, plywood or plastic but its size must be equal to the board size (called imperial size).

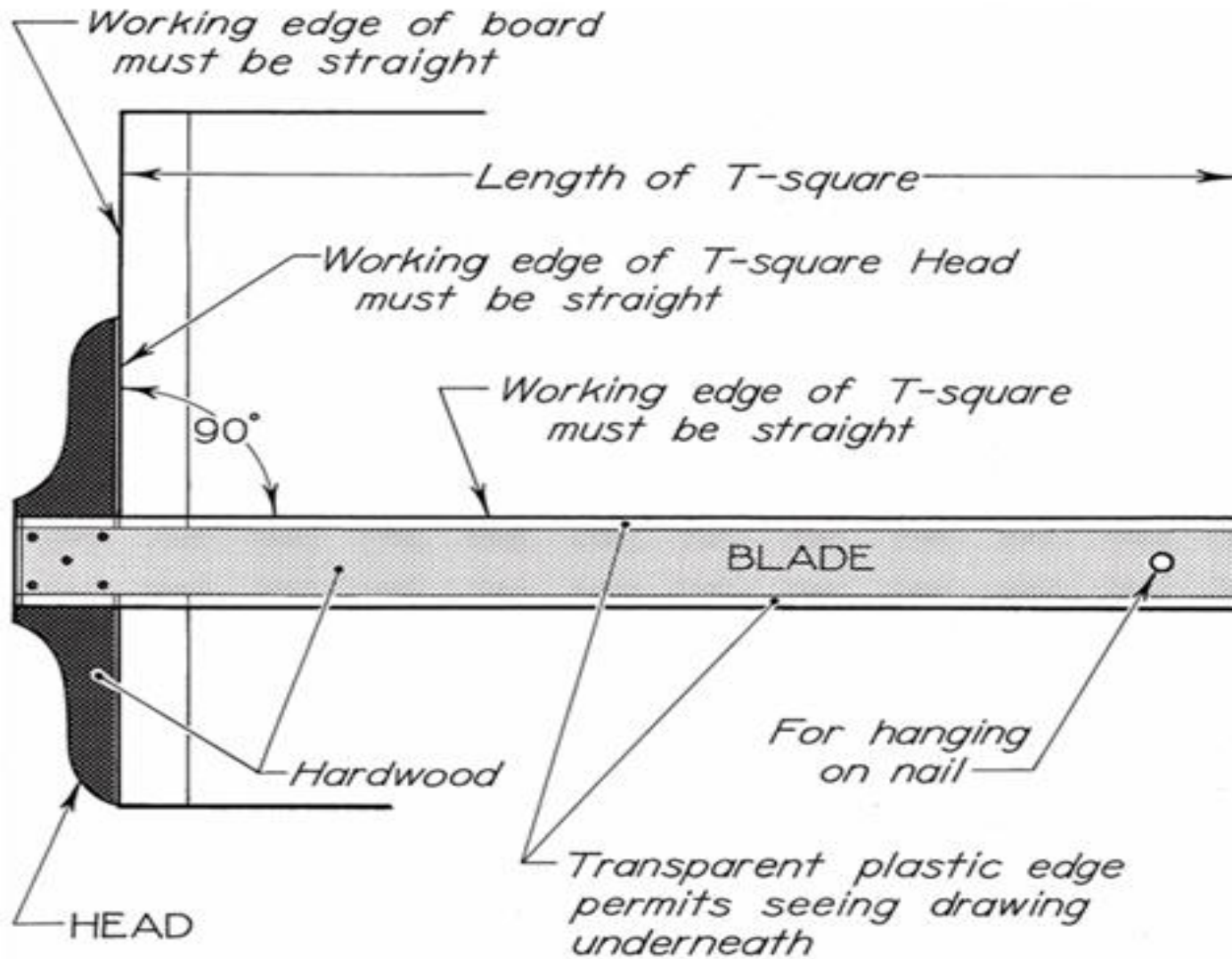


# T SQUARE



- ◉ Blade
- ◉ Head
- ◉ Working Edges
- ◉ Transparent Edge
- ◉ (Imperial Size)





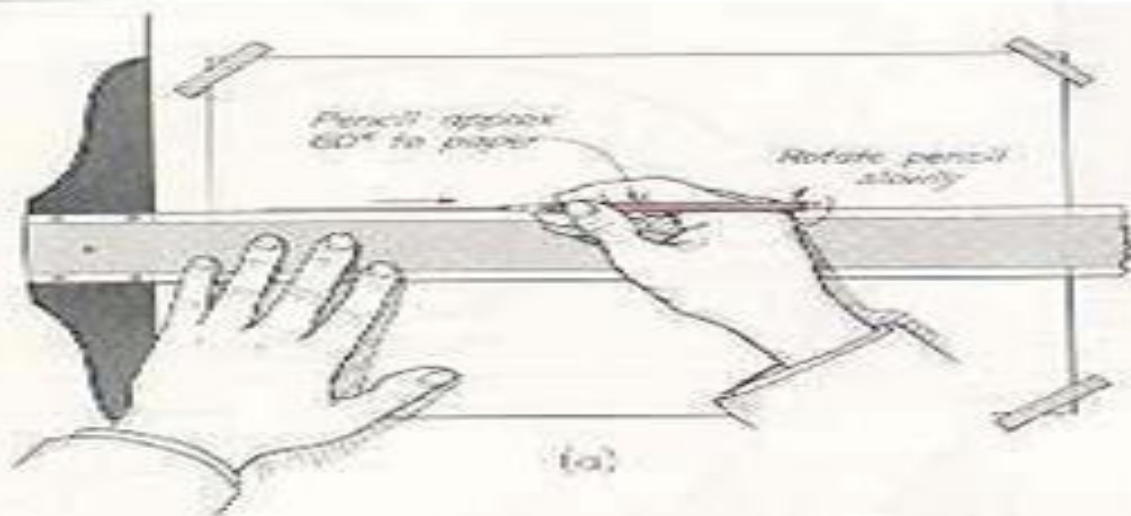


Fig. 2.20 Drawing a Horizontal Line.

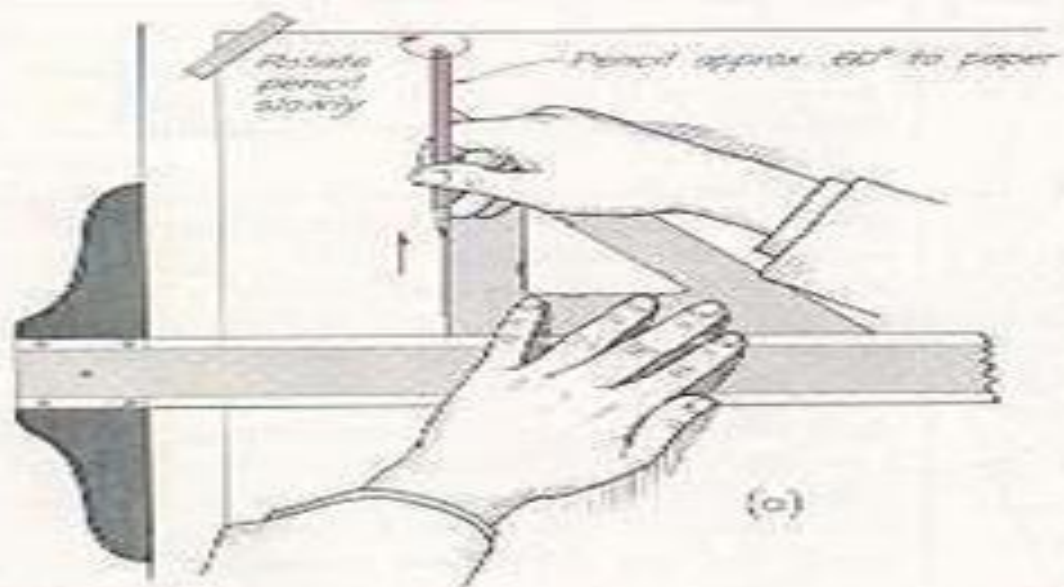
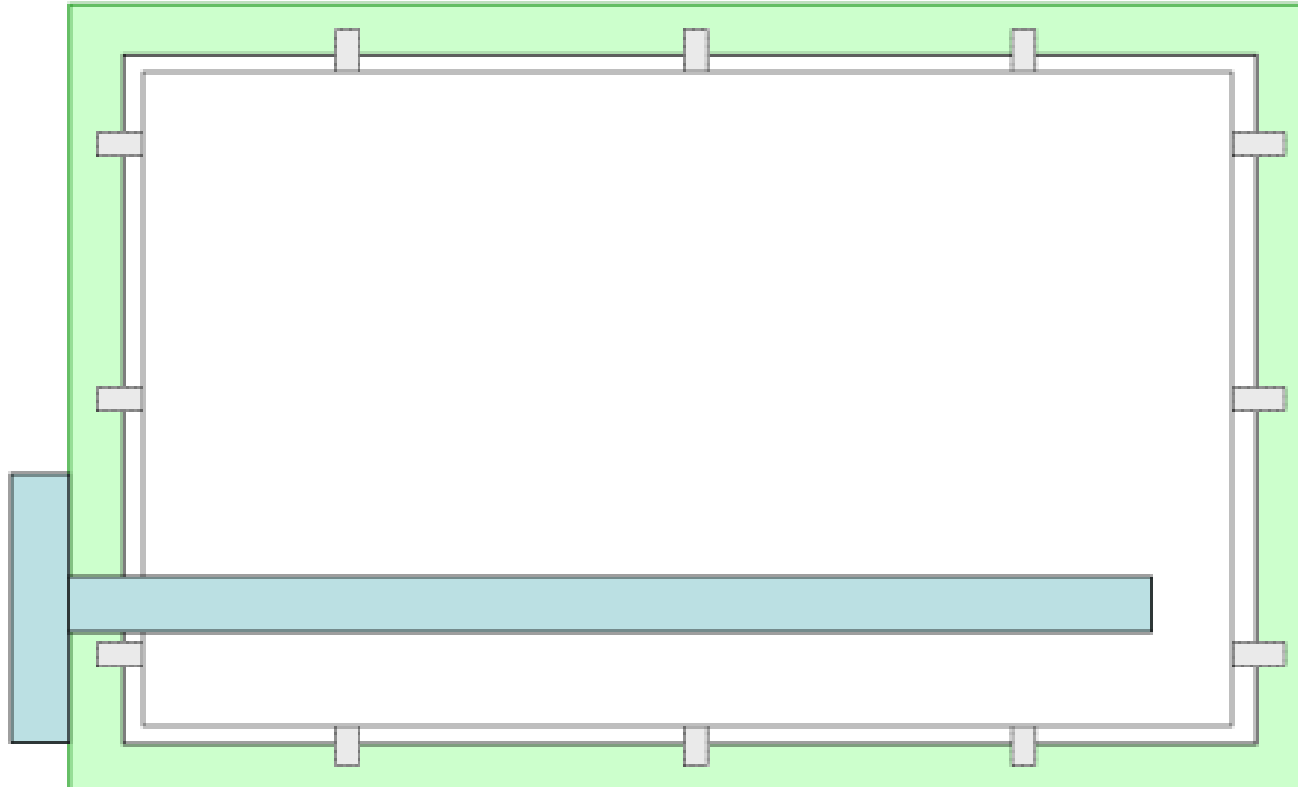
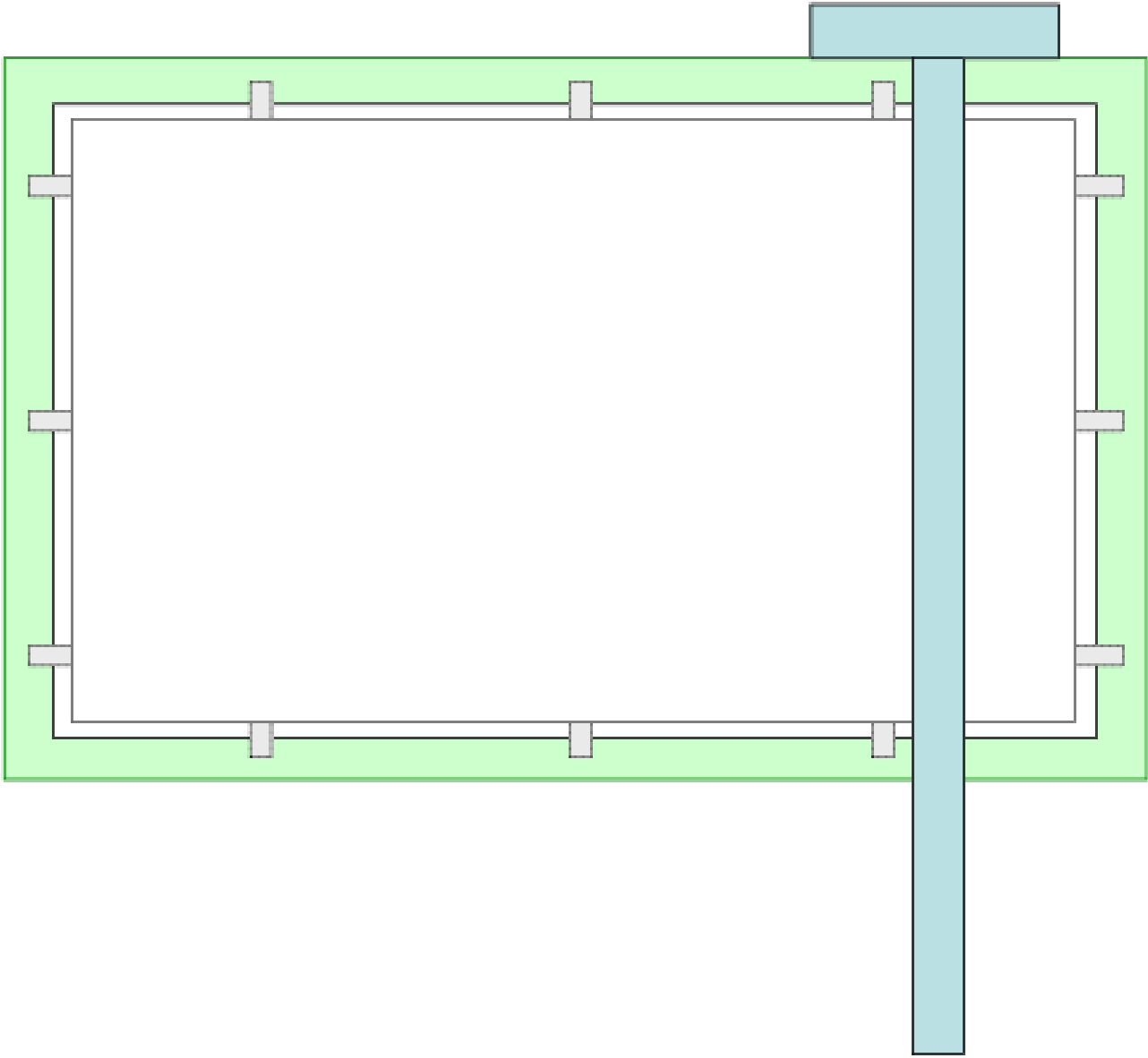
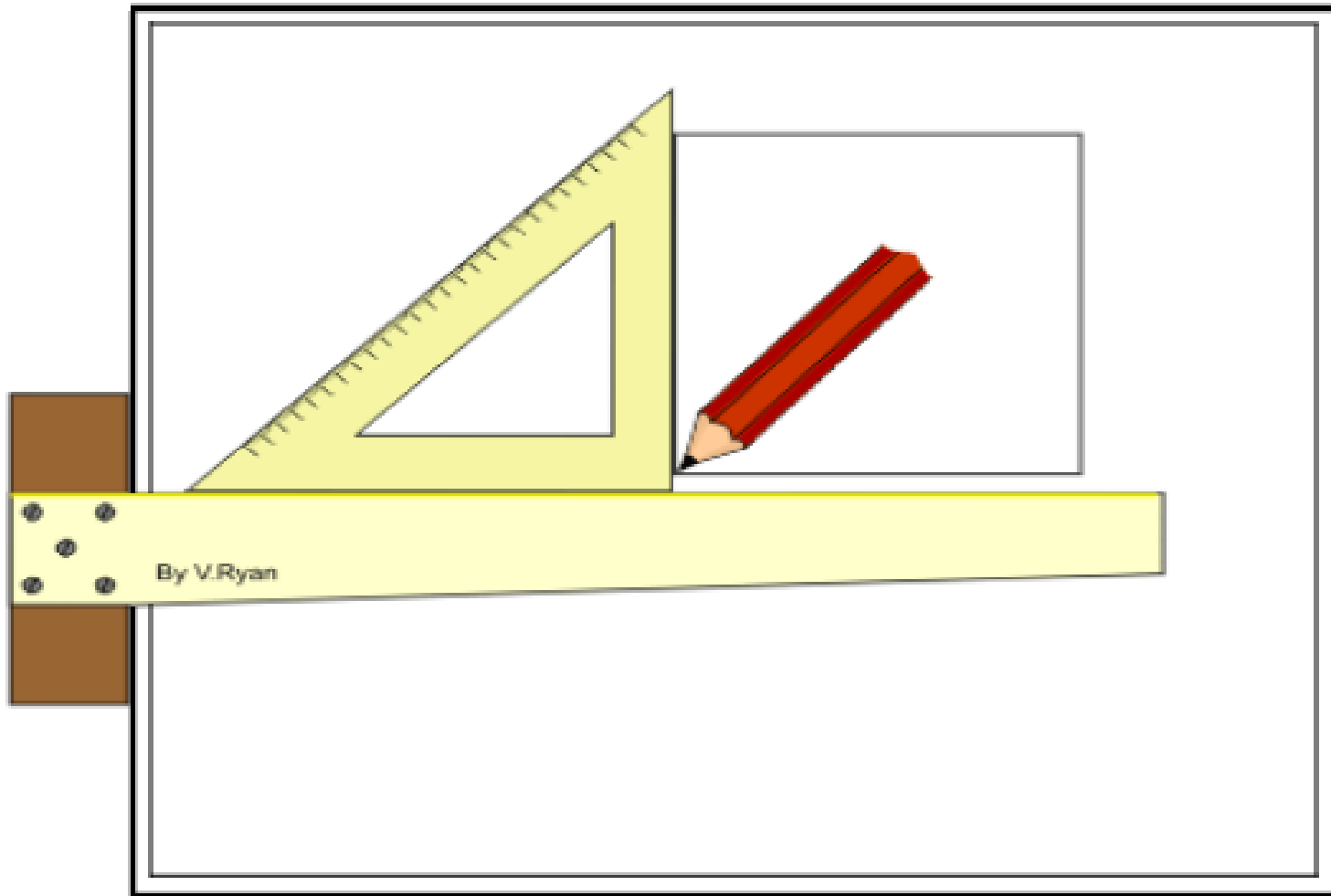


Fig. 2.21 Drawing a Vertical Line.

# Uses of T Scale in Drawing

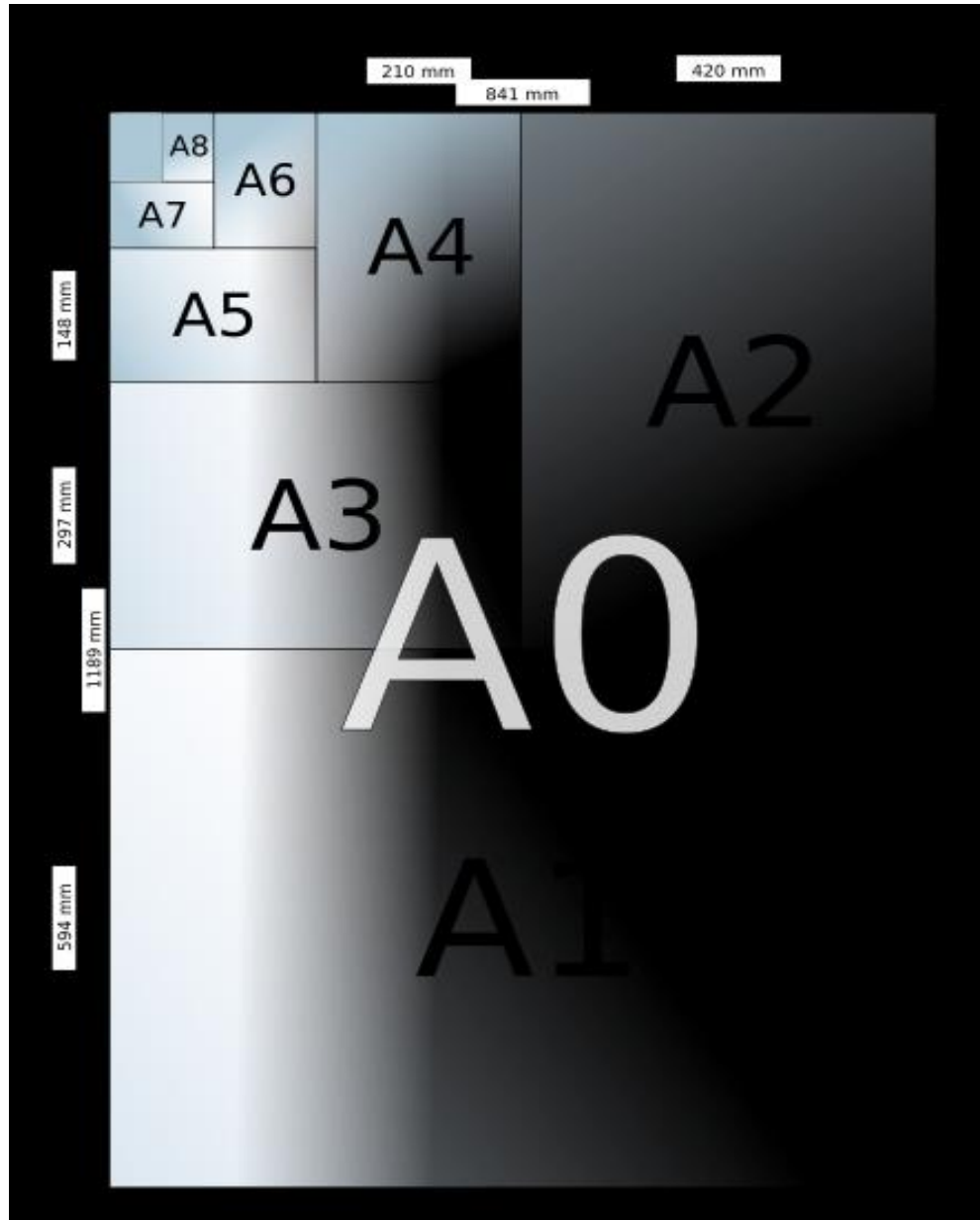






# DRAWING SHEET

- Imperial size (30" X 22") sheet of better quality should be used. In general, paper should have sufficient grains or teeth against which lead of the pencil may work, color of the paper should be agreeable to the eye, the sheet should provide a hard surface not easily grooved by the pencil and erasing qualities of the paper should be good. Drawing on a good quality sheet is always easier.



30" X 22" Imperial  
Size  
Grains  
Colour  
Grooved by Pencil  
Erasing Quality



# DRAWING SHEET

- Trimmed paper of a size A0 ~ A4.
- Standard sheet size **(ISO)**

A4      210 x 297

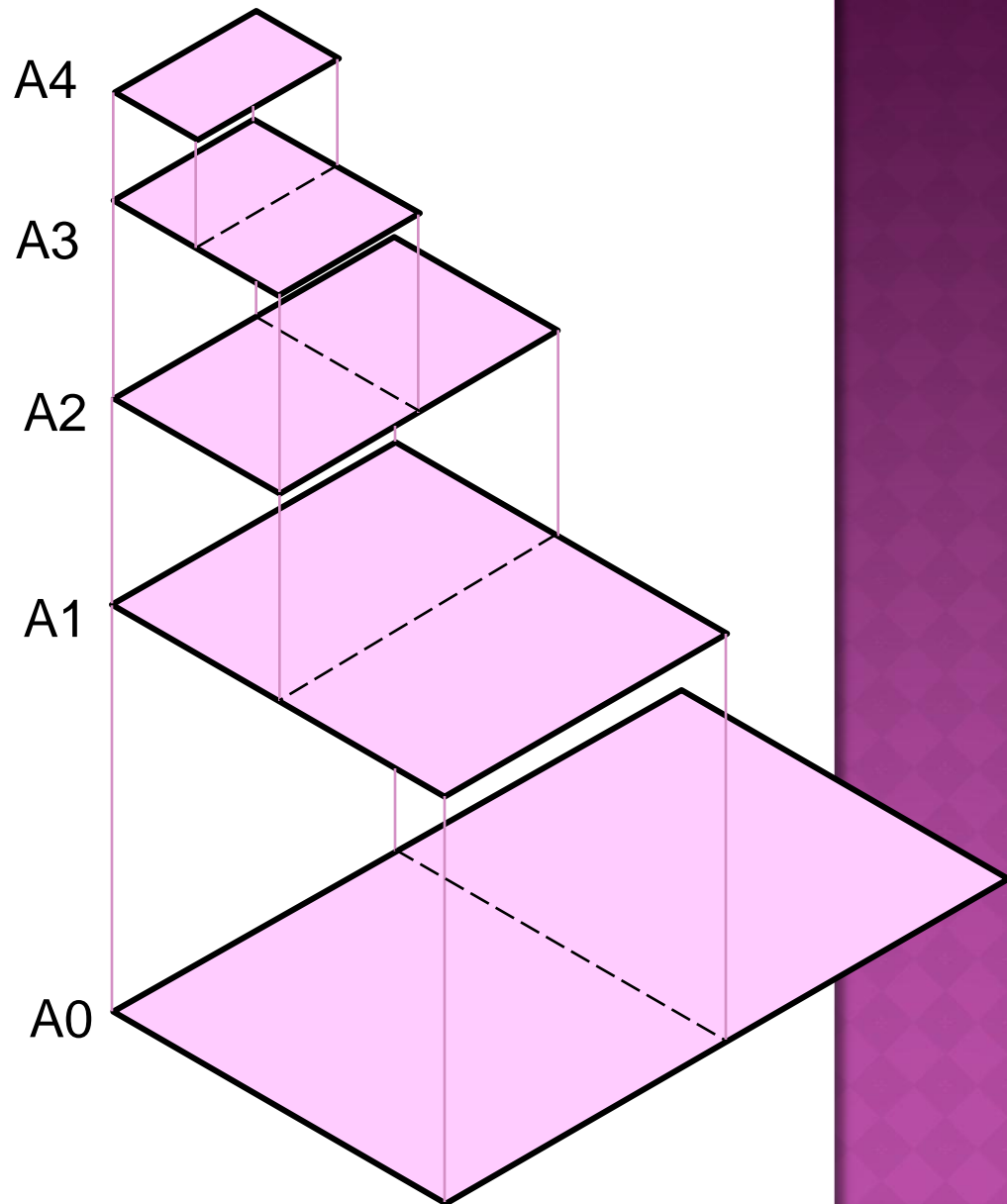
A3      297 x 420

A2      420 x 594

A1      594 x 841

A0      841 x 1189

*(Dimensions in millimeters)*



## DRAFTING TAPE (SCOTCH TAPE)

- ◉ It is a colorless sticking tape which is used to fix the sheet on the drawing board.

### **Eraser**

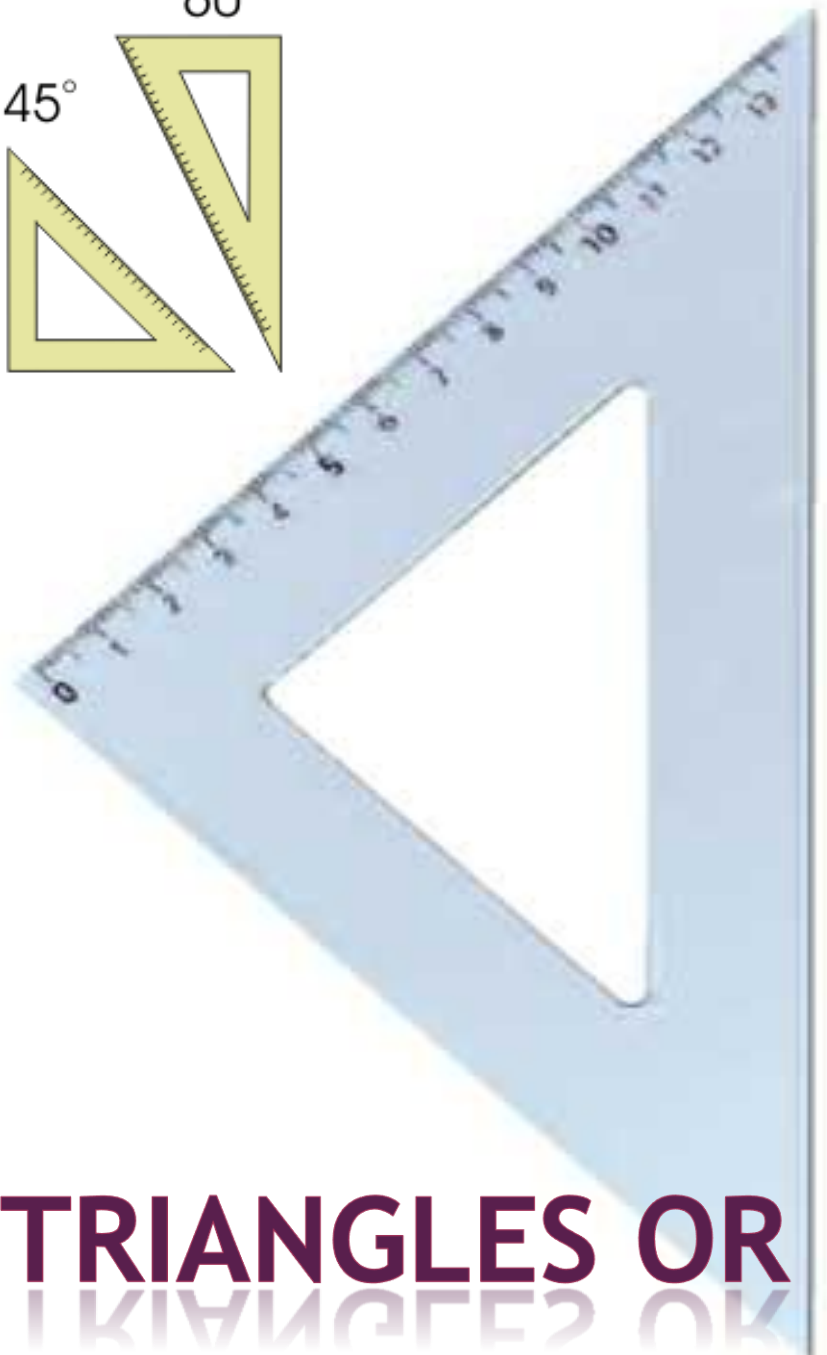
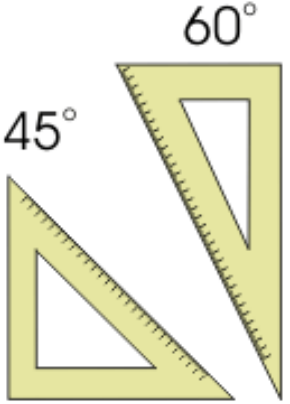
- Eraser is used to rubout extra and incorrect lines. It should be of suitable grade and of good quality.

# Drafting Tape (Scotch Tape)



## TRIANGLES OR SET-SQUARE

- Two triangles are used in drawing. For the first triangle, angles are  $45^\circ$  and  $90^\circ$  and are called  $45^\circ$  - triangle. The other triangle has  $30^\circ$ ,  $60^\circ$  and  $90^\circ$  angles and is called  $30^\circ$  -  $60^\circ$  triangle.  $45^\circ$  -triangle should be about 10 in. (25 cm) in size, whereas, longer side of  $30^\circ$  -  $60^\circ$  triangle should be about 14 in. (35 cm). At least one side of each triangle must be graduated in inches or centimeters depending upon the units to be used for the drawing work. These triangles are made of transparent plastic material.

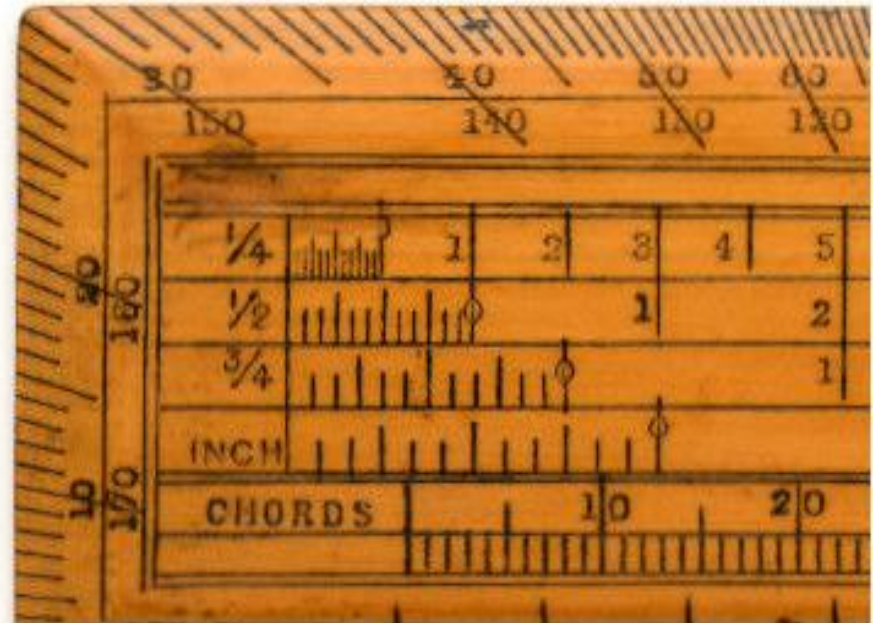
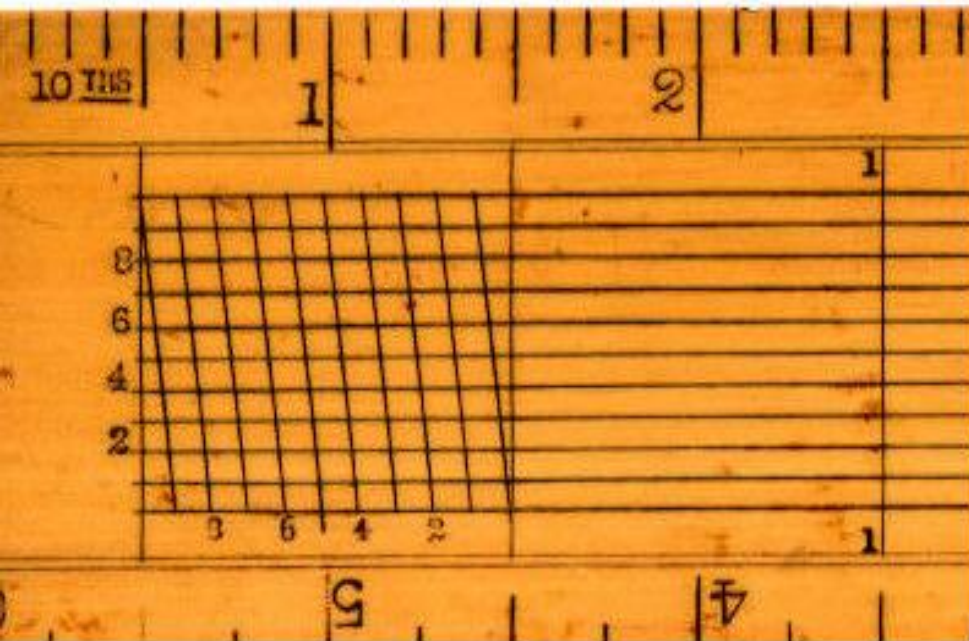
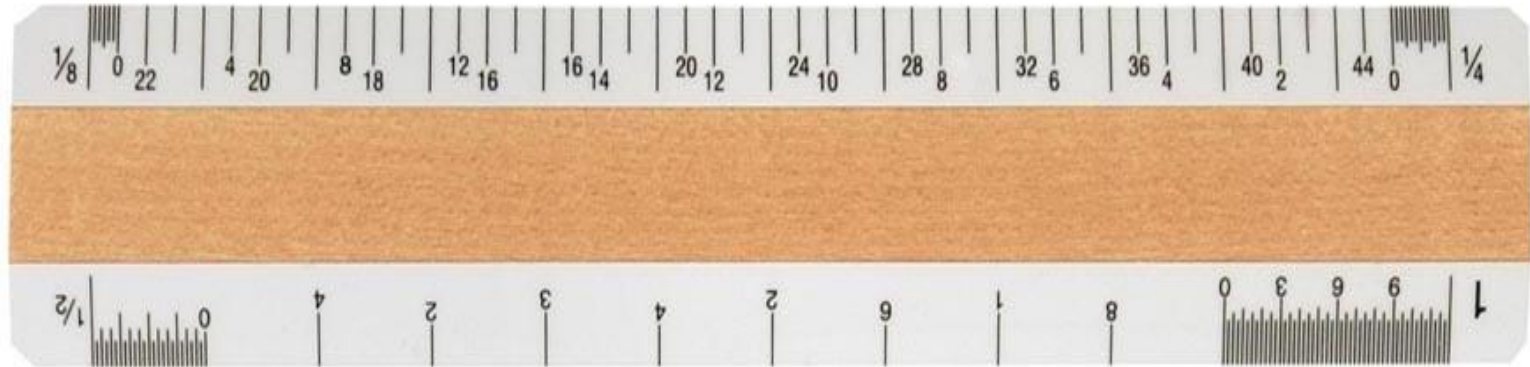


# TRIANGLES OR SET-SQUARE

## DIAGONAL SCALE

- ⦿ It is a 6 inches long flexible scale which basically used for measuring very small dimensions with reasonable accuracy but, in general, it is a multipurpose scale. With decimal diagonal scale in inch units, measurements may be taken up to second decimal place.

# SCALE (DIAGONAL SCALE)

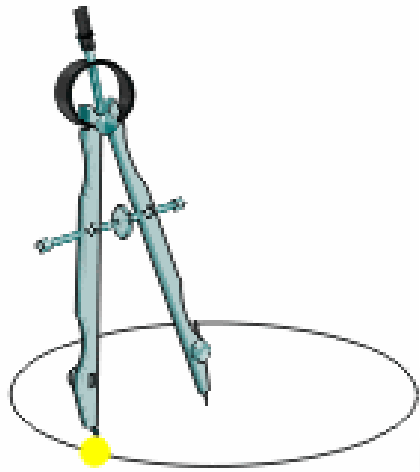


# COMPASSES AND DIVIDERS

- Compasses is an instrument with the help of which we can draw circles, it consists of two arms hinged together at one end. One of the arms holds a metallic needle at the free end while the other arm may hold another needle, lead, pen, or a lengthening bar. Bow-type compass with opening and closing screw in between the two arms is preferable because the compass may be opened exactly and further the opening is not disturbed while drawing the circle. If both arms end into needle points, the instrument is called a divider. At least two compasses, one small and one large, and one divider should be obtained with all the accessories like extra leads, extra needles, lengthening bar, and small screw tighter. The set of compasses and dividers is commonly available in the form of a drawing instrument box.

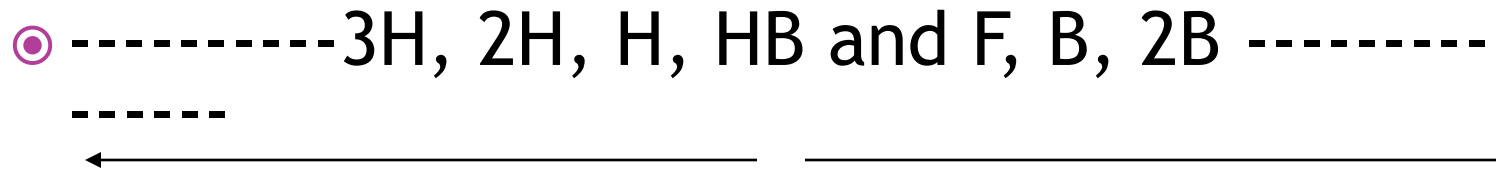


# COMPASS AND DIVIDER



# PENCILS

- The basic instrument for drawing is the graphite lead pencil made in various hardness. Hardness of the pencil is specified by its grade, 9H to 7B.



Hardness increases  
increases

Softness

- For ordinary building drawing, 4H, H, HB, and B pencils are only required.

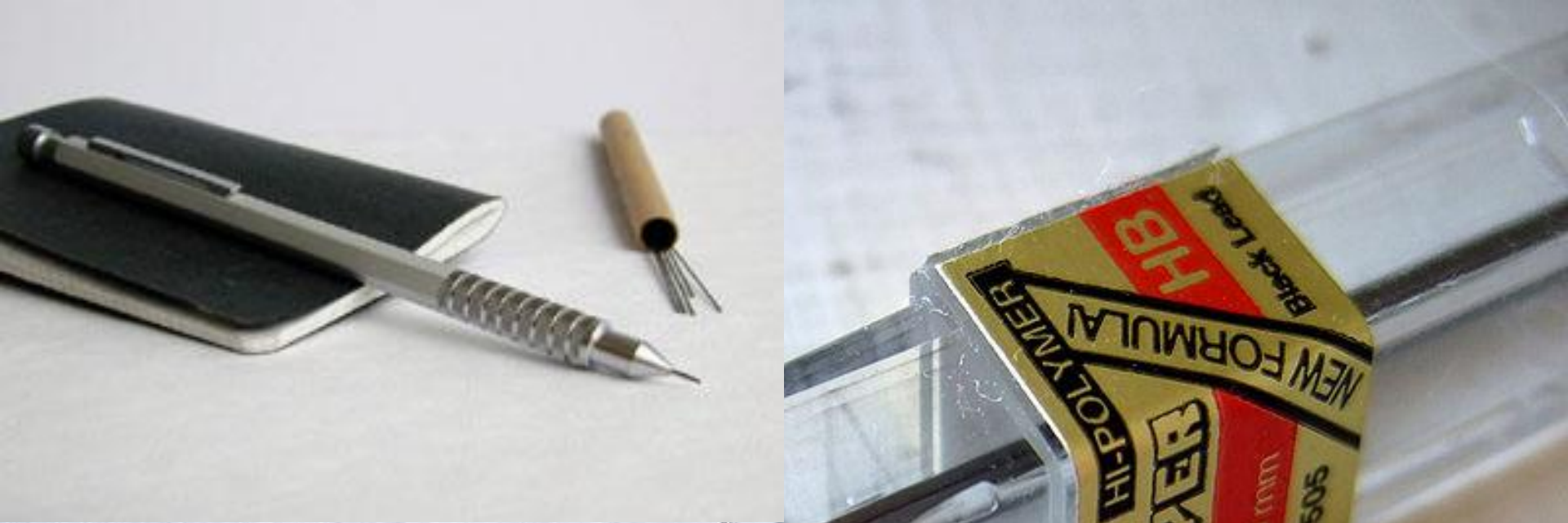
# PENCILS

- Grade, 9H to 7B.
- -----3H, 2H, H, HB and F, B, 2B -----  
-

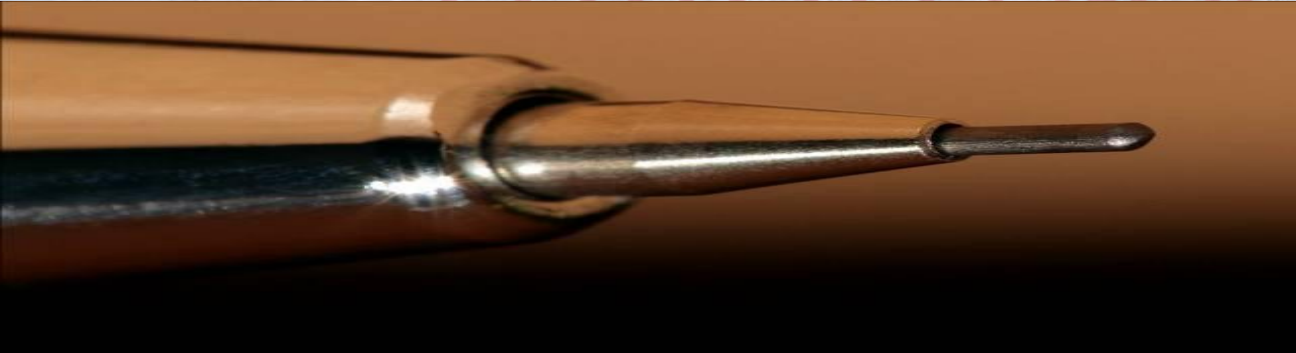
Hardness increases

Softness increases

- For ordinary building drawing, 4H, H, HB, and B pencils are only required.



# CLUTCH PENCIL



# Wooden Pencils Grades



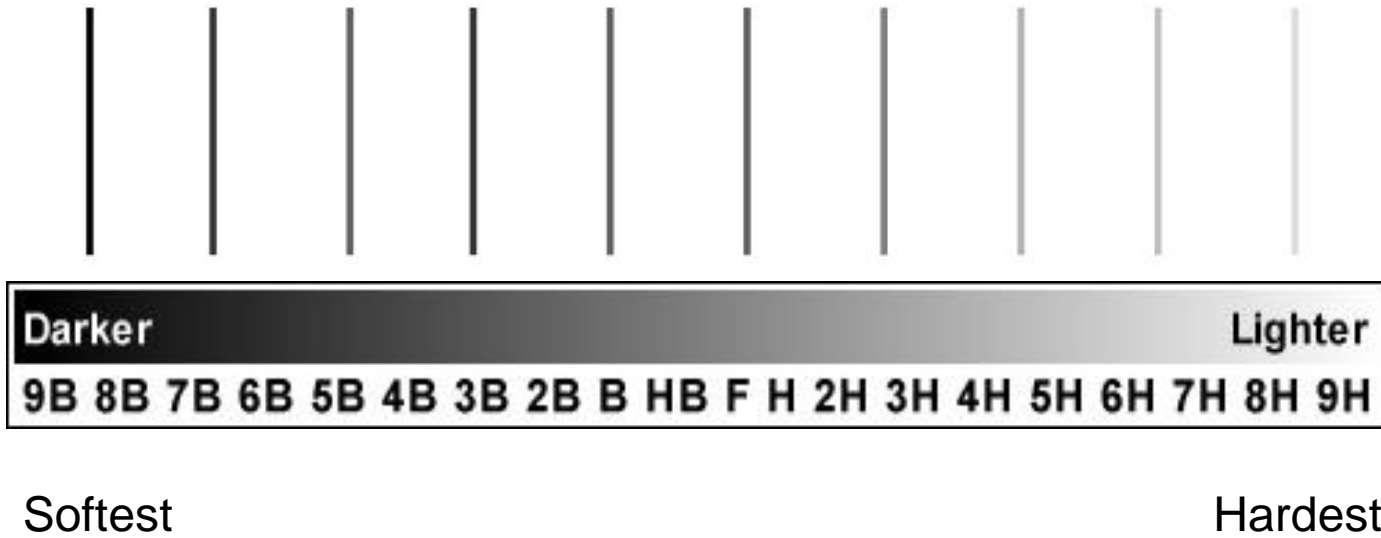
Softest

Hardest

SOFT					MEDIUM					HARD						
6B	5B	4B	3B	2B	B	HB	F	H	2H	3H	4H	5H	6H	7H	8H	9H



# Pencil Grades




## SMALL KNIFE AND SANDPAPER PAD

- Sandpaper pad is a small wooden strip pasted with a sandpaper on one side and a small foam on the other end. Sandpaper is used to make required shape of the lead and foam is used for final cleaning of the same.

## Erasing Shield

- It is a thin metallic plate with perforations of various shapes and is used to remove extra pines after the completion of a drawing without disturbing the required lines.

The background of the left side of the image is a dark teal color with a faint, light-colored technical drawing of a mechanical part, possibly a valve or a similar component, overlaid on it. The drawing shows various lines, curves, and dimensions, typical of an engineering drawing.

Small knife  
Sand paper pad  
Towel or brush / tissue

**DRAWING**  
FOR Civil Engineering





## TOWEL OR BRUSH

- During drawing work, frequent cleaning of the sheet and the instruments is needed. Hence, a towel or a brush should always be available.

## Triangular Scale

- This instrument is triangular in shape having six edges and usually two scales are provided over each edge, one starting from the left and the other starting from the right.
- The scales (in F.P.S. units) available in triangular shape are generally of three types.

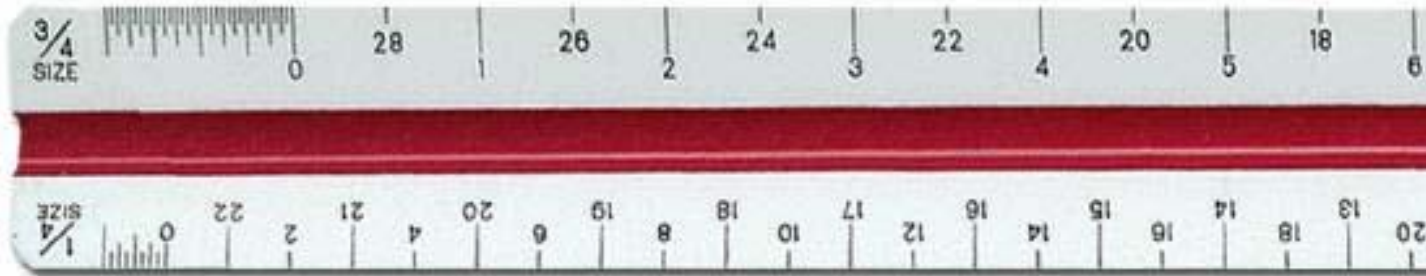


Triangular Scale

# MECHANICAL ENGINEER'S SCALE

- ⦿ These scales are used to draw the object on the actual size, double size, half size, quarter size , or eight size. As usually smaller dimensions are involved in machine drawing, bigger divisions represent inches which are then subdivided into fractions.

# Inches Scales



## CIVIL ENGINEER'S SCALE

- ⦿ This scale is graduated in the decimal system and the set of these scales is as follows:
- ⦿ 10, 20, 30, 40 - - - - -
- ⦿ On a 10-scale, inch is divided into 10 equal parts, one part is generally considered to be equal to 1 foot in survey maps. In other words, 10 ft of the actual structure will be shown by 1 inch of the line on the drawing sheet.
- ⦿ Mechanical Engineer's and Civil Engineer's Scales are not used for the building drawing.

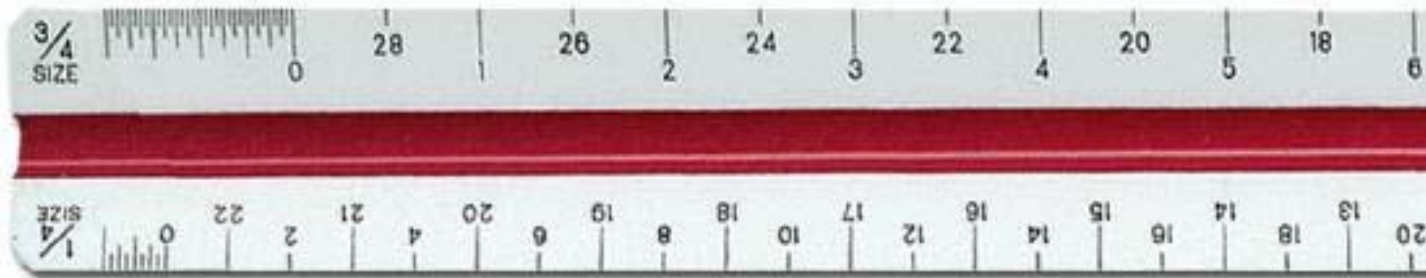
# Metric Scales



# ARCHITECTURAL SCALE

- Full, Half, Quarter, Eighth - - - - -  
-
- Or 1,  $\frac{1}{2}$ ,  $\frac{1}{4}$ ,  $\frac{1}{8}$ , - - - - -  
--
- Architectural scale is actually an inch-foot scale and full scale here means that one foot of the structure is represented by one inch of the drawing line, size is reduced 12 times before drawing. Similarly half scale means that one foot of the structure is represented by half inch of the drawing line, reduction factor being 24.
- Architectural triangular scale should be obtained for building drawing.

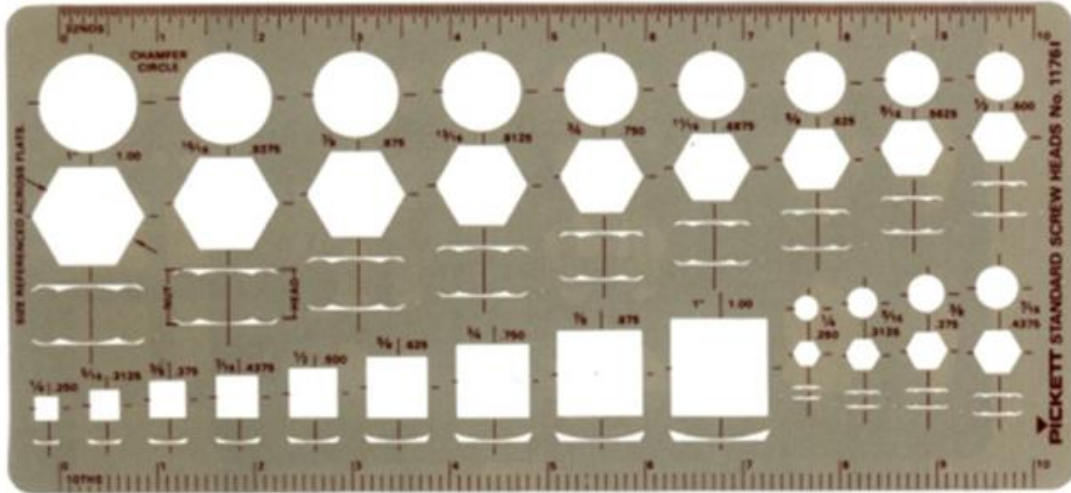
# Inches Scales



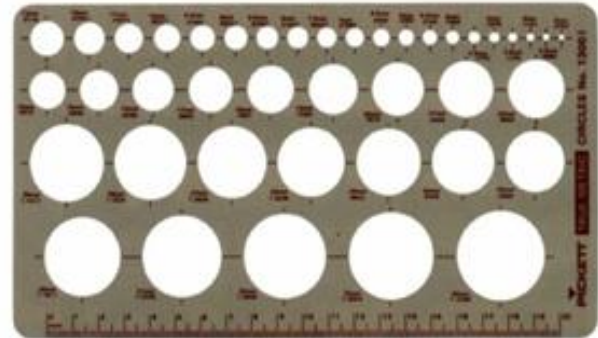


## SET OF CIRCLES (CIRCLE TEMPLATE)

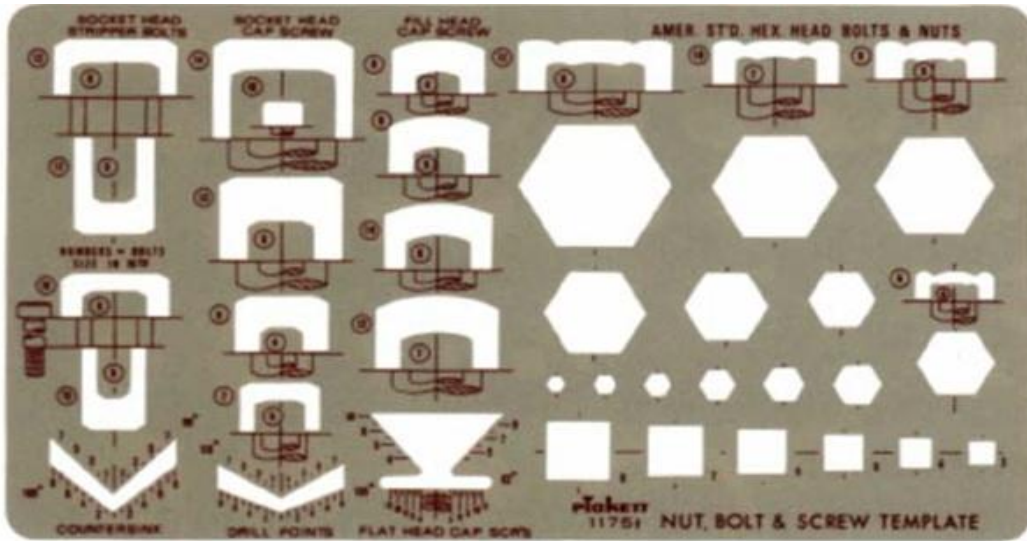
- ⦿ This is a thin sheet of plastic having circular openings of various sizes and is especially useful to draw circles of very small radii. It may also be used to draw curves tangent to other circles or straight lines.



Screw Heads Template



Circle Template



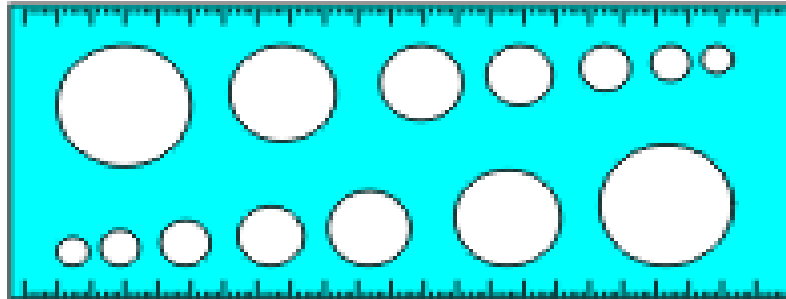
Nut, Bolt and Screw Template



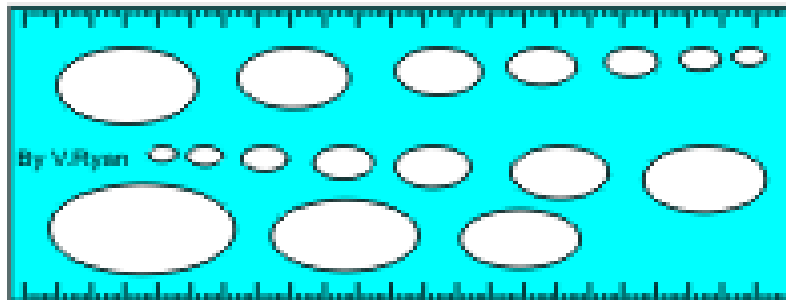
Ellipse Template

# Drawing Templates

## CIRCLE TEMPLATE

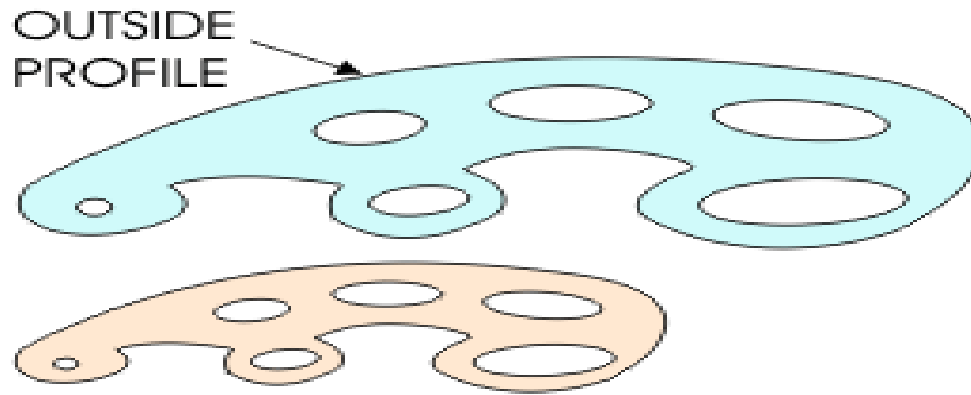


## ELLIPSE TEMPLATE

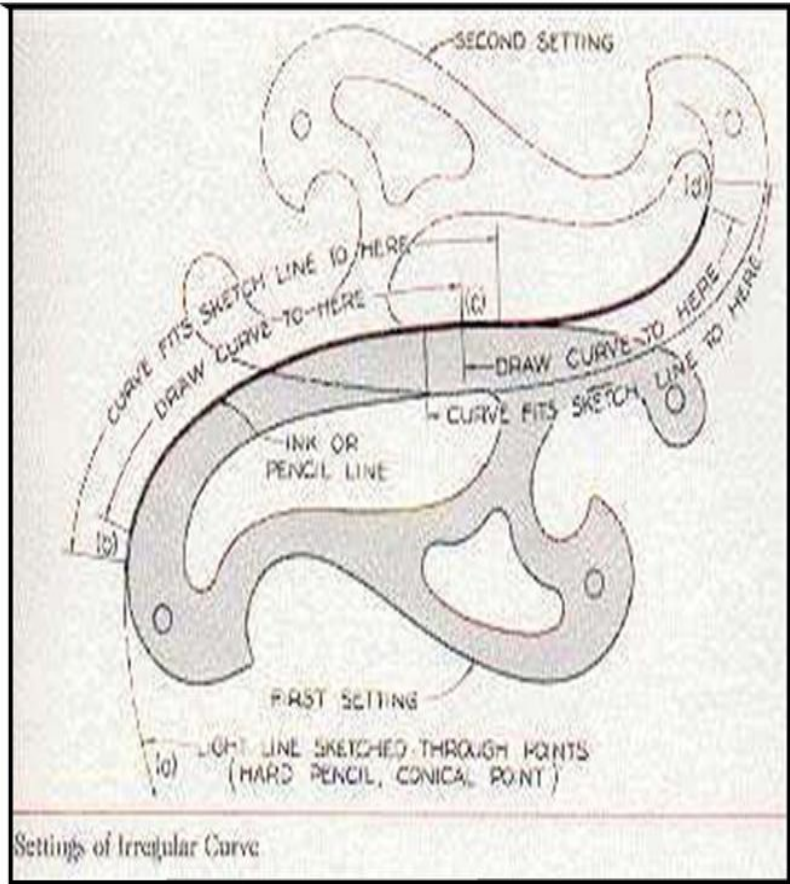


# FRENCH CURVES

- These are made of plastic sheets with edges lying in irregular curves. Suitable curves may be fitted for the already plotted points and freehand curves may be changed into smooth curves.



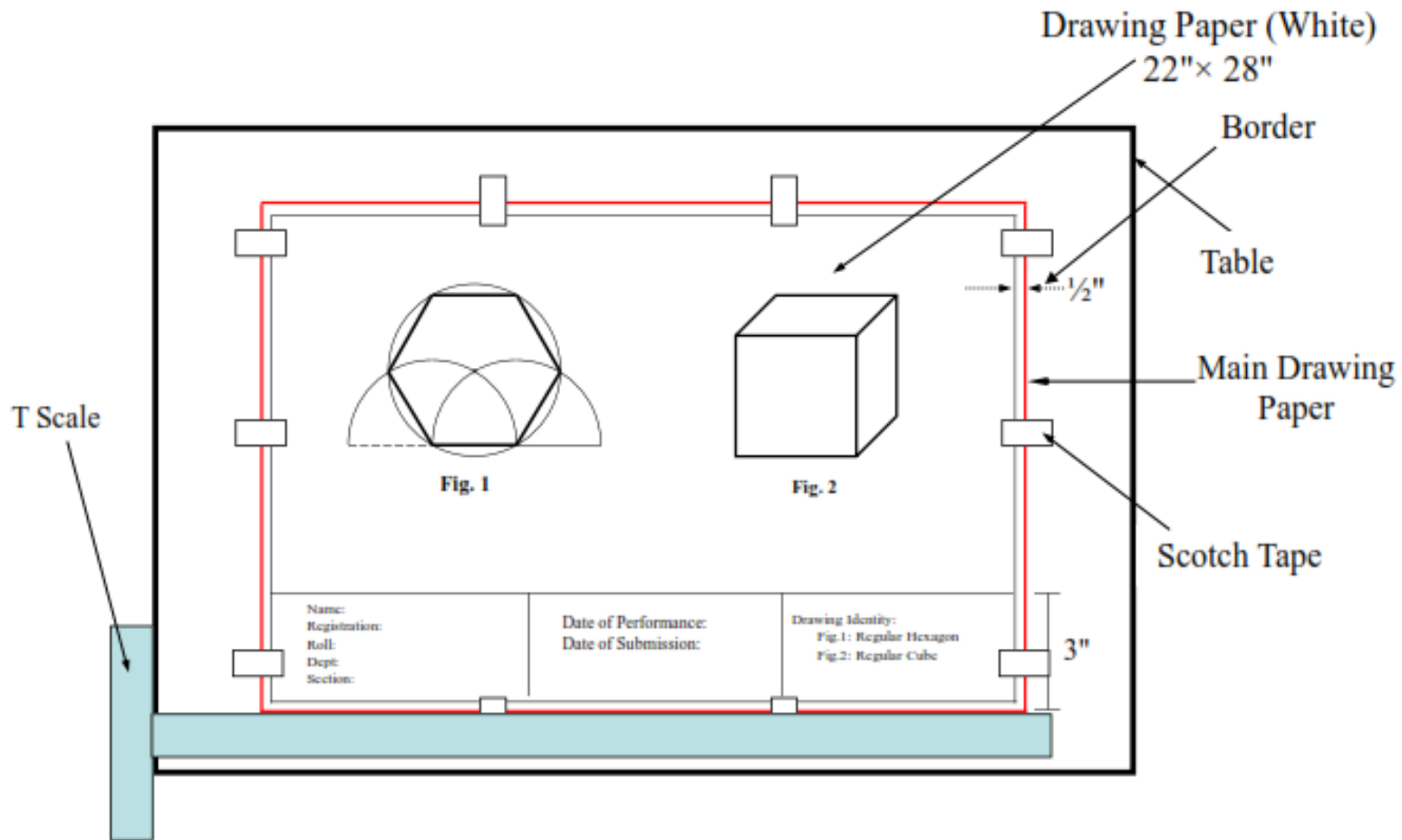
# French Curves and Flex Curves



## FLEXI - ROD

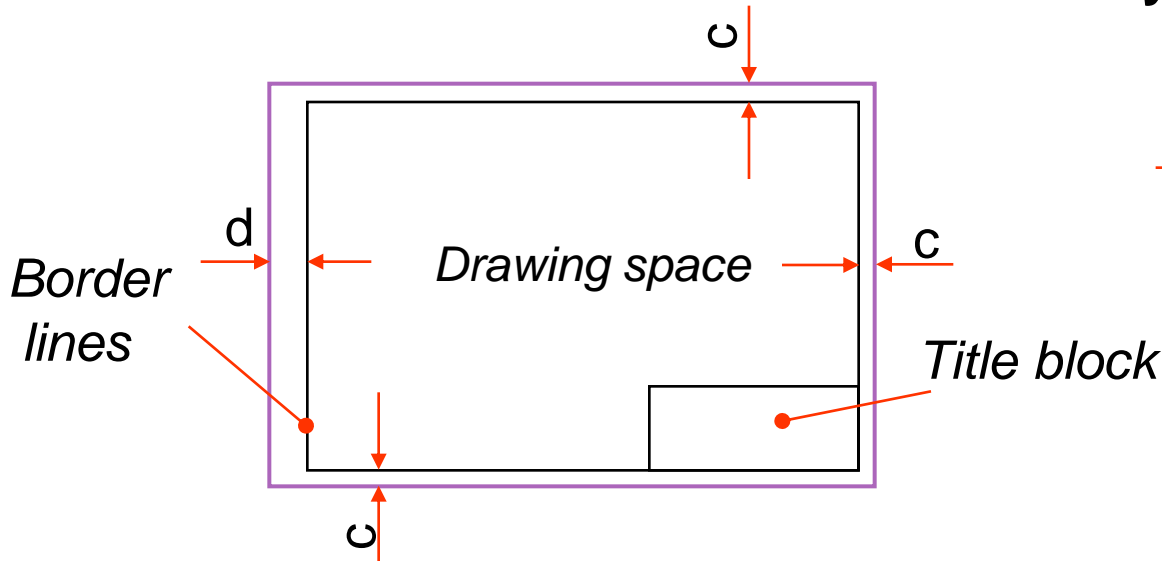
- ⦿ It serves nearly the same purpose as the French Curves do. First the flexi -rod is shaped according to the required curvature, it then retains its shape and is used to draw smooth curves.

# PREPARATION OF DRAWING PAPER

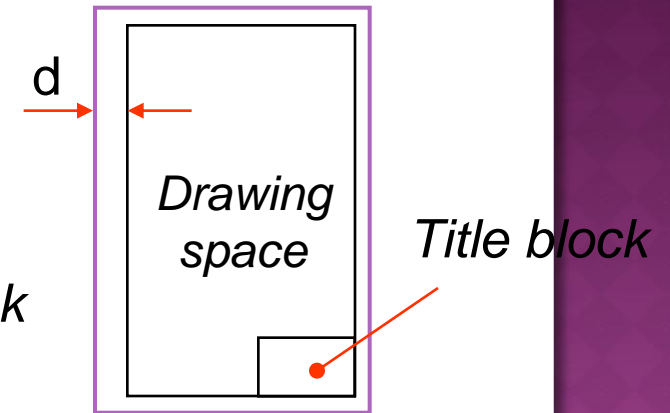


# Orientation of drawing sheet

## 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
----	----	----



TITLE  
BOX/BLOCK

LINES

# 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

NOTE : We will learn other types of line in later chapters.

# Meaning of Lines

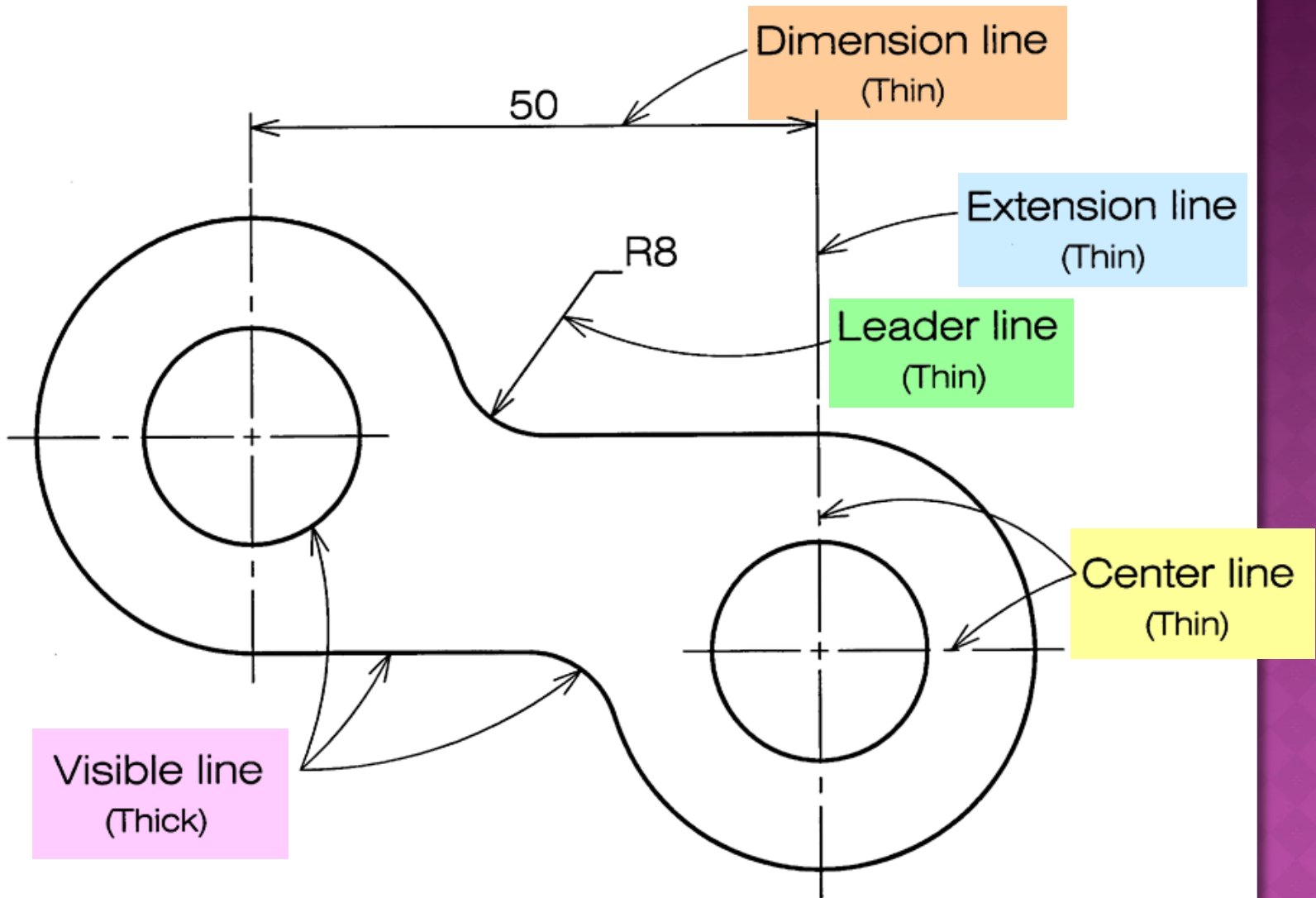
**Visible lines** represent features that can be seen in the current view

**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

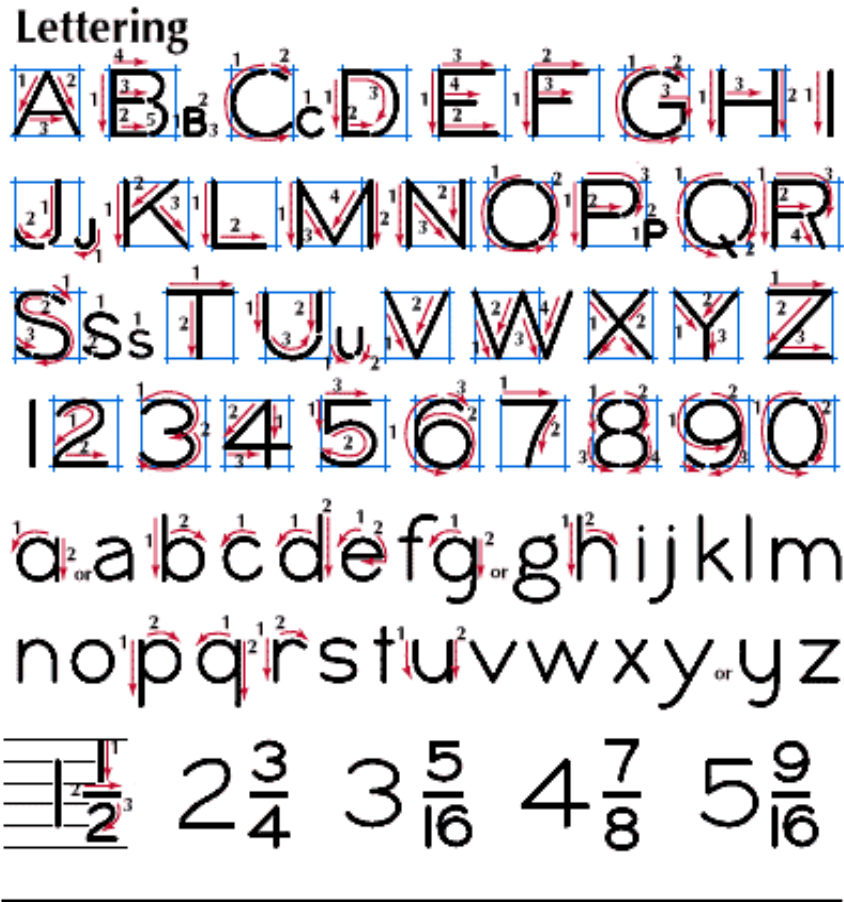
**Dimension and Extension lines** indicate the sizes and location of features on a drawing

**Example** : Line conventions in engineering drawing



LETTERING

# lettering



Study of vertical lettering and patient practice can produce letters like these capitals, lowercase letters, and fractions. Guidelines and numbers indicate the direction and order of the strokes.

# TEXT ON DRAWINGS

Text on engineering drawing is used :

- To communicate nongraphic information.
- As a substitute for graphic information, in those instances where text can communicate the needed information more clearly and quickly.

Thus, it must be written with

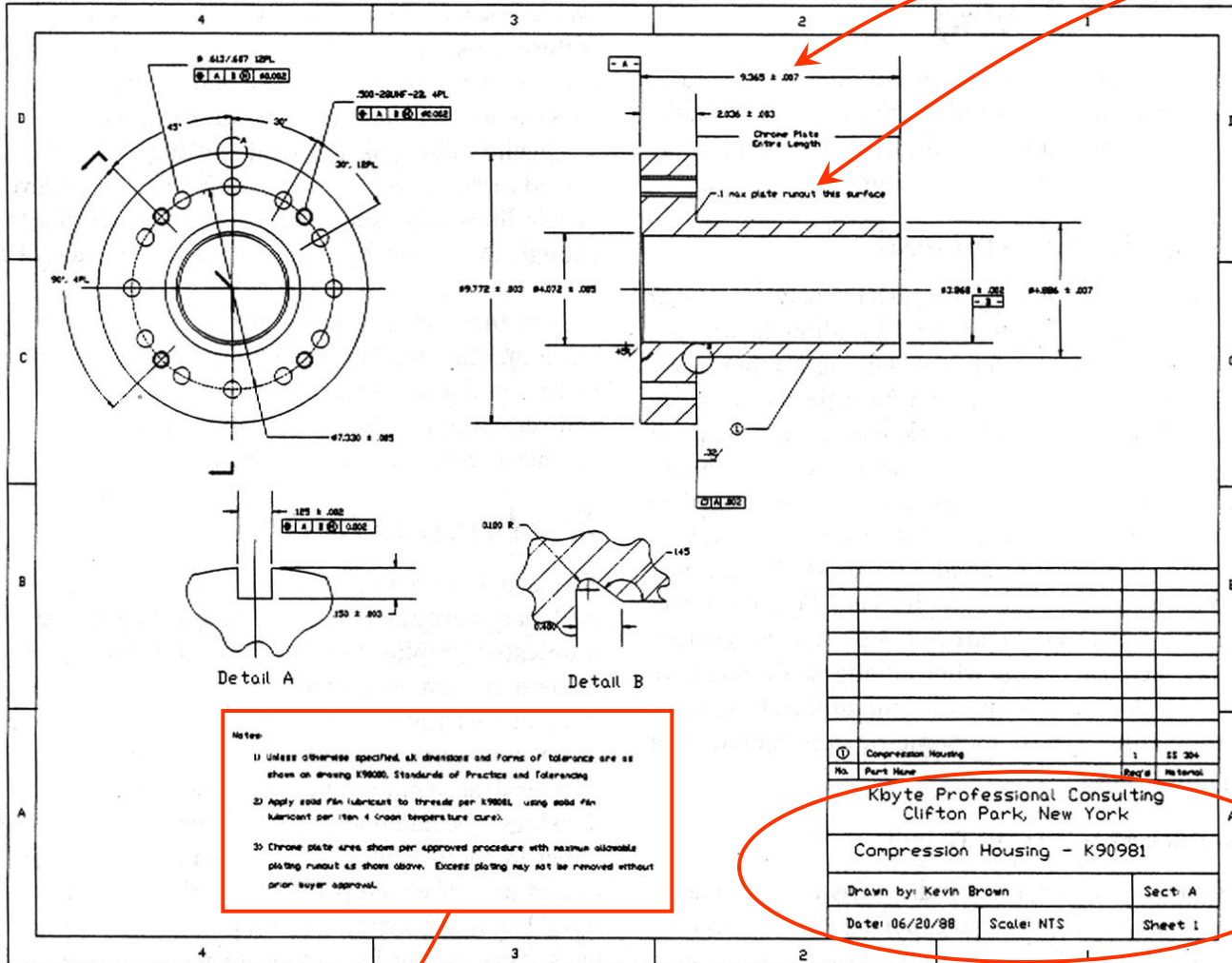
***Legibility*** - shape  
- space between letters and words

***Uniformity*** - size  
- line thickness



# Example Placement of the text on drawing

Dimension & Notes



Notes

- 1) Unless otherwise specified, all dimensions and forms of tolerances are as shown on drawing K90981, Standards of Practice and Tolerancing
- 2) Apply gold film lubricant to threads per K90861, using gold film lubricant per item 4 (room temperature cure).
- 3) Chrome plate area shown per approved procedure with maximum allowable plating runout as shown above. Excess plating may not be removed without prior buyer approval.

No.	Part Name	Qty	Material
1	Compression Housing	1	SS 304

Kbyte Professional Consulting  
Clifton Park, New York

Compression Housing - K90981

Drawn by: Kevin Brown	Sect: A
Date: 06/20/88	Scale: NTS
	Sheet 1

Notes

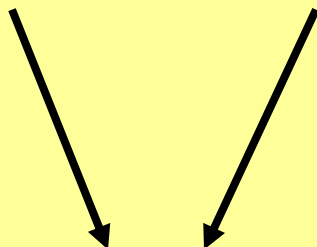
Title Block

# BASIC STROKES

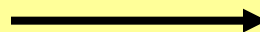
**Straight**



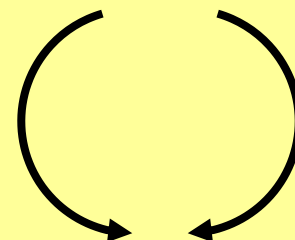
**Slanted**



**Horizontal**



**Curved**

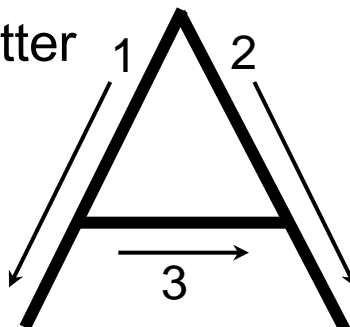


**Examples :** *Application of basic stroke*

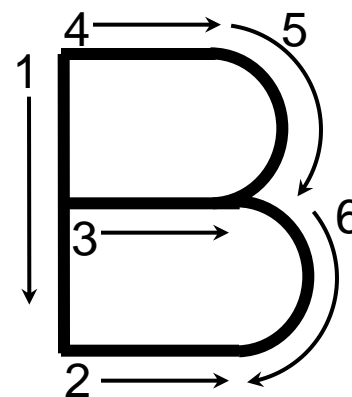
“I” letter



“A” letter

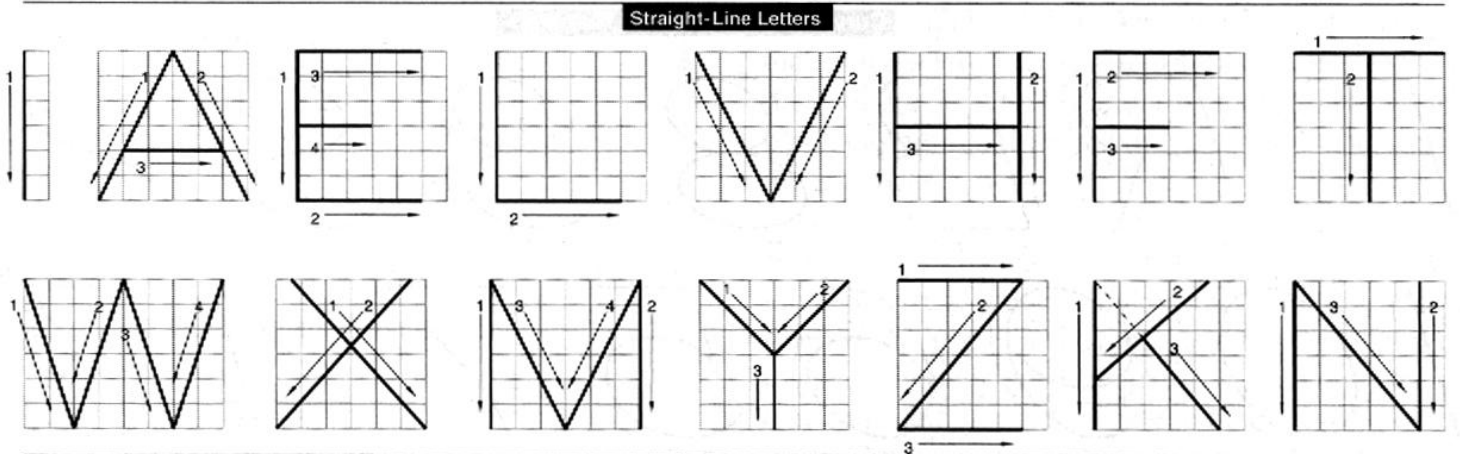


“B” letter

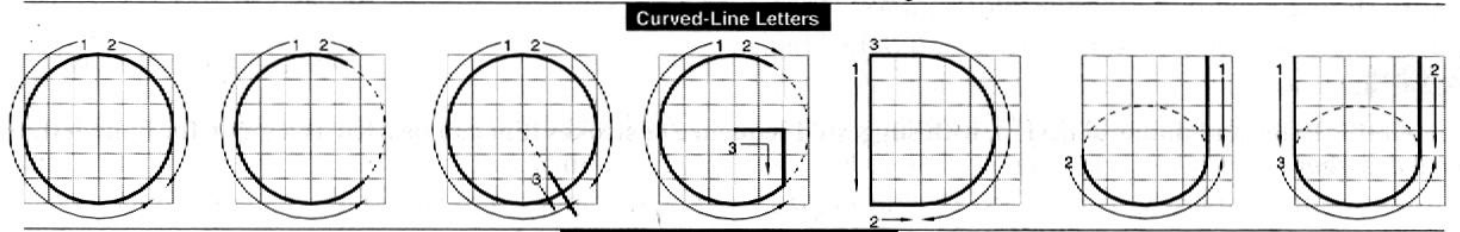


# Upper-case letters & Numerals

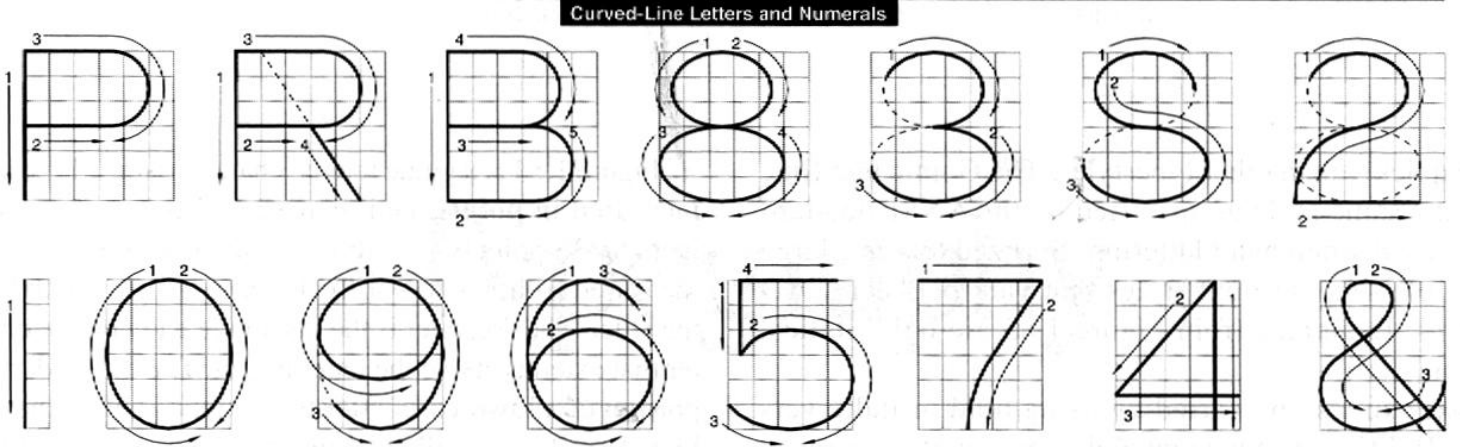
Straight line letters



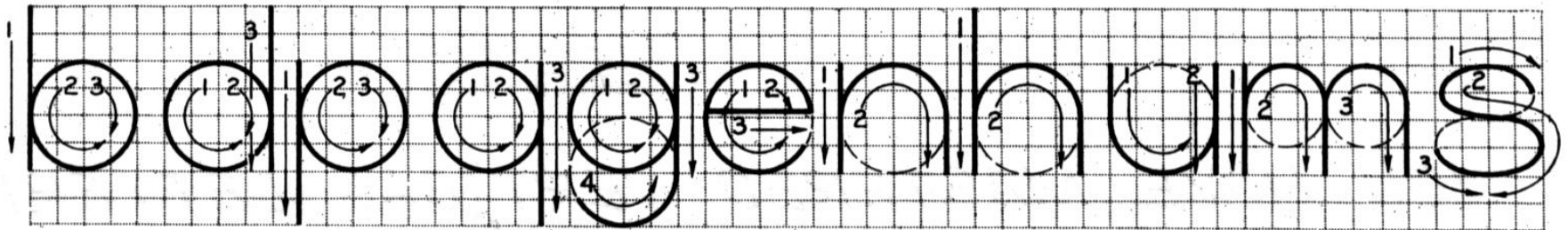
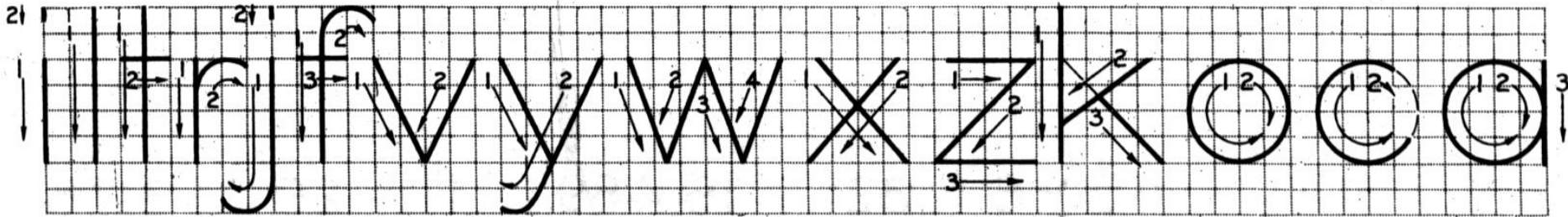
Curved line letters



Curved line letters & Numerals



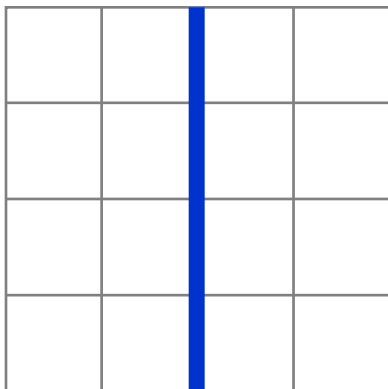
# Lower-case letters



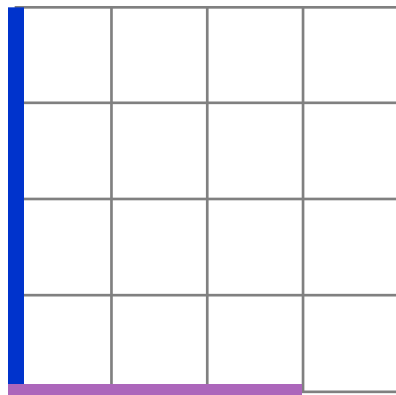
- The text's body height is about  $2/3$  the height of a capital letter.

# STROKE SEQUENCE

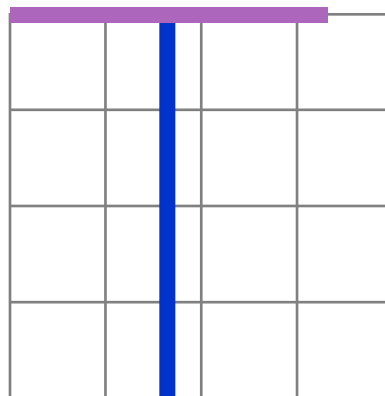
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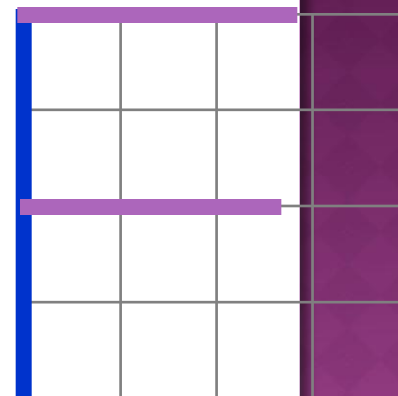
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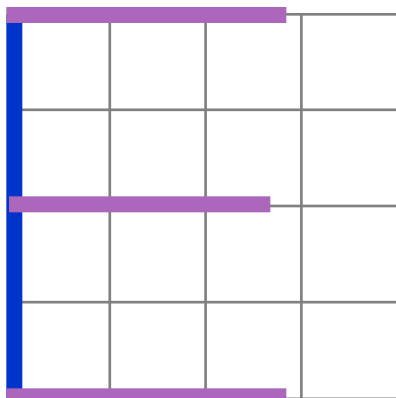
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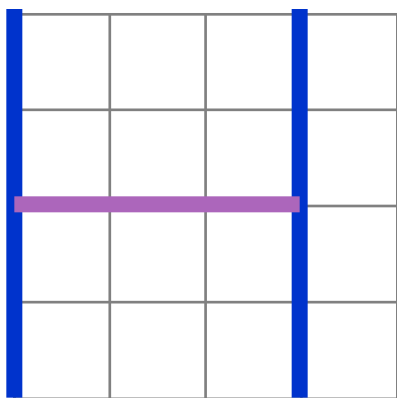
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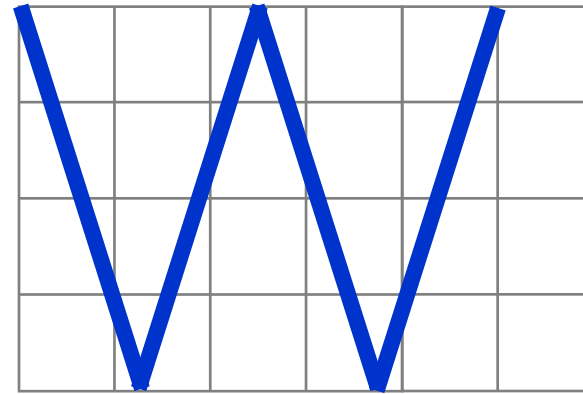
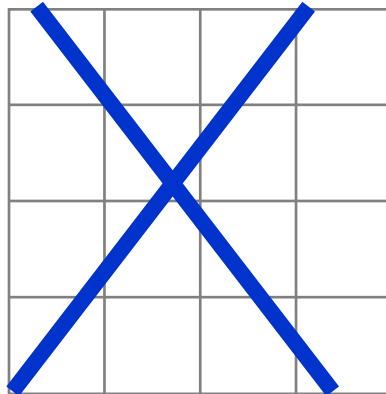
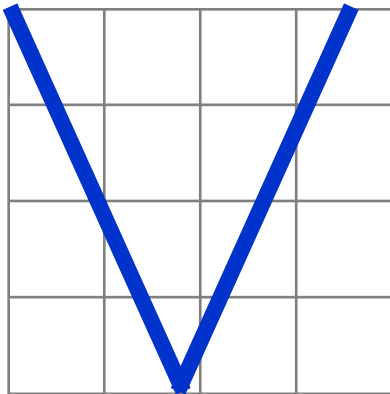
E



H

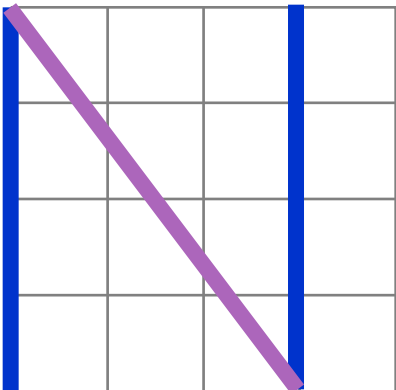


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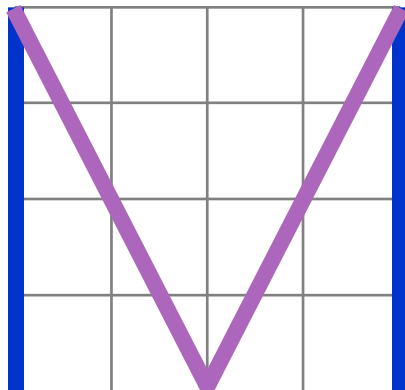


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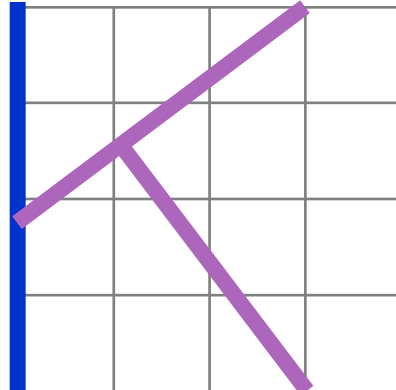
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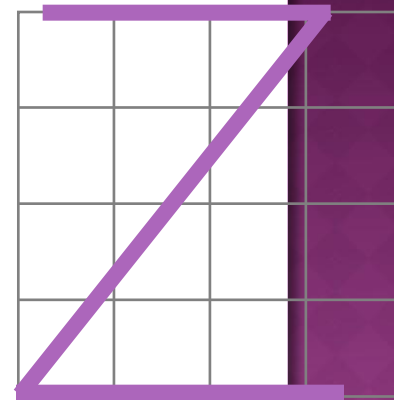
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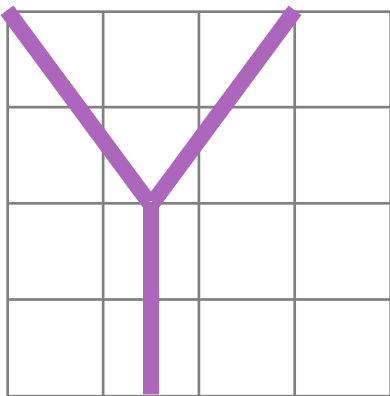
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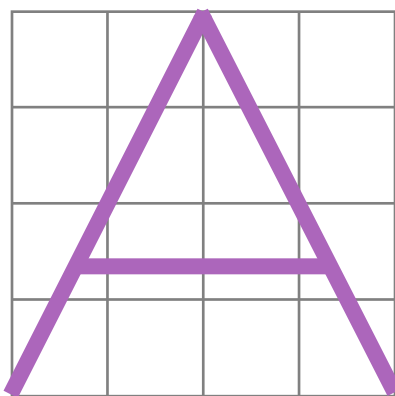
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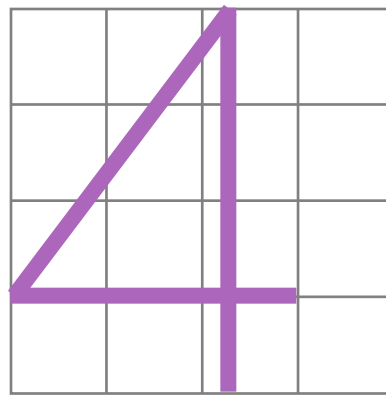
Y



A

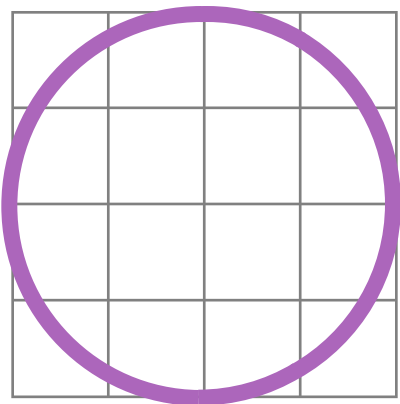


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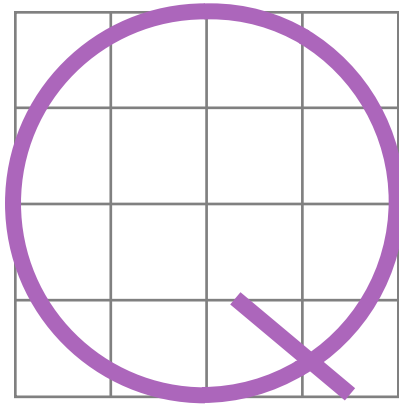


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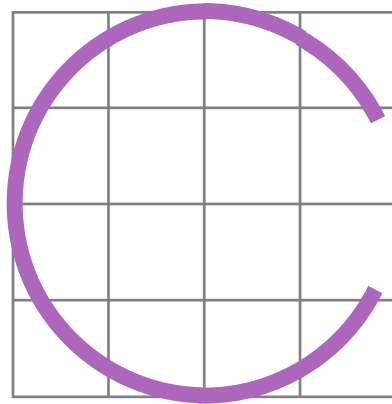
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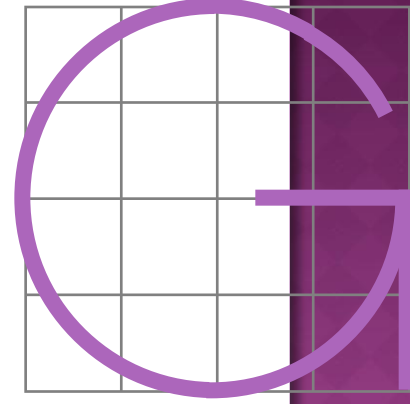
Q



C



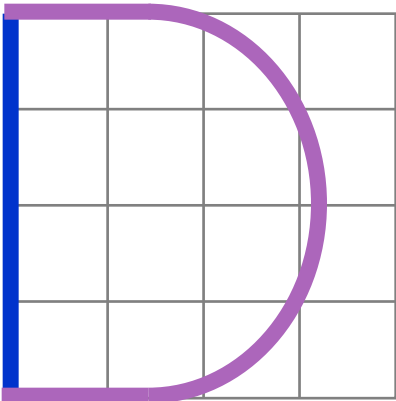
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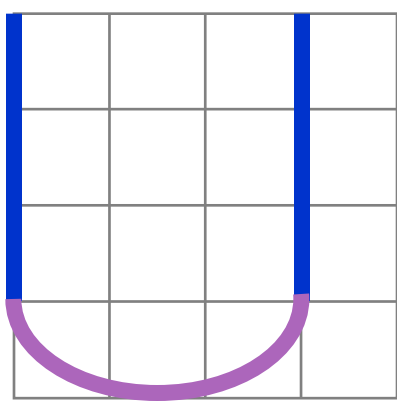


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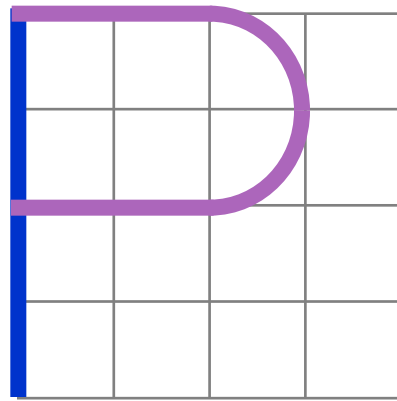
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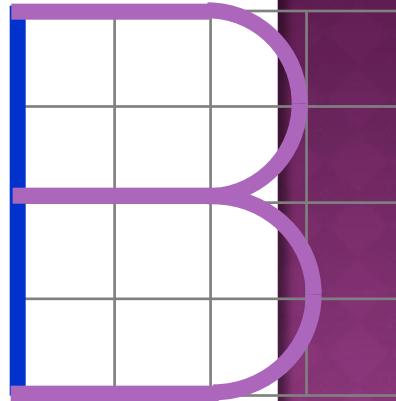
U



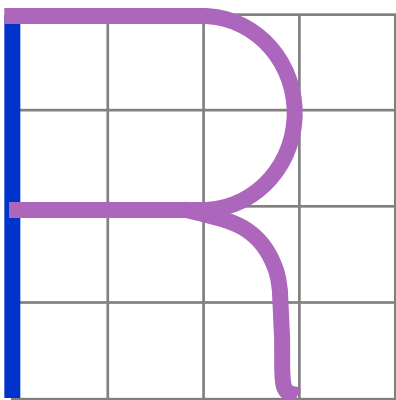
P



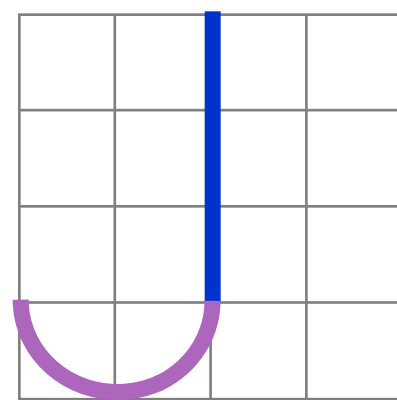
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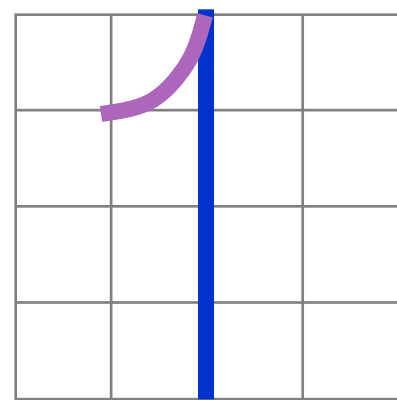
R



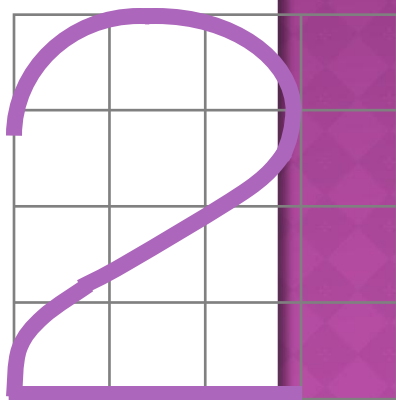
J



1

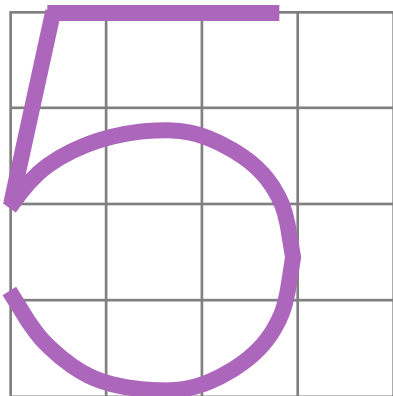


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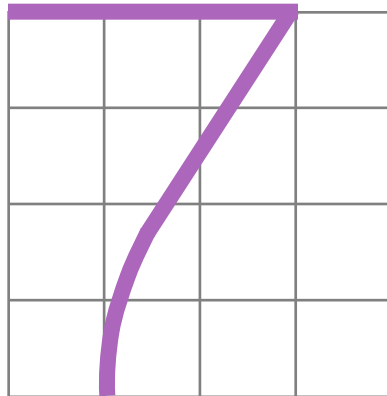


# STROKE SEQUENCE

5

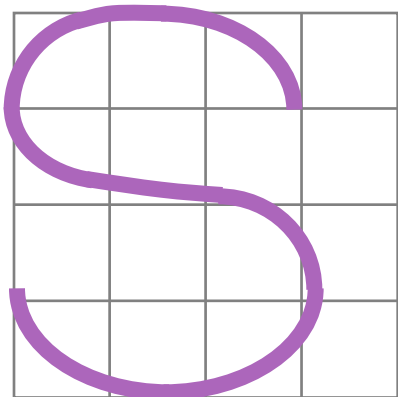


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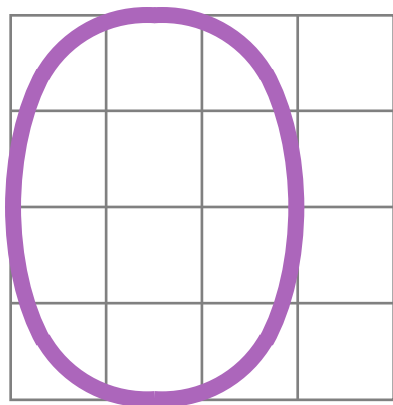


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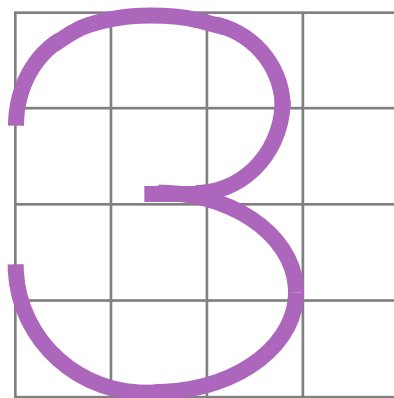
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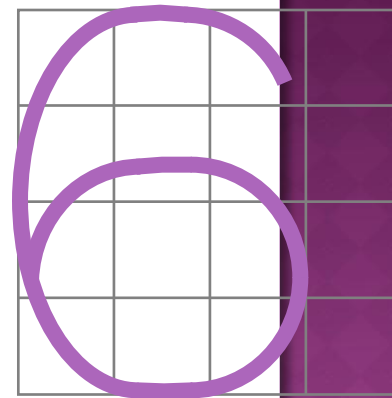
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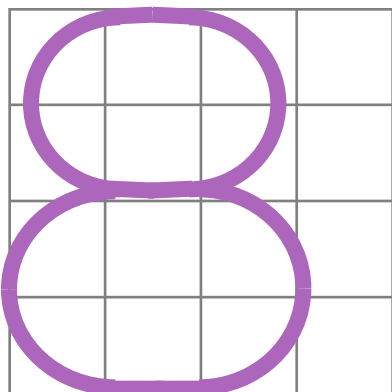
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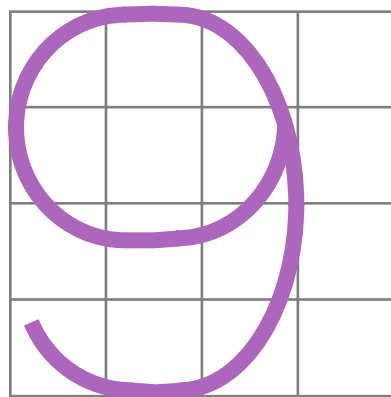
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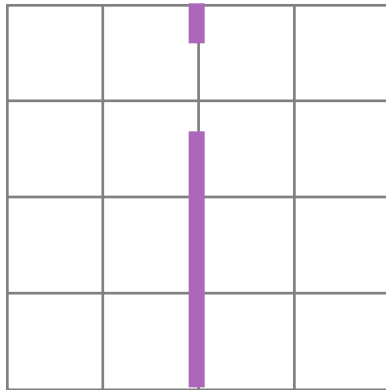
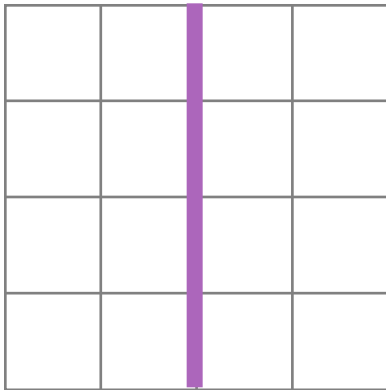
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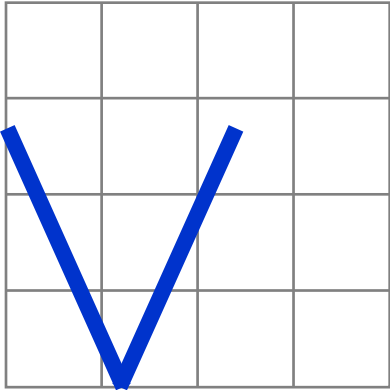


# Stroke Sequence

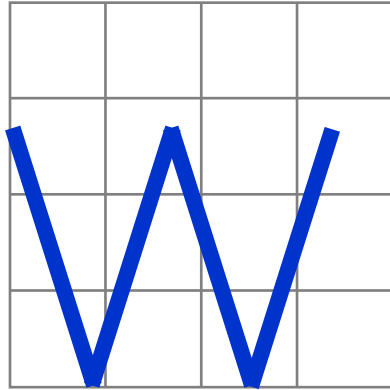


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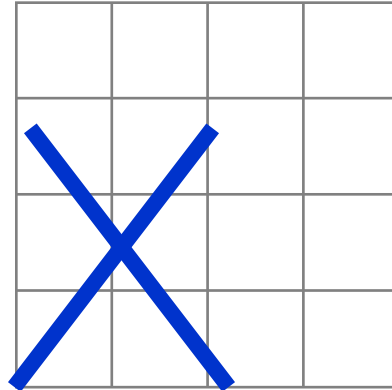
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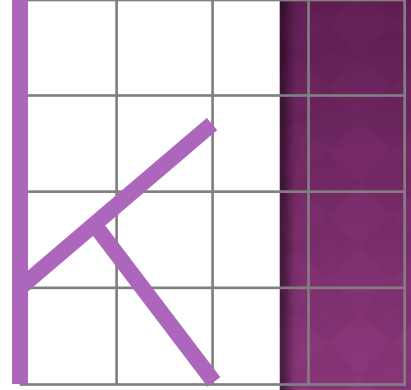
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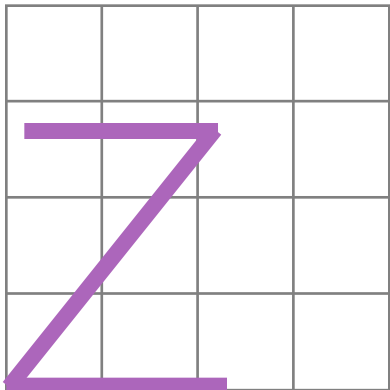
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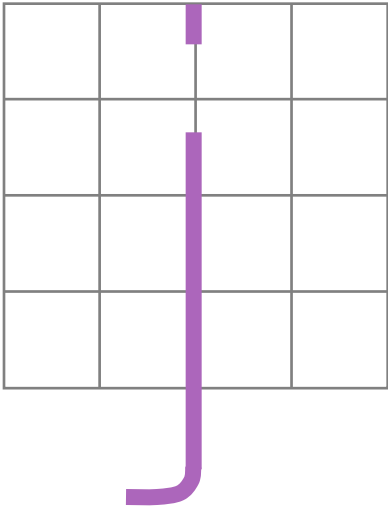


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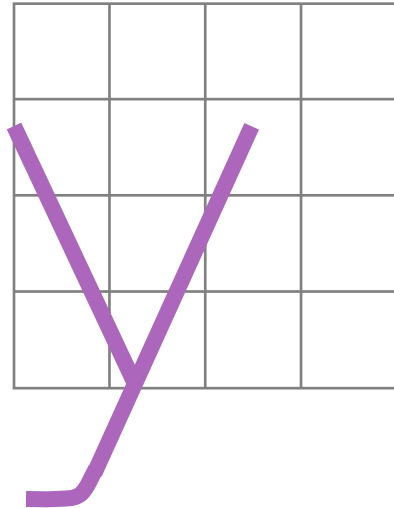


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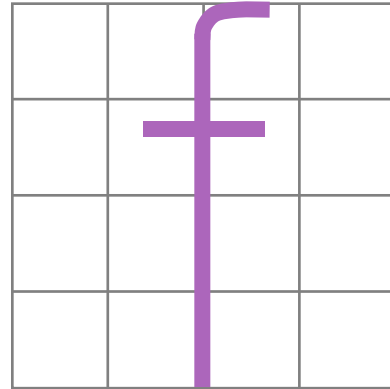
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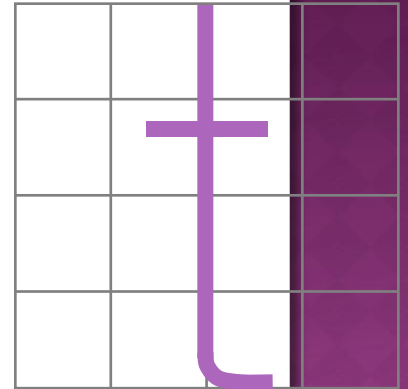
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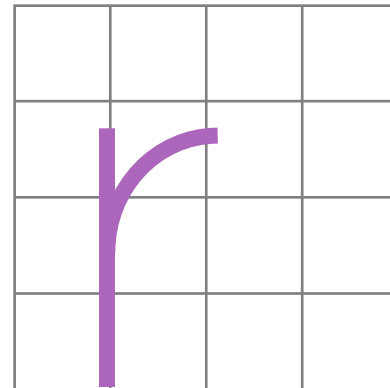
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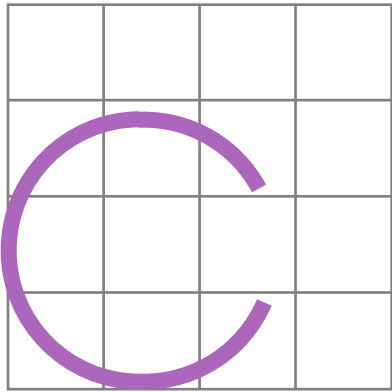


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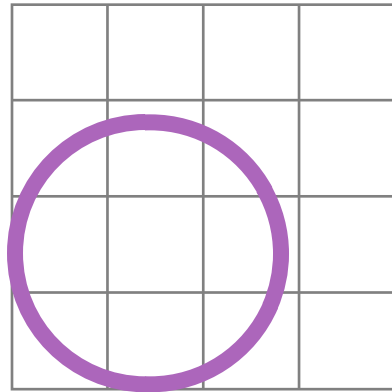


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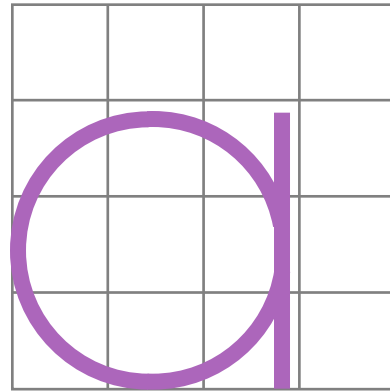
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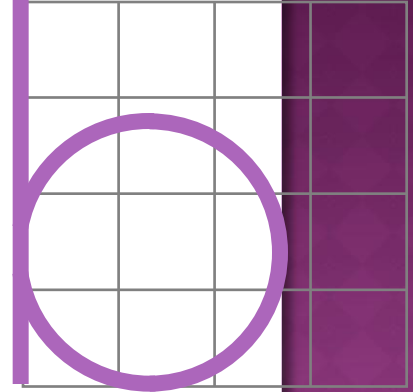
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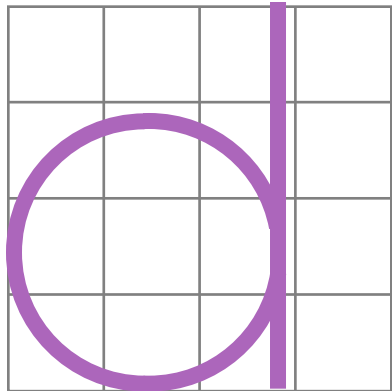
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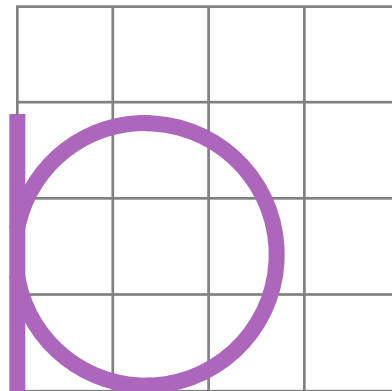
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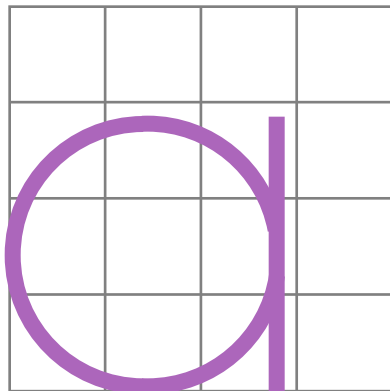
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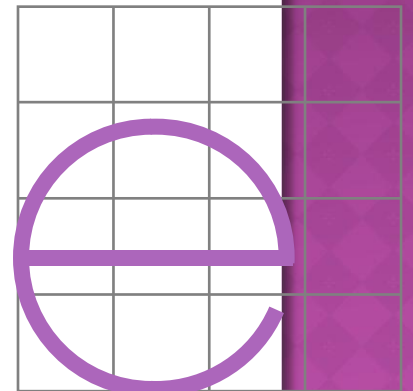
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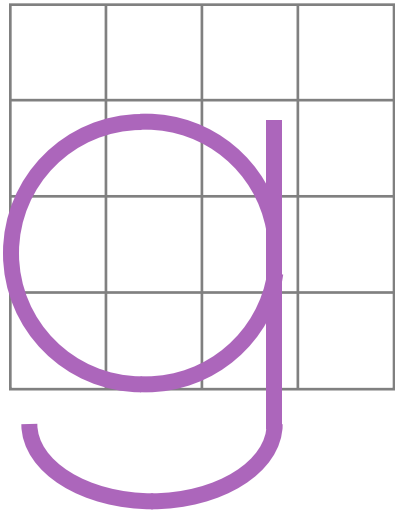


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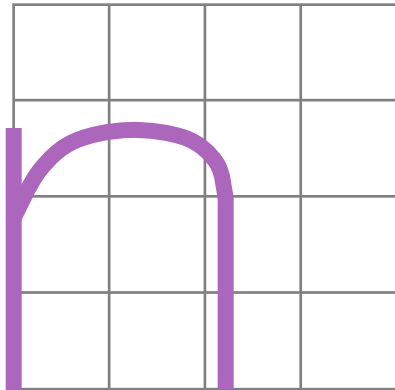


# Stroke Sequence

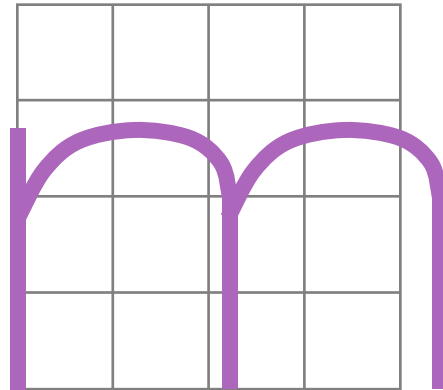
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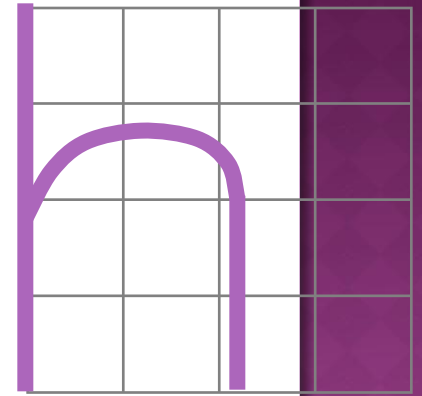
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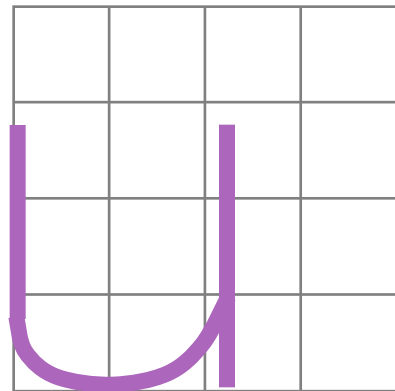
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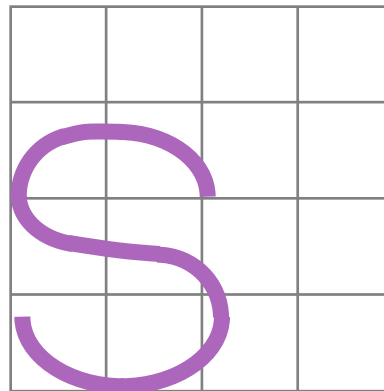
h



u



s






# Word Composition

Look at the same word having different spacing between letters.

A) Non-uniform spacing

JIRAPONG



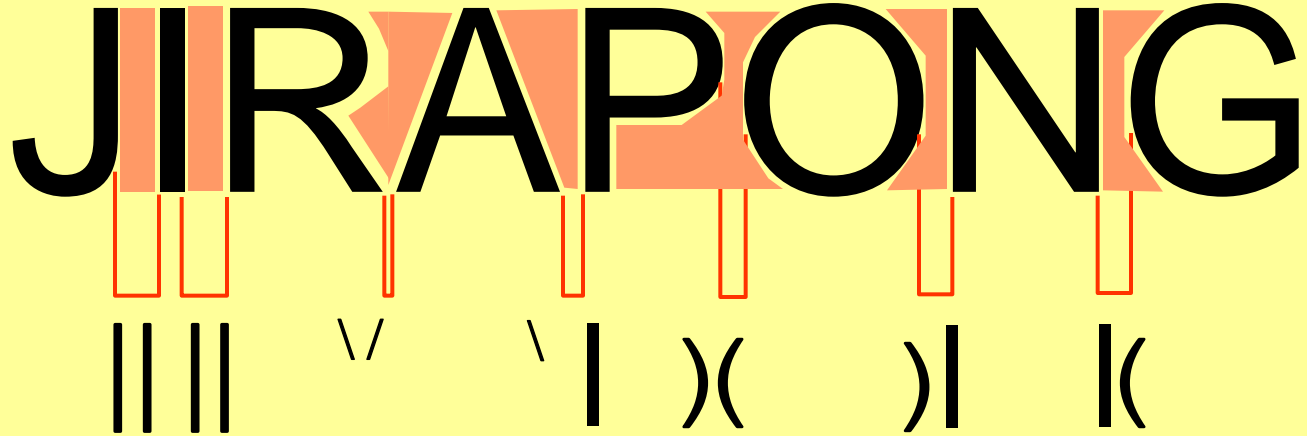
B) Uniform spacing

JIRAPONG



Which one is easier to read ?

# Word Composition



General conclusions are:

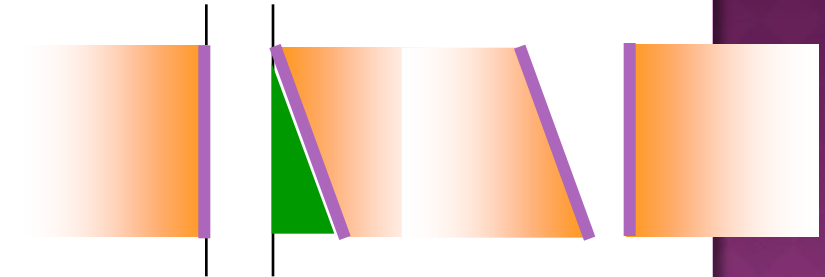
- Space between the letters depends on the contour of the letters at an adjacent side.
- Good spacing creates approximately equal **background area** between letters.

# Space between Letters

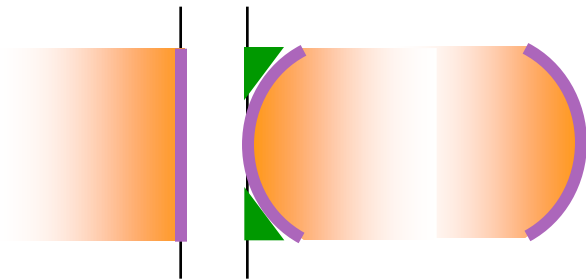
## 1. Straight - Straight



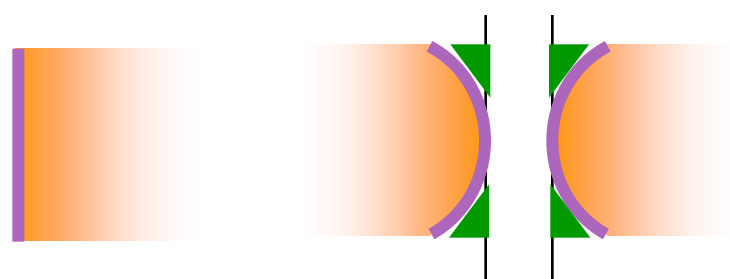
## 3. Straight - Slant



## 2. Straight - Curve

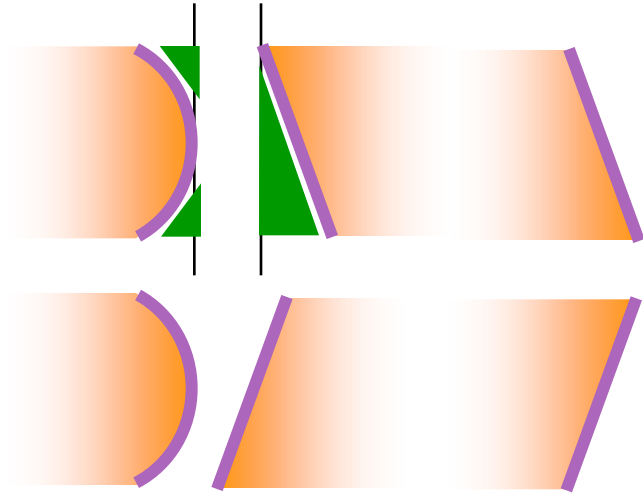


## 4. Curve - Curve

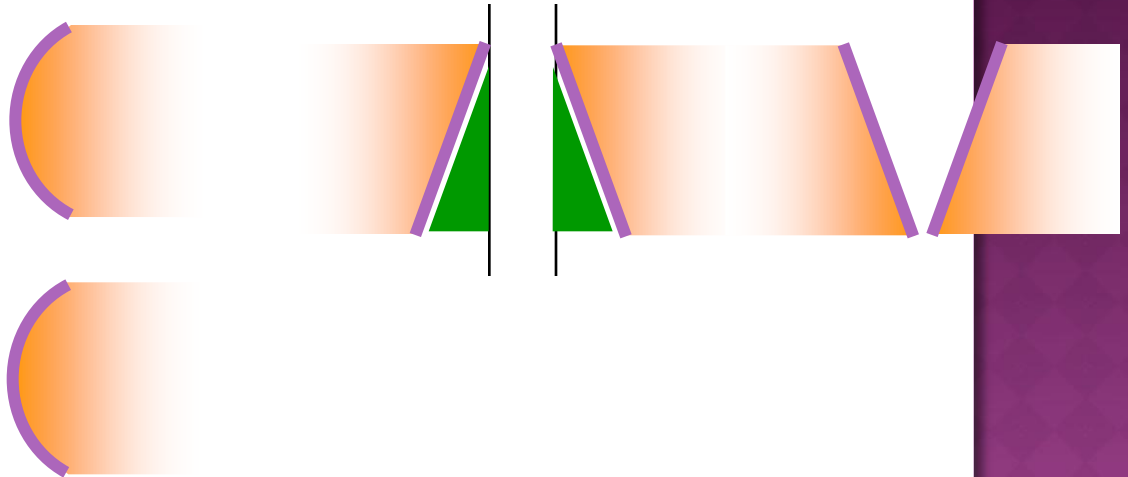


# Space between Letters

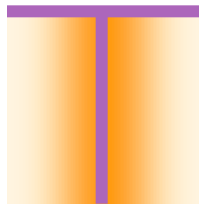
## 5. Curve - Slant



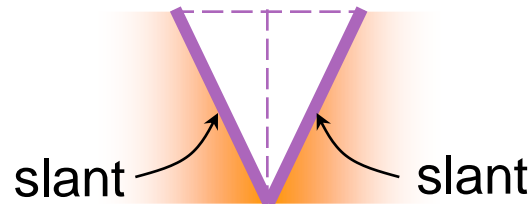
## 6. Slant - Slant



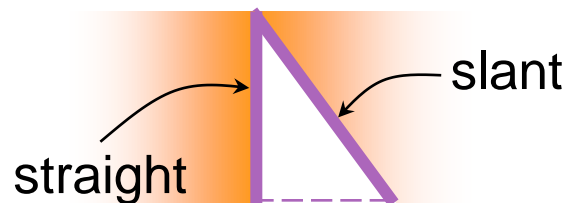
## 7. The letter "L" and "T"



≡



≡



## Example : *Good and Poor Lettering*

ESTIMATE

**GOOD**

EstiMaTE

Not uniform in style.

ESTIMATE  
ESTIMATE

Not uniform in height.

ESTIMATE  
ESTIMATE

Not uniformly vertical or inclined.

ESTIMATE  
ESTIMATE

Not uniform in thickness of stroke.

ESTIMATE

Area between letters not uniform.

ABILITY WILL NEVER CATCH UP  
WITH THE DEMAND FOR IT

Area between words not uniform.

# Sentence Composition

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

## Example

ALL O DIMENSIONS O ARE O IN  
INCHES O UNLESS  
OTHERWISE O SPECIFIED.

# TASK#1

- ◉ After the practice of boundary line
- ◉ Now draw the Title box/block
- ◉ Then the different types of Lines
- ◉ Stokes Practice with the following *Pangram*  
*The quick brown fox jumps over the lazy dog*
- ◉ Both in Capital and small
- ◉ Please draw the provided Seven (07) diagrams with suitable scales

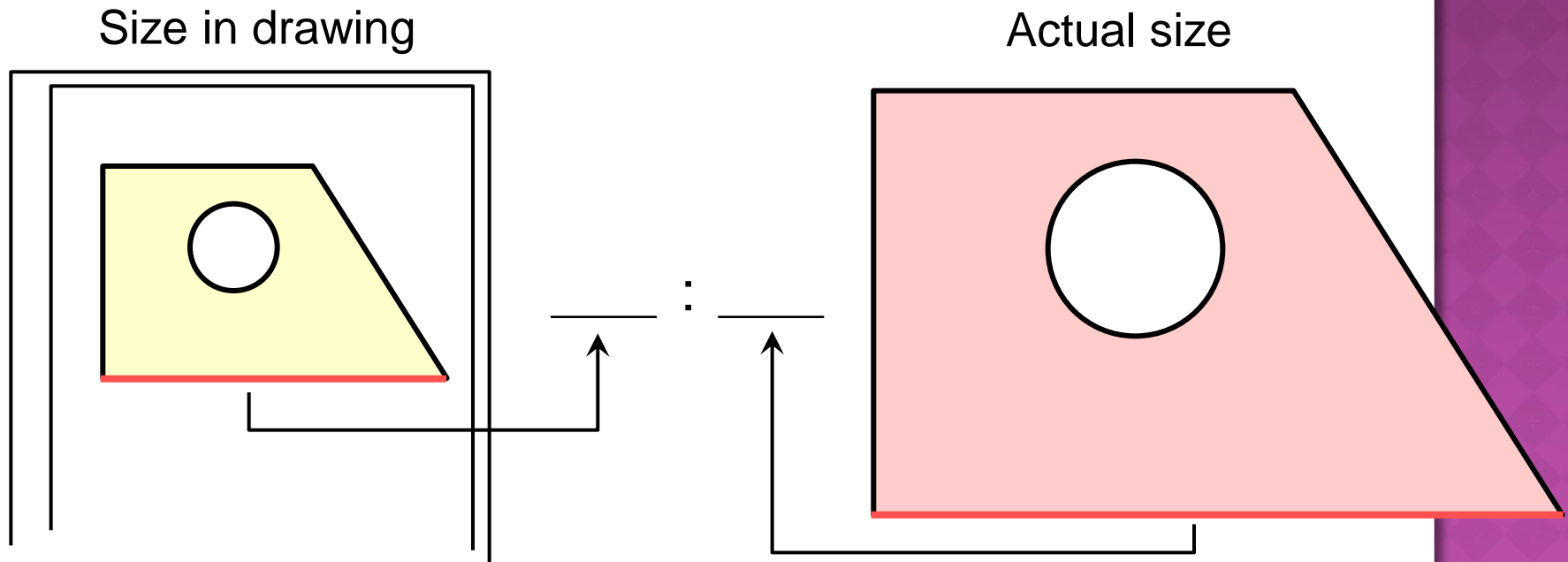
# SCALES



# 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 ( $X > 1$ )

SCALE 1:**X** for *reduction* scales ( $X > 1$ )

- Dimension numbers shown in the drawing are correspond to “true size” of the object and they are independent of the scale used in creating that drawing.

# INSTRUMENTAL PRACTICE

# TASK#2

- ◉ Study and practice of scales
- ◉ Please draw the provided Seven (07) diagrams with suitable scales

# BUILDING

- Beams
- Roof Slabs
- Walls
- Floors



# INTRODUCTION

- ◉ No matter how knowledgeable an engineer may be concerning the highly complex technical and scientific aspects of his profession, without a command of the engineer drawing he would be completely ineffective simply because he would fail miserably in understanding the designs of others and in transmitting his designs to others.
- ◉ A site-engineer reads the drawings supplied to him and accordingly carries out the construction exactly as originally conceived by the engineer.

# INTRODUCTION

- From the above example, it is clear that the only way of communication among the engineers is drawing with the help of which they can understand other engineers and express themselves.
- Hence it may safely be said that engineering drawing is the language of the engineers.

# INTRODUCTION

- ⦿ Engineering drawing may also be defined in another way, that is, it is a system of communication in which ideas are expressed exactly, information is conveyed completely and unambiguously, and even the most complicated shapes are specifically described.