بسم الله الرحمن الرحيم

Engineering Drawing

Textbook: Engineering Drawing

By M.B.Shaha and B.C. Rana

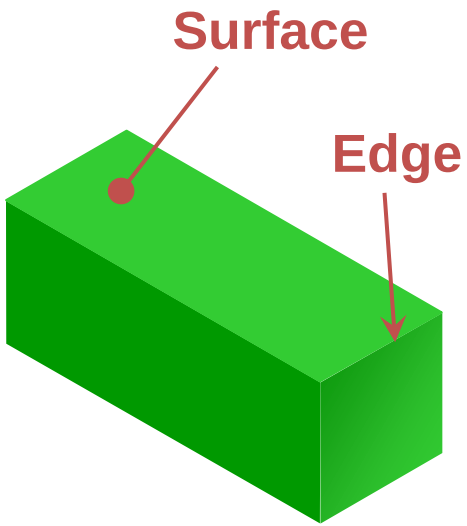
2nd edition , 2009

Engineering Drawing

Language

communicates an idea or design

use **Lines** to represent the **surfaces**, **edges** and **contours** of objects.



Engineering Drawing Applications(Importance)

- Mechanical Engineering

  .Detailed drawing of a part that needs to be machined.

- Electrical Engineering

  . A circuit schematic.

- Civil Engineering

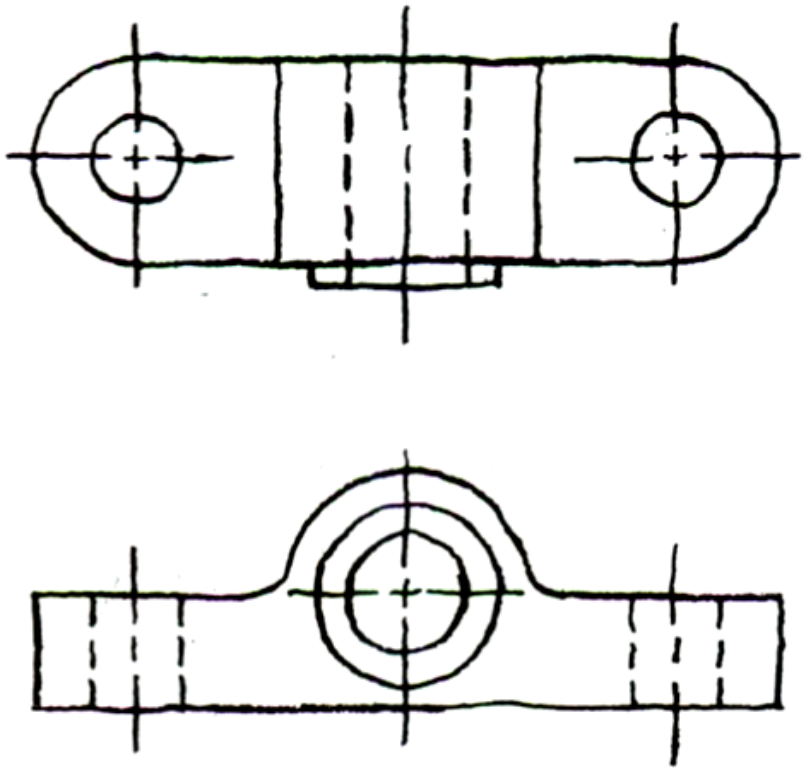
  . Plans for a bridge.

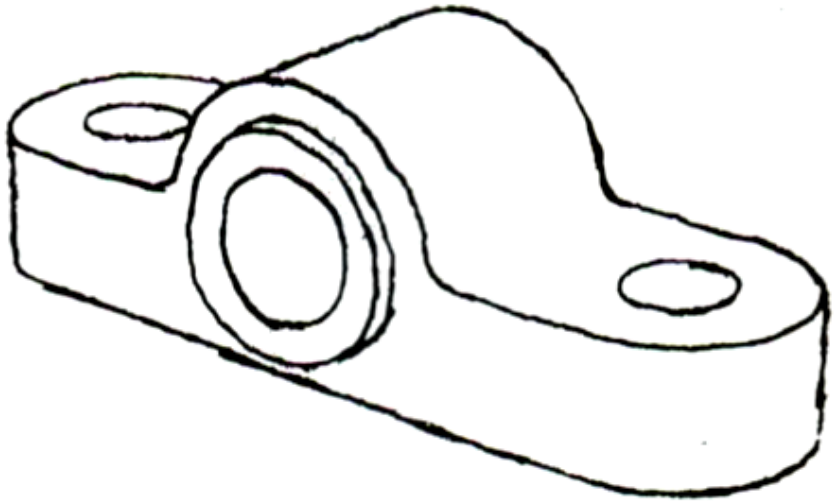
Drawing Types: A drawing can be done using **freehand**, **instruments** or **computer** methods.

Freehand Drawing

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

Example

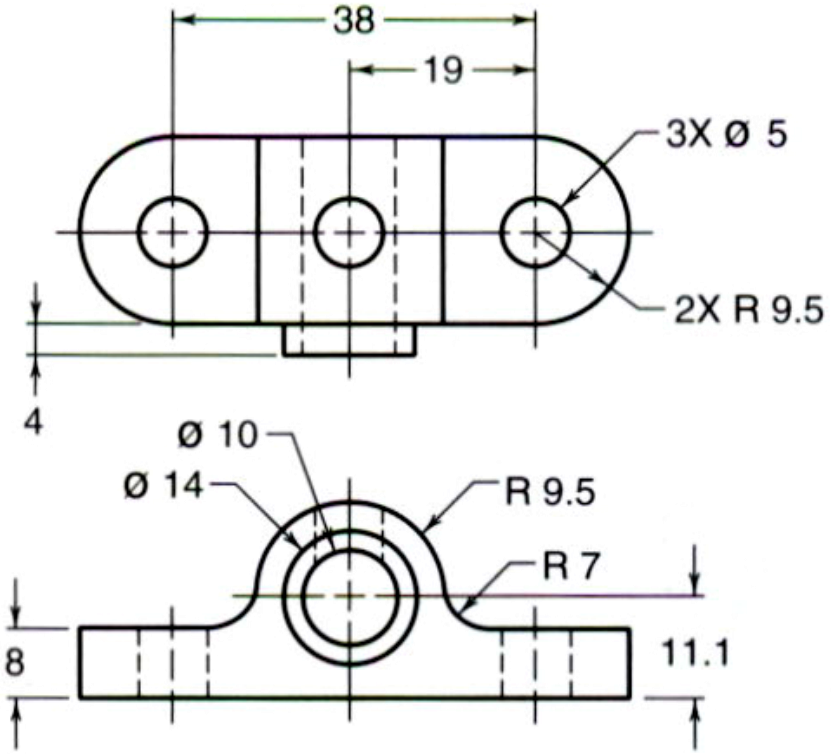




Drawing Instruments

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.

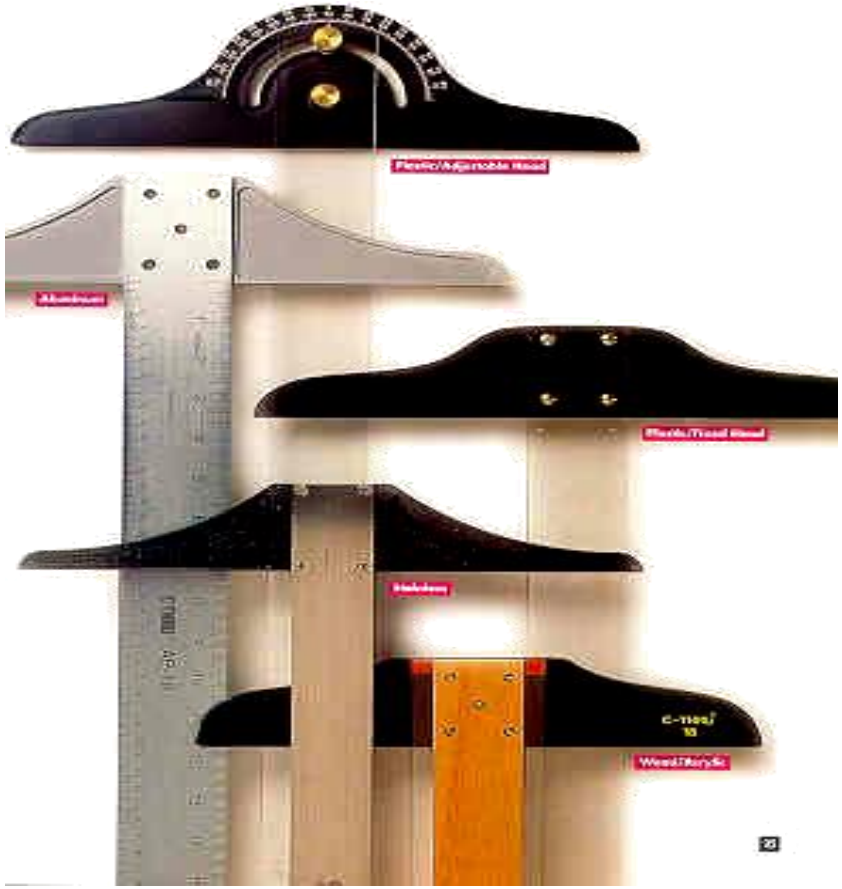
Example

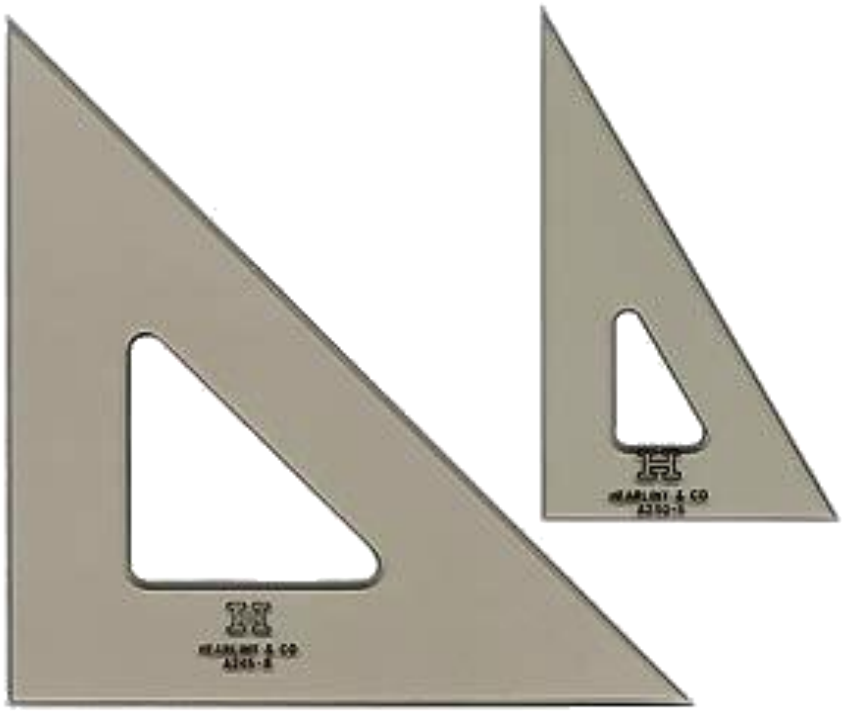
Standard Codes

Country	Code	Full Name
USA	ANSI	American National Standard Institute
Japan	JIS	Japanese Industrial Standard
UK	BS	British Standard
Australia	AS	Australian Standard
Germany	DIN	Deutsches Institut für Normung

ISO International Standards Organization

Drawing Tools



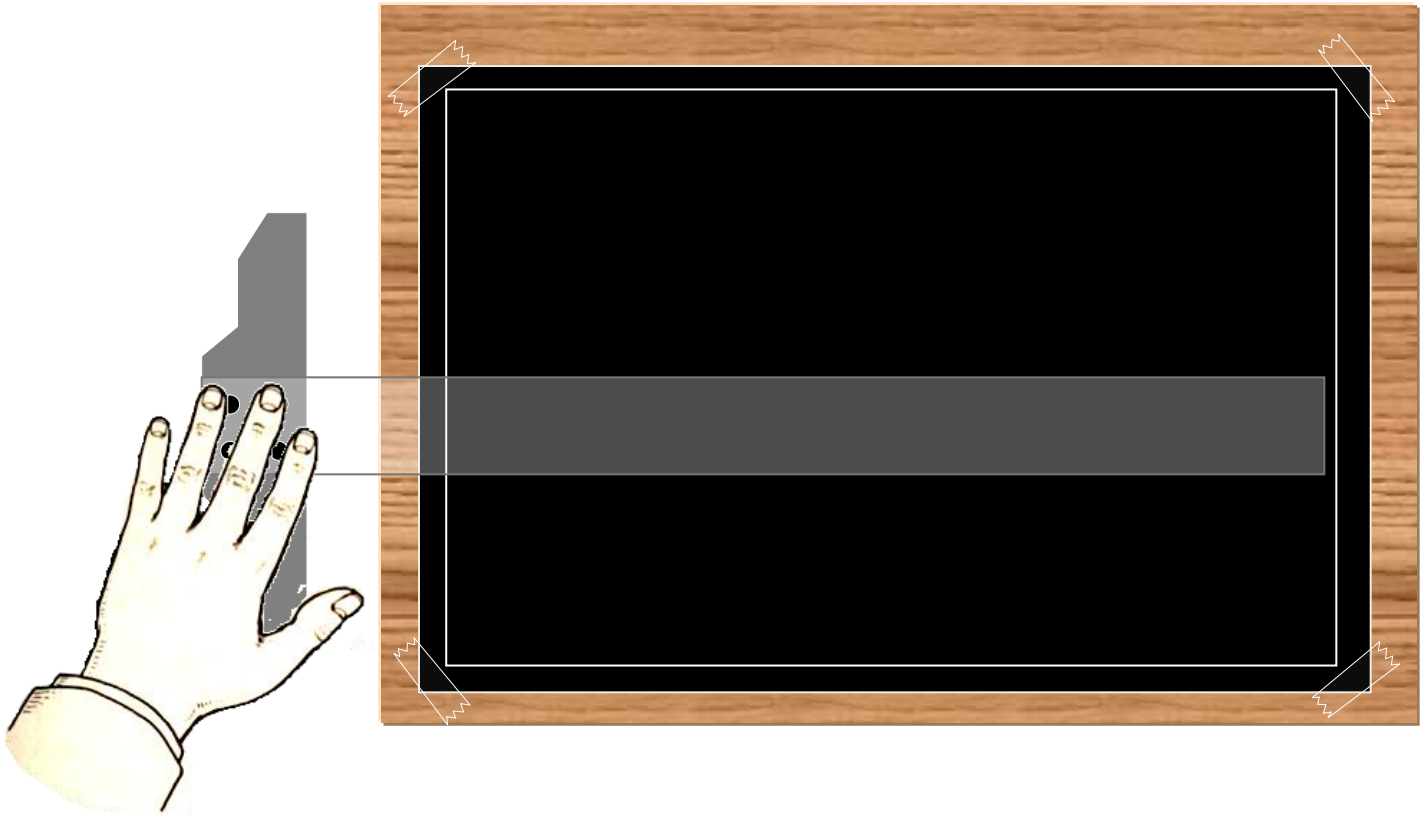


T-Square ⇨ Straight line ⇦ Triangles

Draw a Horizontal Line

1. Press the T-square head against the left edge of the table.

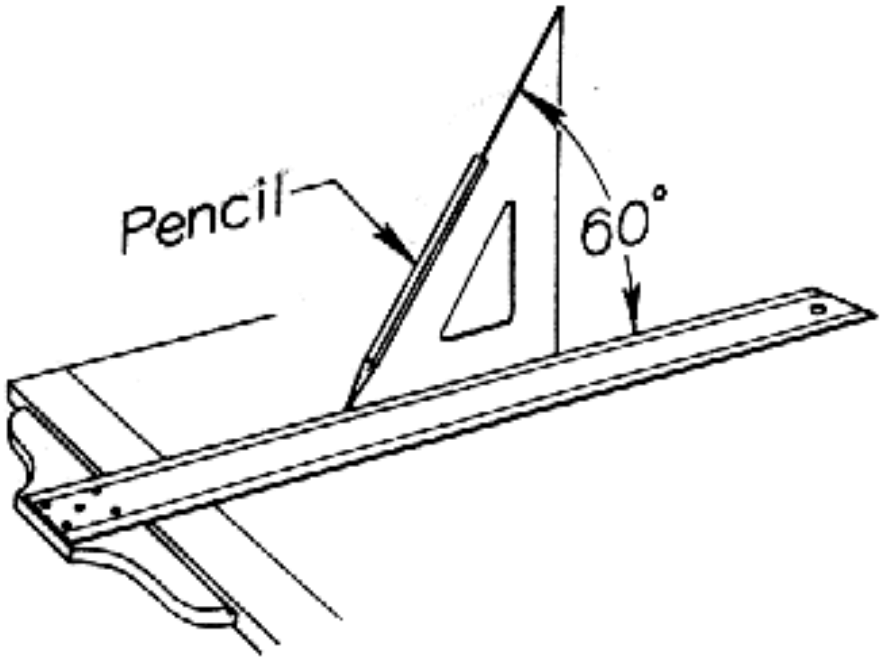
2. Smooth the blade to the right.



Draw a Horizontal Line

3. Lean the pencil at an angle about 60º with the paper in the direction of the line.

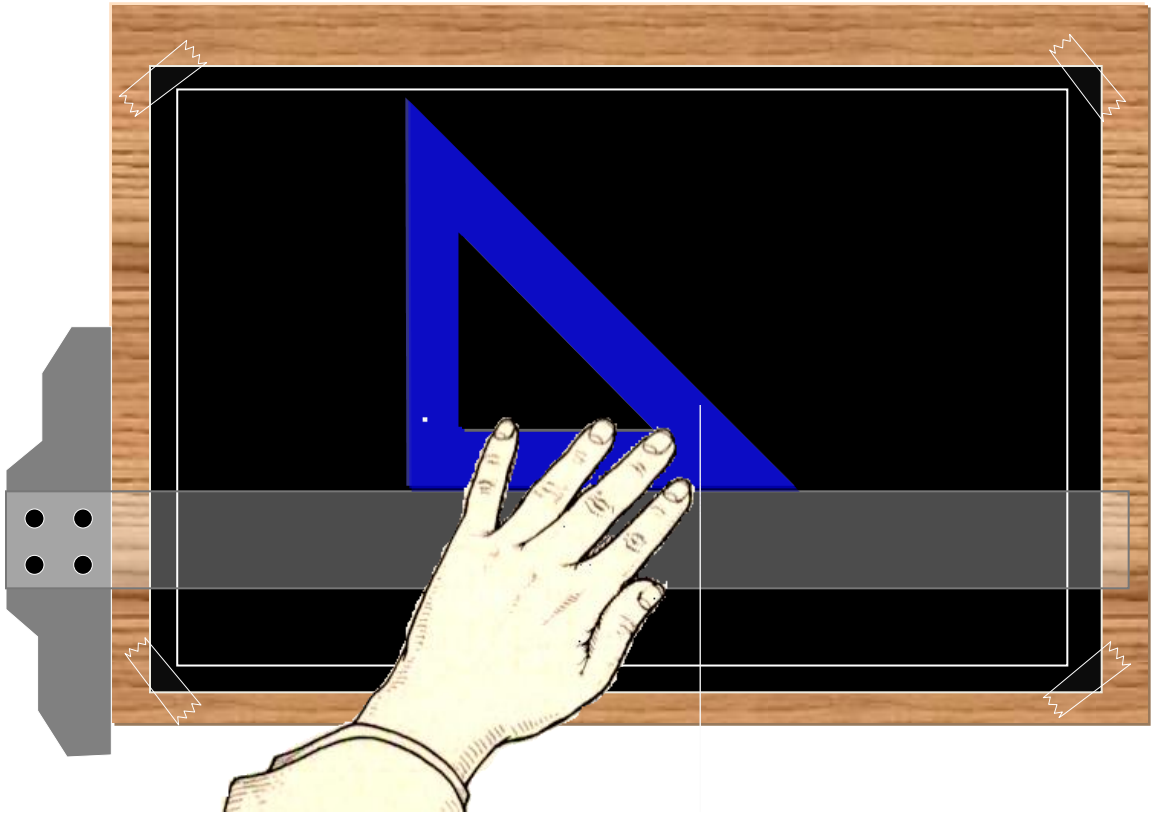
4. Draw the line from left to right while rotating the pencil slowly .



Draw a Vertical Line

1. Set T-square as before. Place any triangle on T-square edge.

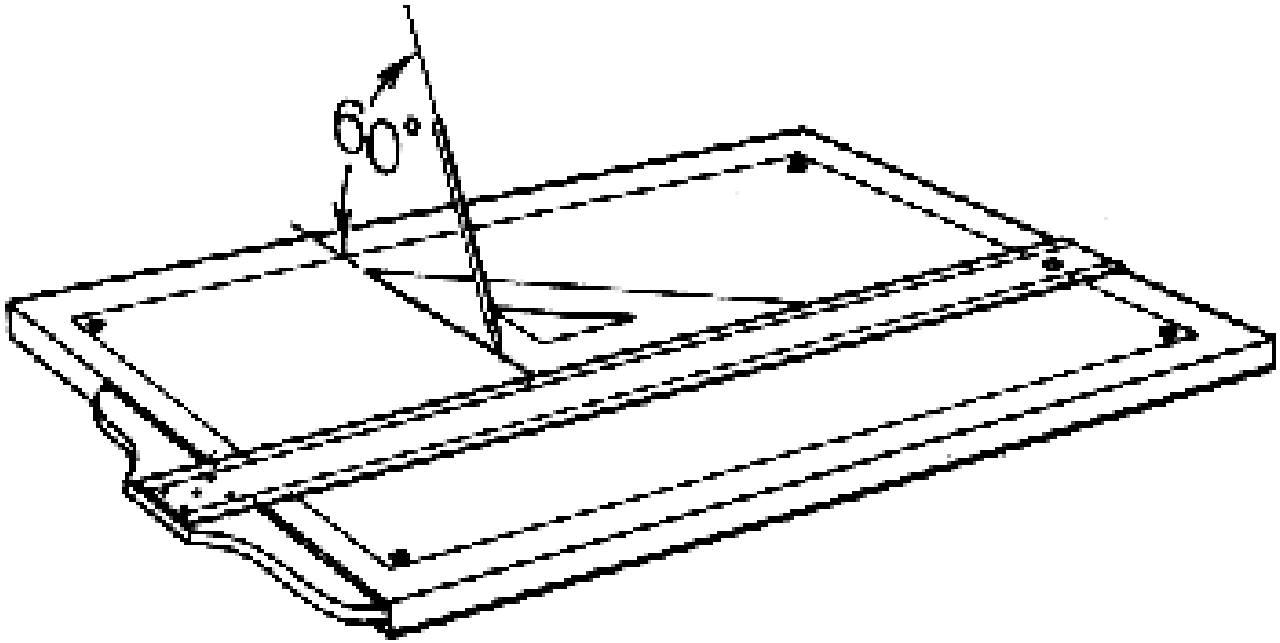
2. Slide your left hand to hold both T-square and triangle in position.



Draw a Vertical Line

3. Lean the pencil to the triangle.

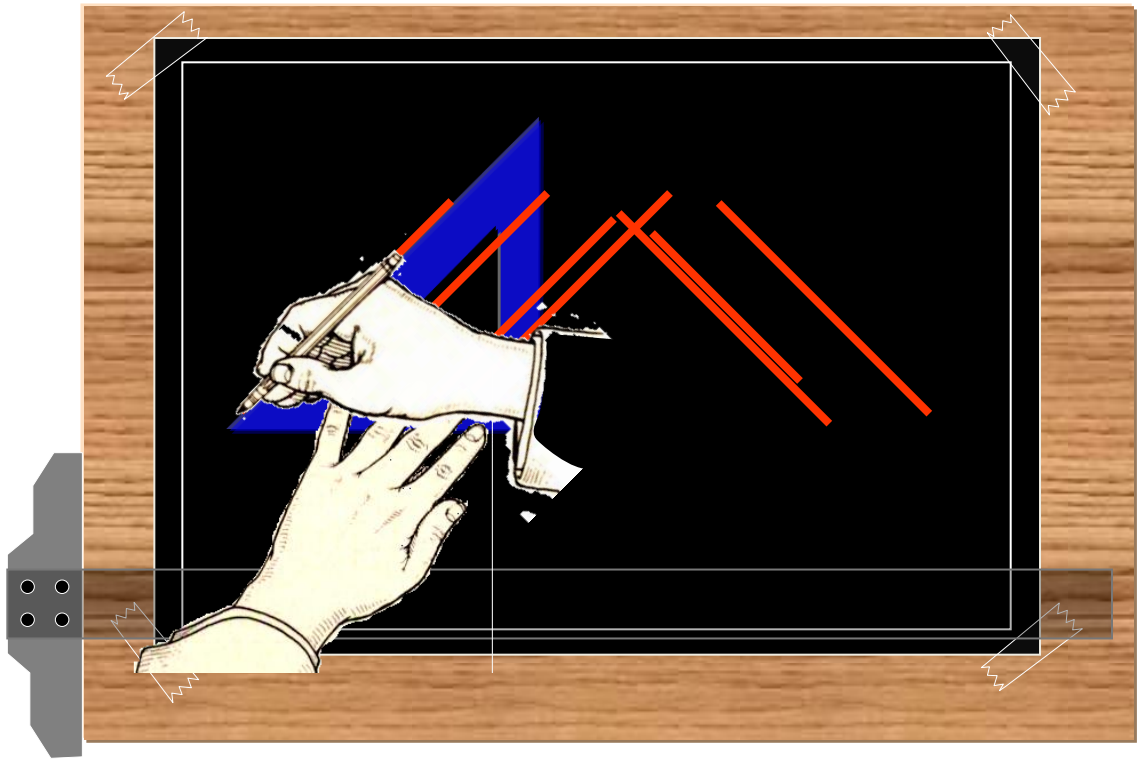
4. Draw the line upward while rotating the pencil slowly.



Draw a Line at 45º with Horizontal

1. Place 45º triangle on the T-square edge and press them firmly against the paper.

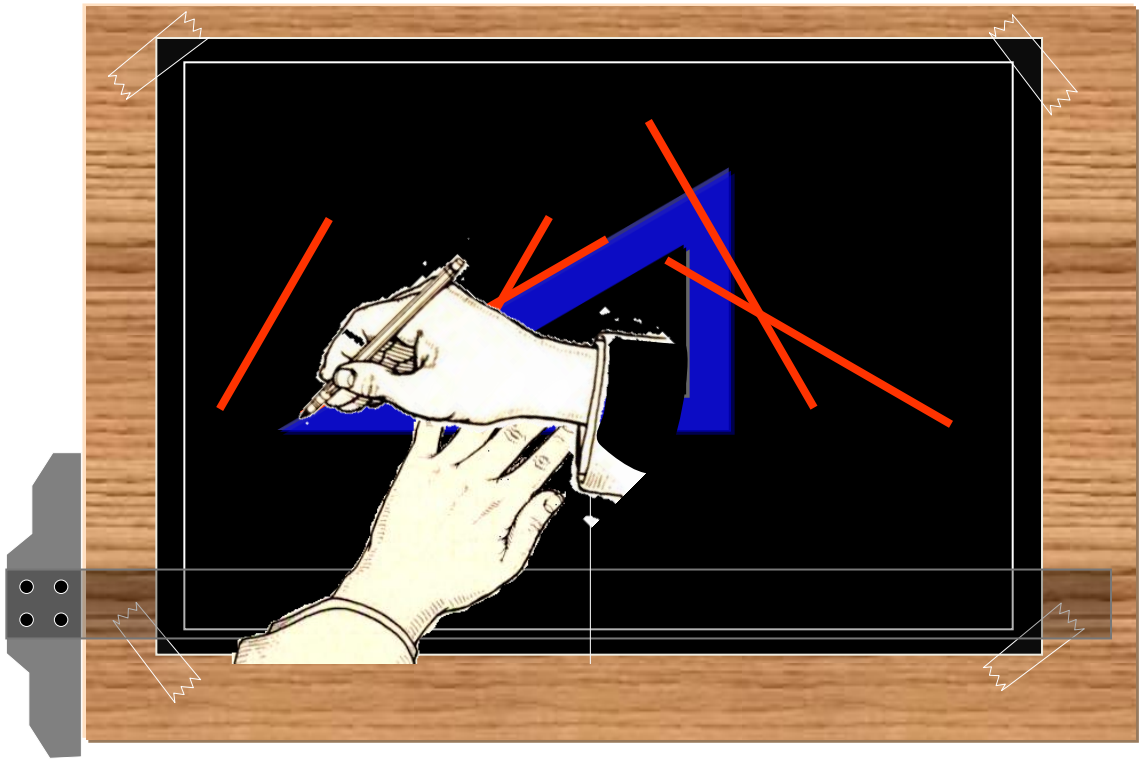
2. Draw the line in the direction as shown below.



Draw a line at Angle 30º and 60º

1. Place 30º-60º triangle on the T-square edge and press them firmly against the paper.

2. Draw the line in the direction as shown below.



Draw the lines at 15º increments

0 deg.

15 deg. = –30 + 45 deg

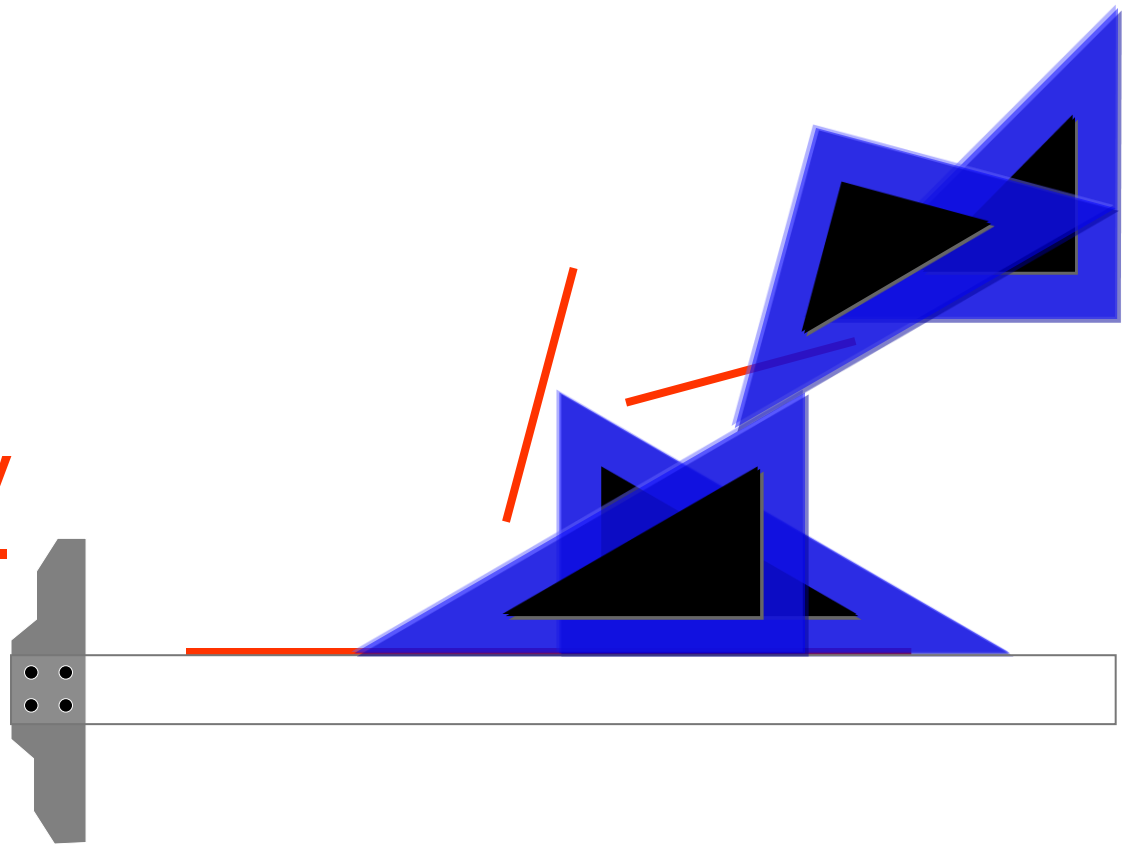
30 deg.

45 deg. Already demonstrated.

60 deg.

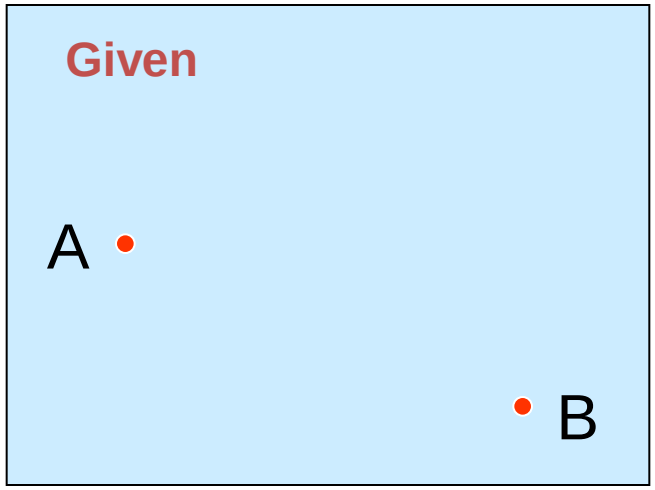
75 deg. = 30 + 45 deg

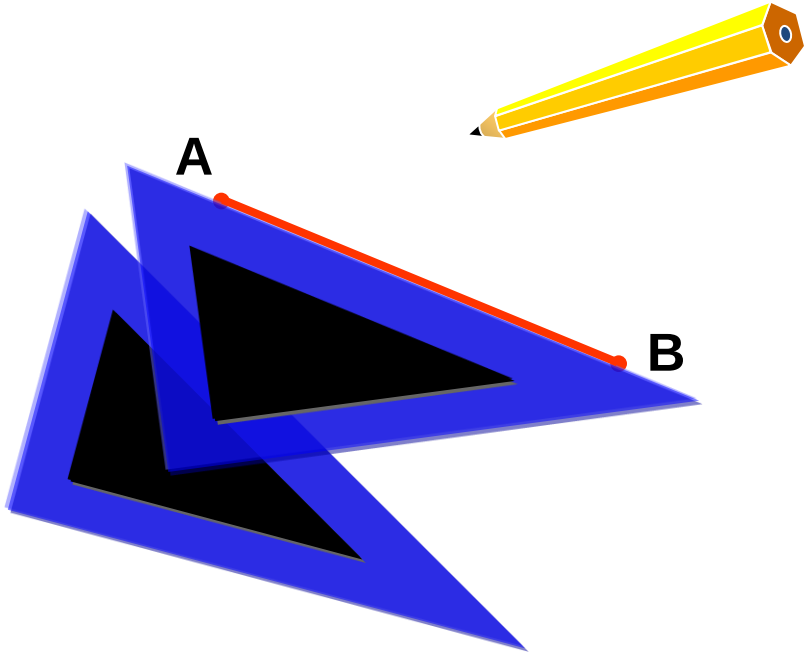
90 deg. Already demonstrated.



Draw the Line Passing Through Two Given Points

1. Place the pencil tip at one of the points.
2. Place the triangle against the pencil tip.
3. Swing the triangle around the pencil tip until its edge align with the second point.
4. Draw a line.

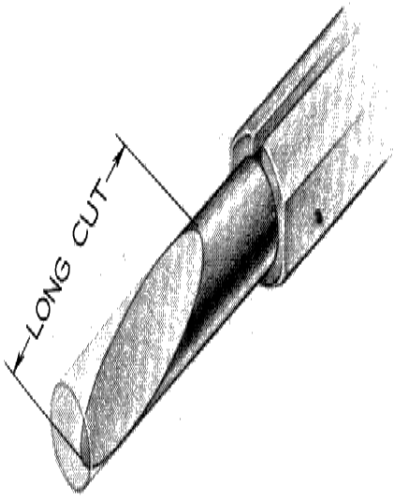


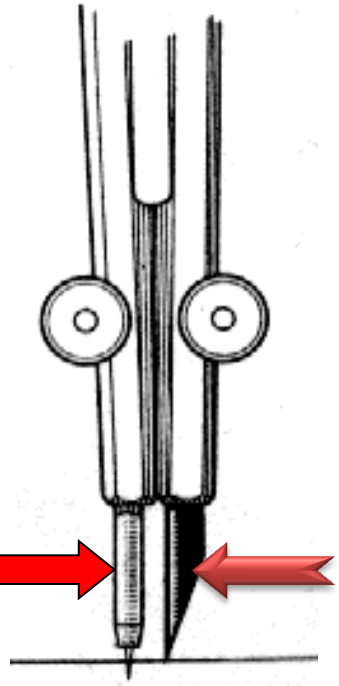


Drawing Tools

Preparing the Compass

1. Sharpen the lead with a sandpaper.
2. Adjust the **needle** and the **lead** so that the tip of the needle extends slightly more than the lead.





needle **lead**

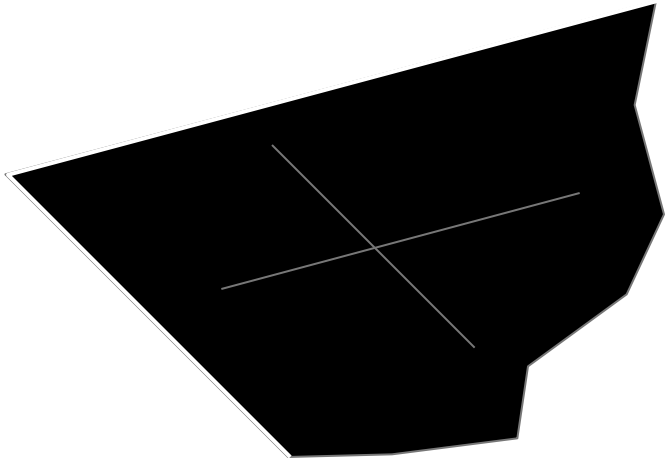
Compasses → Arc, Circle

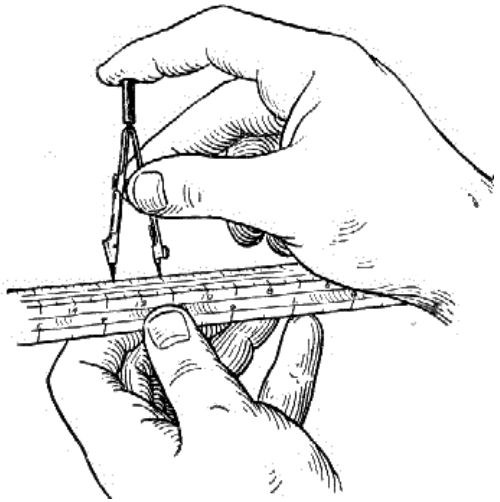
Using the Compass

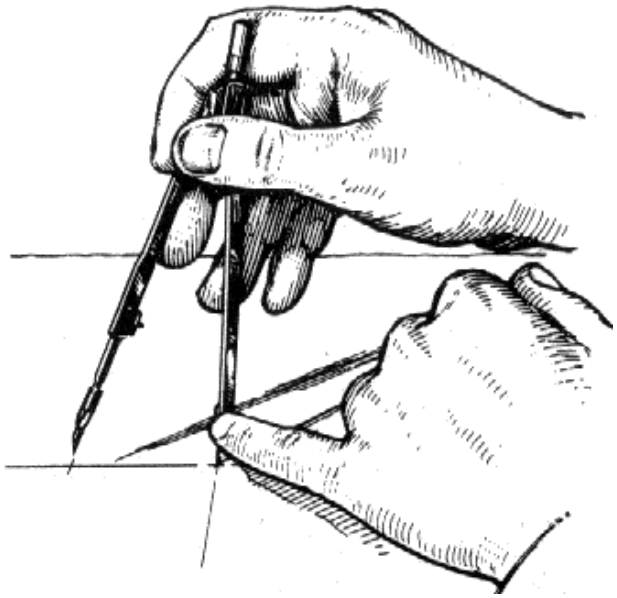
1. Locate the center of the circle by two intersecting lines.

2. Adjust the distance between needle and lead to a distance equal to radius of the circle.

3. Set the needle point at center.



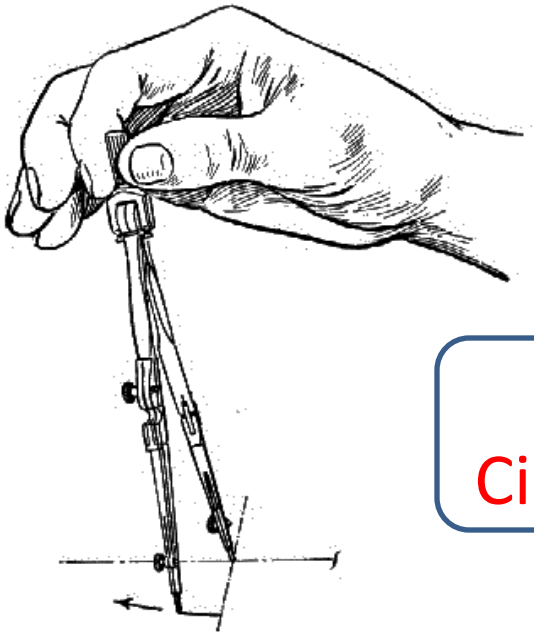




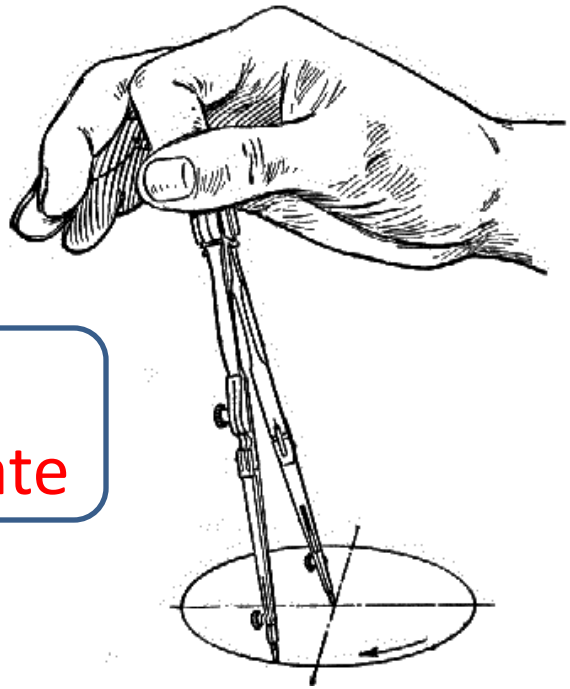
Using the Compass

4. **Start circle.** Apply enough pressure to the needle, holding compass handle between thumb and index fingers.

5. **Complete circle.** Revolve handle clockwise.



Don't Use
Circle Template



Drawing Tools

HB for thick line (0.7 mm or 0.5 mm)

2H for thin line &
3H or 4H for guiding lines

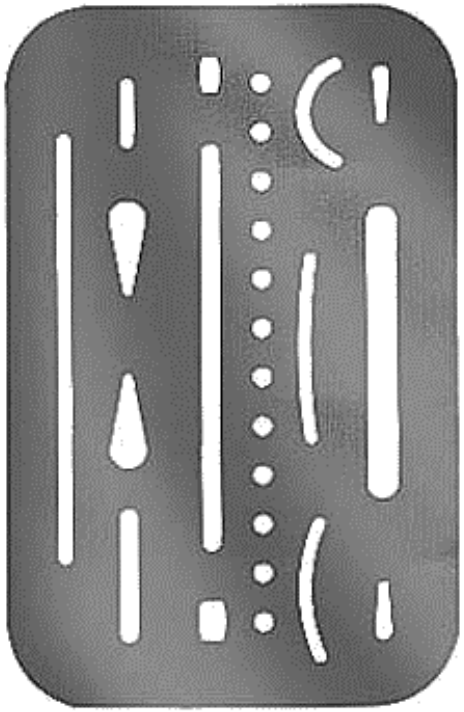
Adhesive Tape

Pencils

Drawing Tools

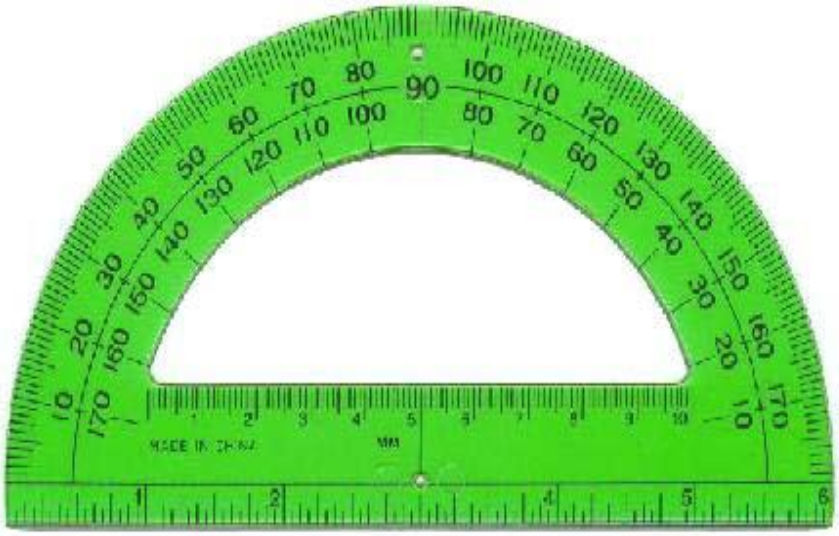
Pencil Eraser

French Curves

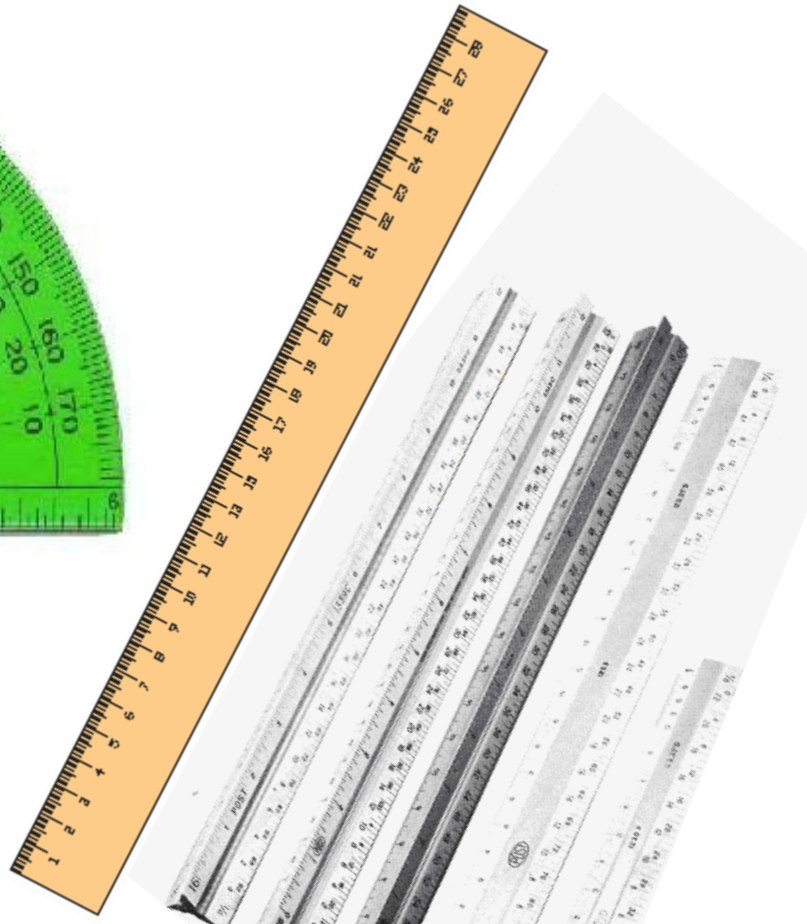


Erasing Shield

Drawing Tools



PROTRACTOR



Scale (ruler)

Drawing Tools

Note :Don’t use any template of:

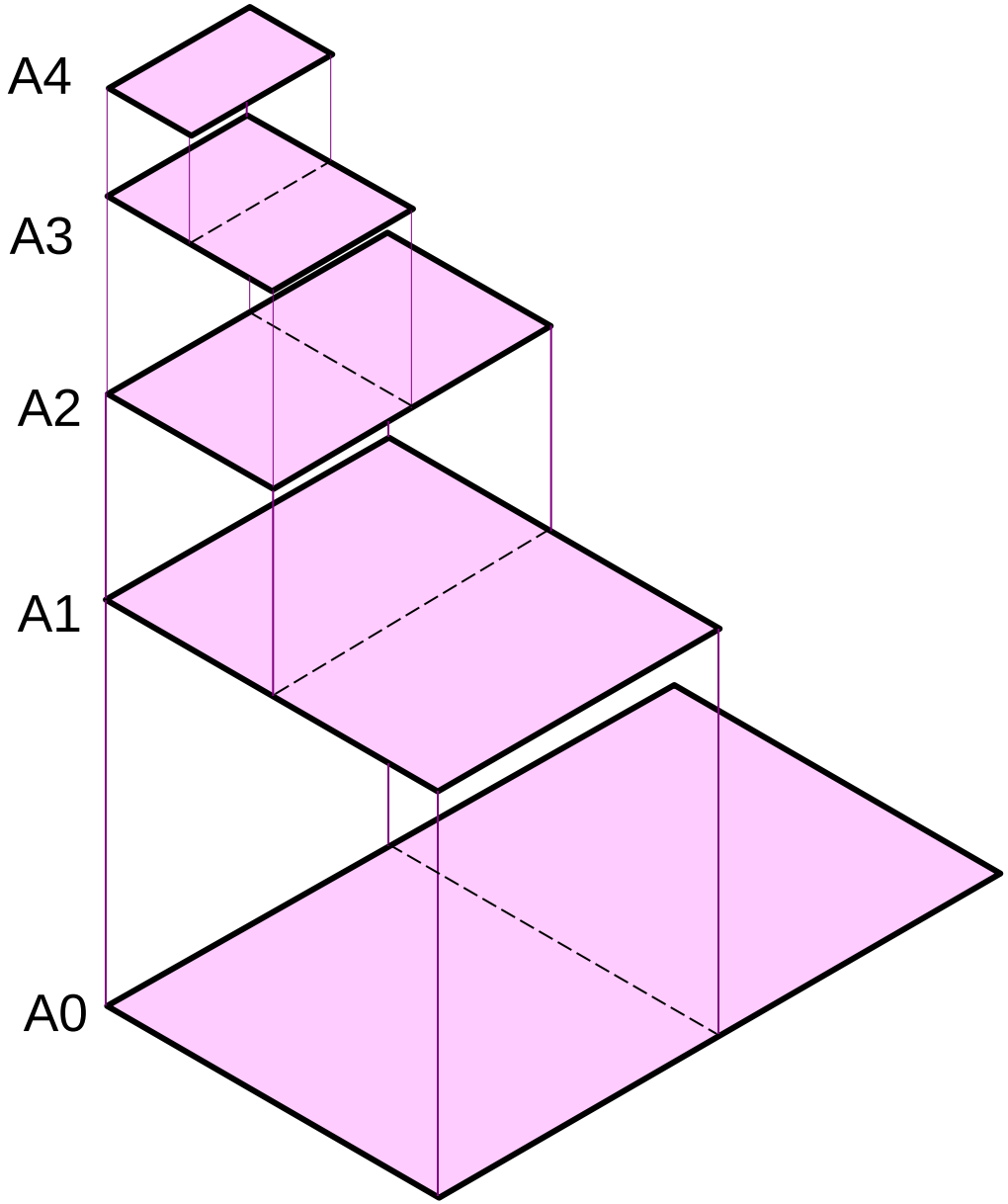
- Circles.
- Ellipses.
- Letters.

Drawing Sheets (Papers)

- 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

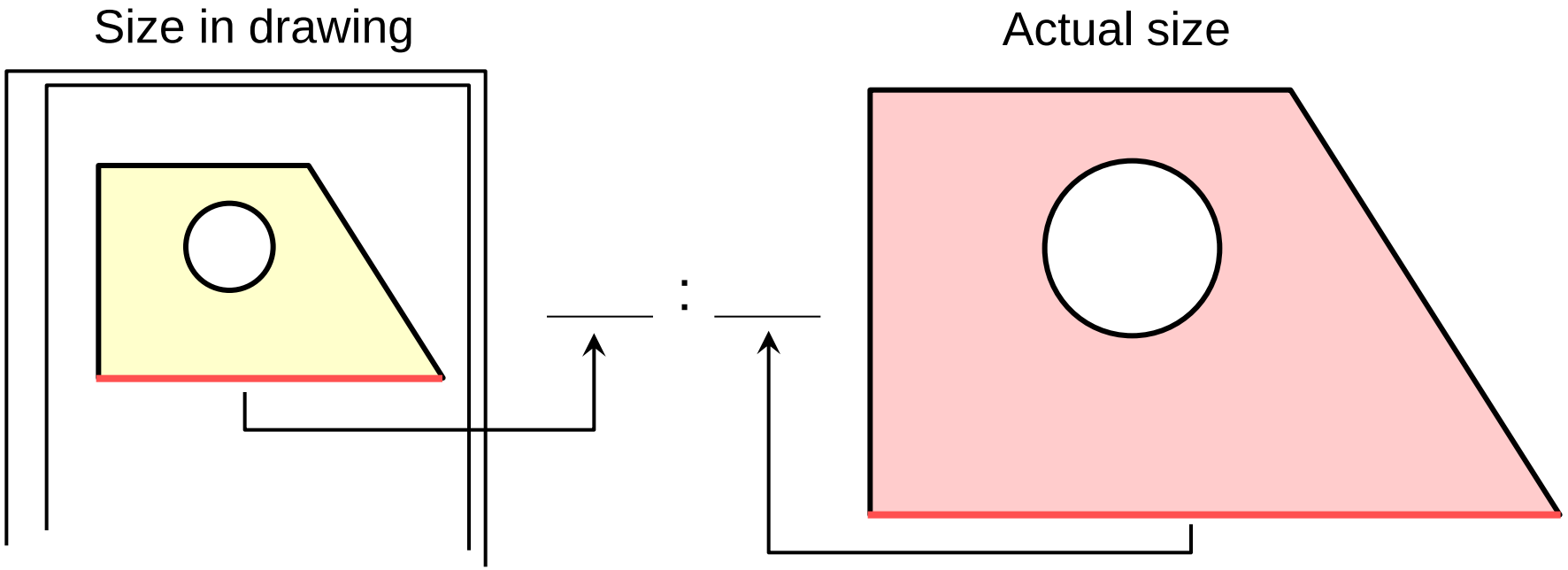
(Dimensions in millimeters)



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

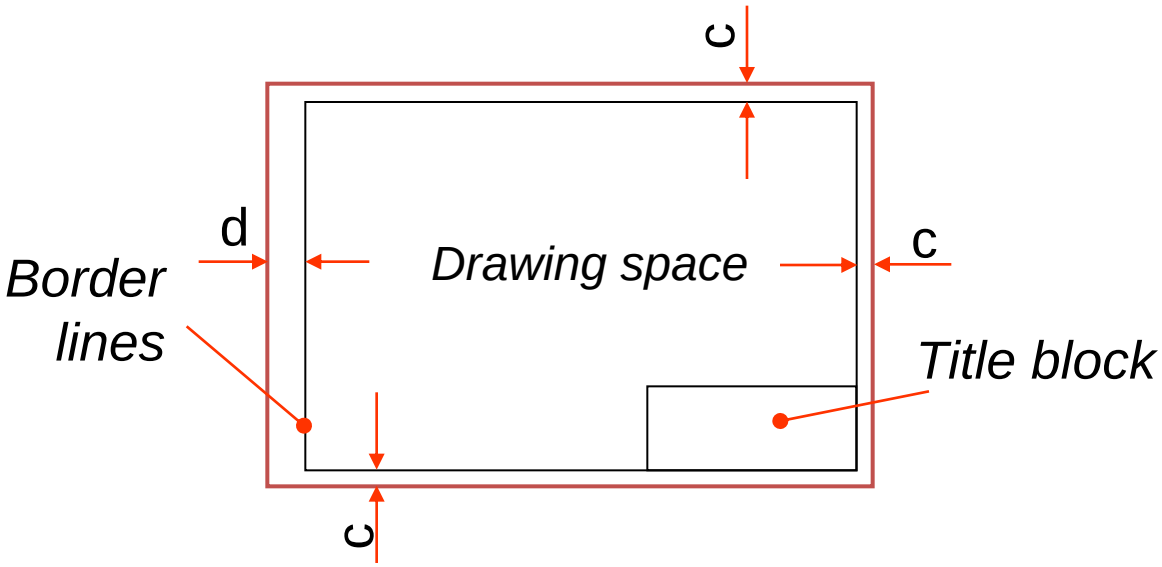
Designation of a scale consists of the word "SCALE" followed by the indication of its ratio, as follow

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.

Note: Take scale as given to u, otherwise you must choose a suitable scale.

Orientation of Drawing Sheet



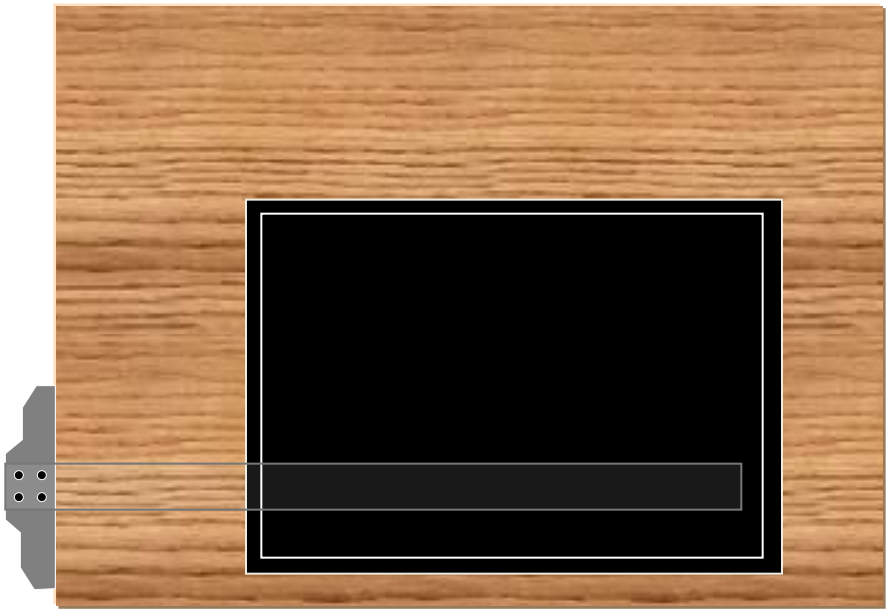
Sheet size	c (min)	d (min)
A4	10	25
A3	10	20
A2	10	25
A1	20	25
A0	20	25

All Dimensions in mm

Fastening Paper to Drafting Board

1. Place the paper close to the table's left edge.

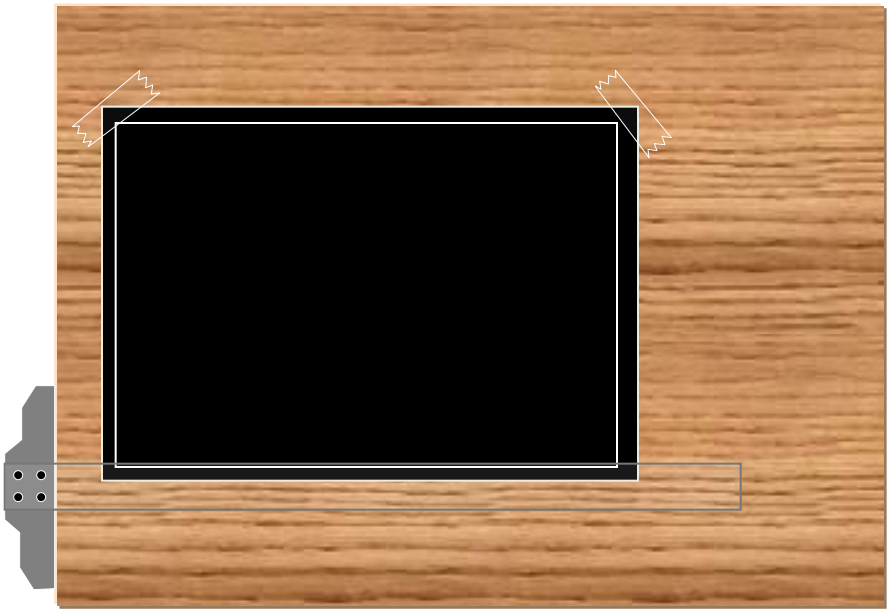
2. Move the paper until its lower edge place about the top edge of T-square.



Fastening Paper to Drafting Board

3. Align the top edge of the paper with T-square blade.

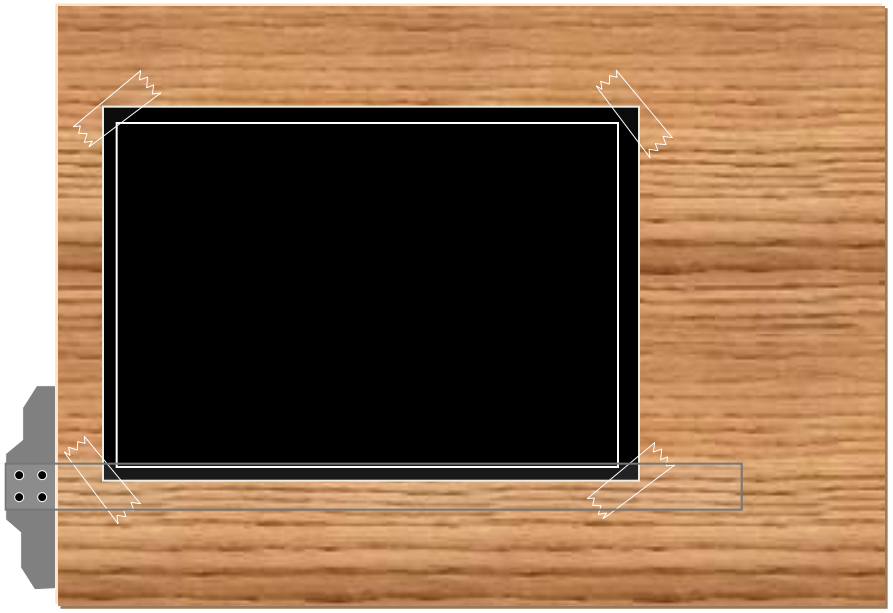
4. Attach the paper's corners with tape.



Fastening Paper to Drafting Board

5. Move T-square down to smooth the paper.

6. Attach the remaining paper's corners with tape.



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

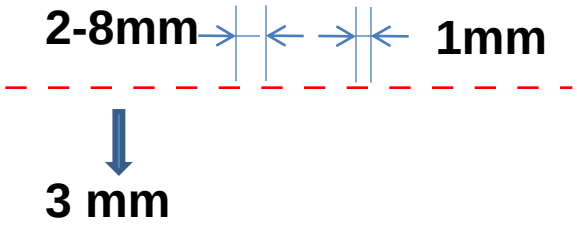
Dimension and Extension lines indicate the sizes and location of features on a drawing

Basic Sketching Line Types

0.7mm
HB

Visible Object – Thick

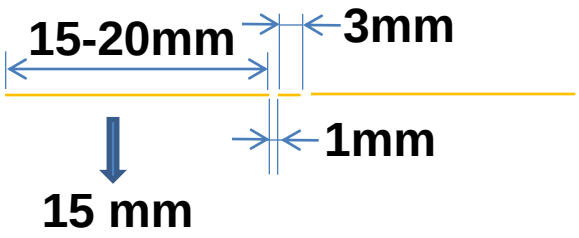
Visible Edges and Outlines



0.3mm
2H

Hidden – Thin

Hidden detail for like wall thickness and holes..

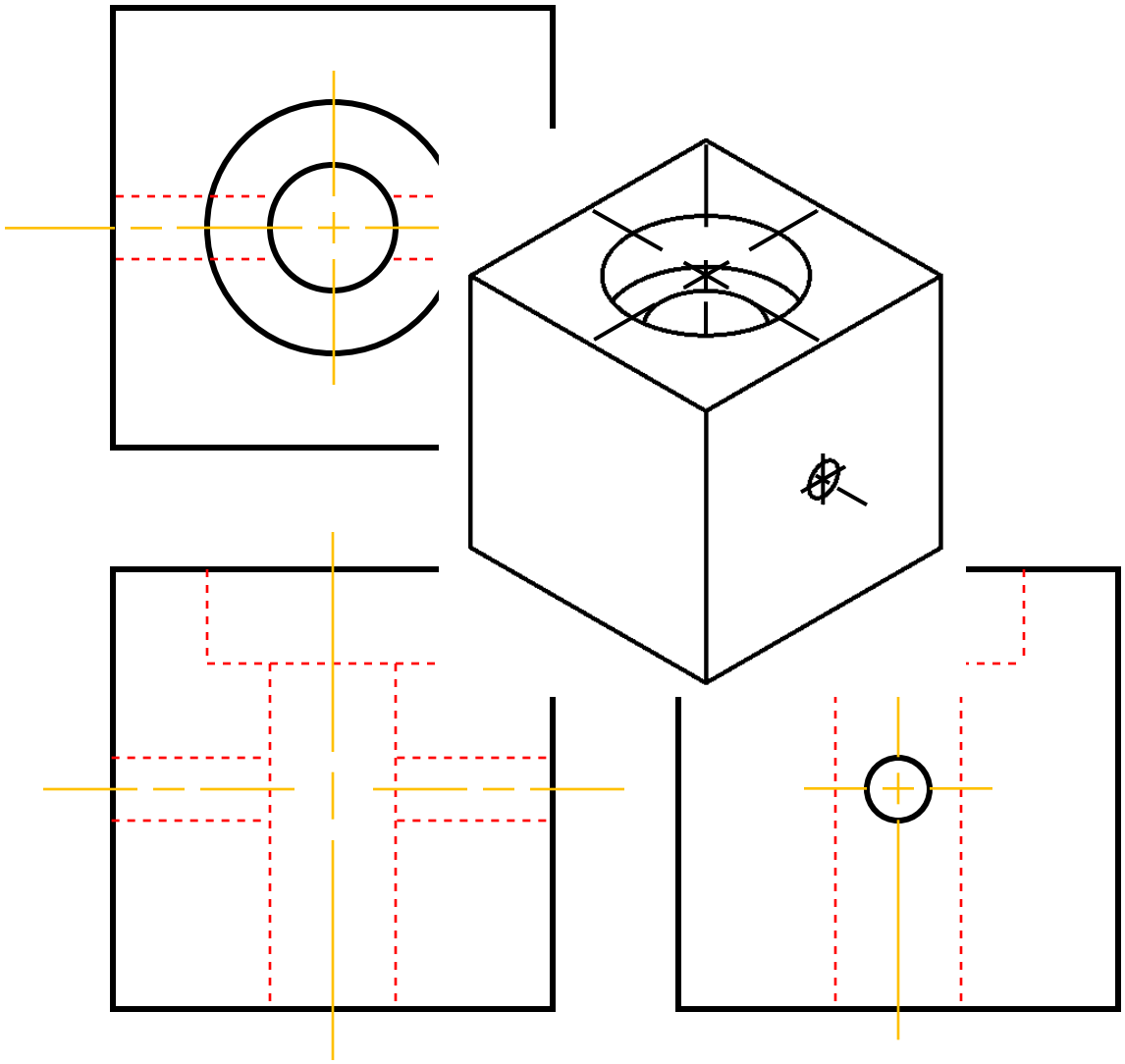


0.3mm
2H

Center - Thin

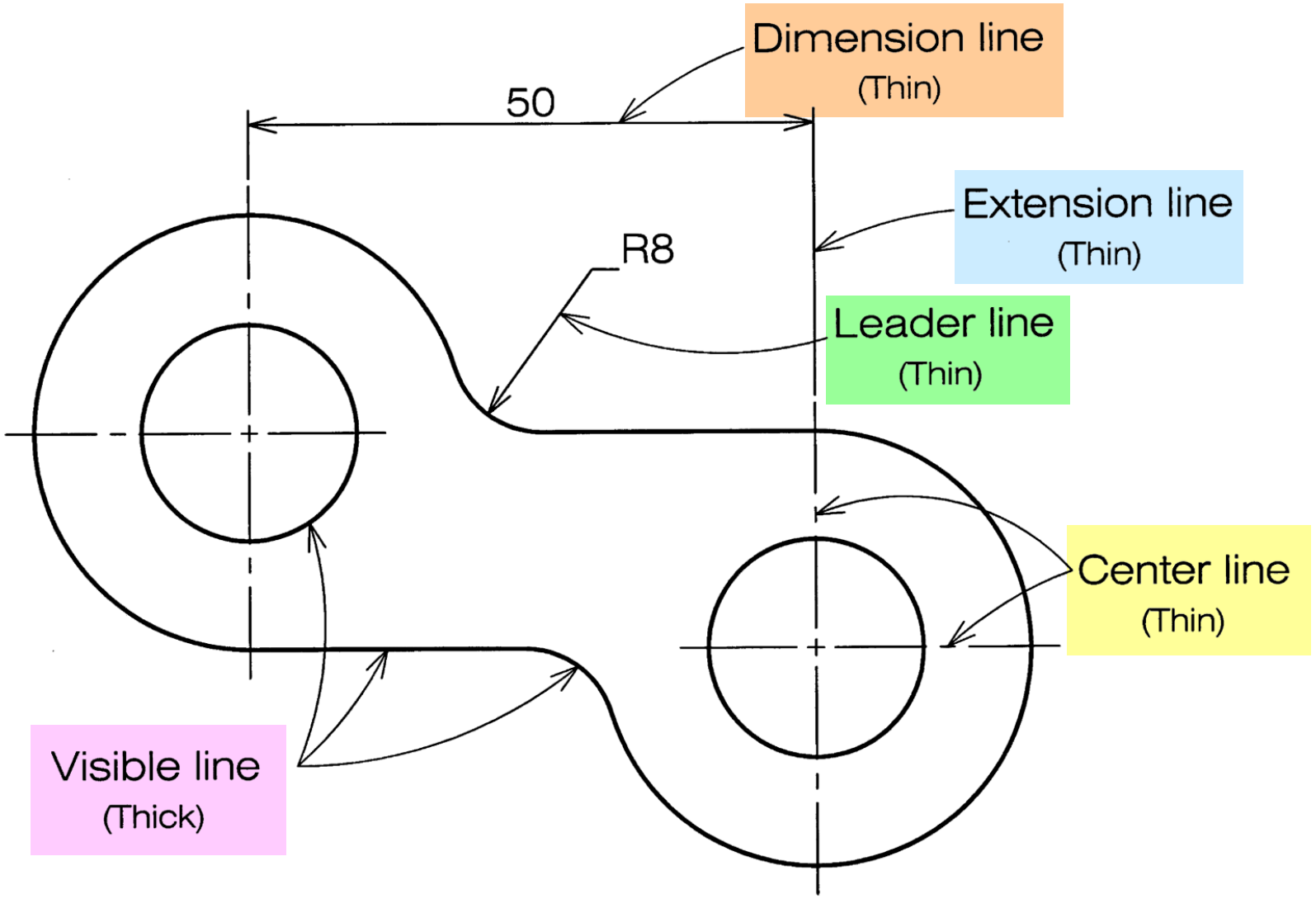
centre of a circle, cylindrical features, or a line of symmetry.

Line Types an Example

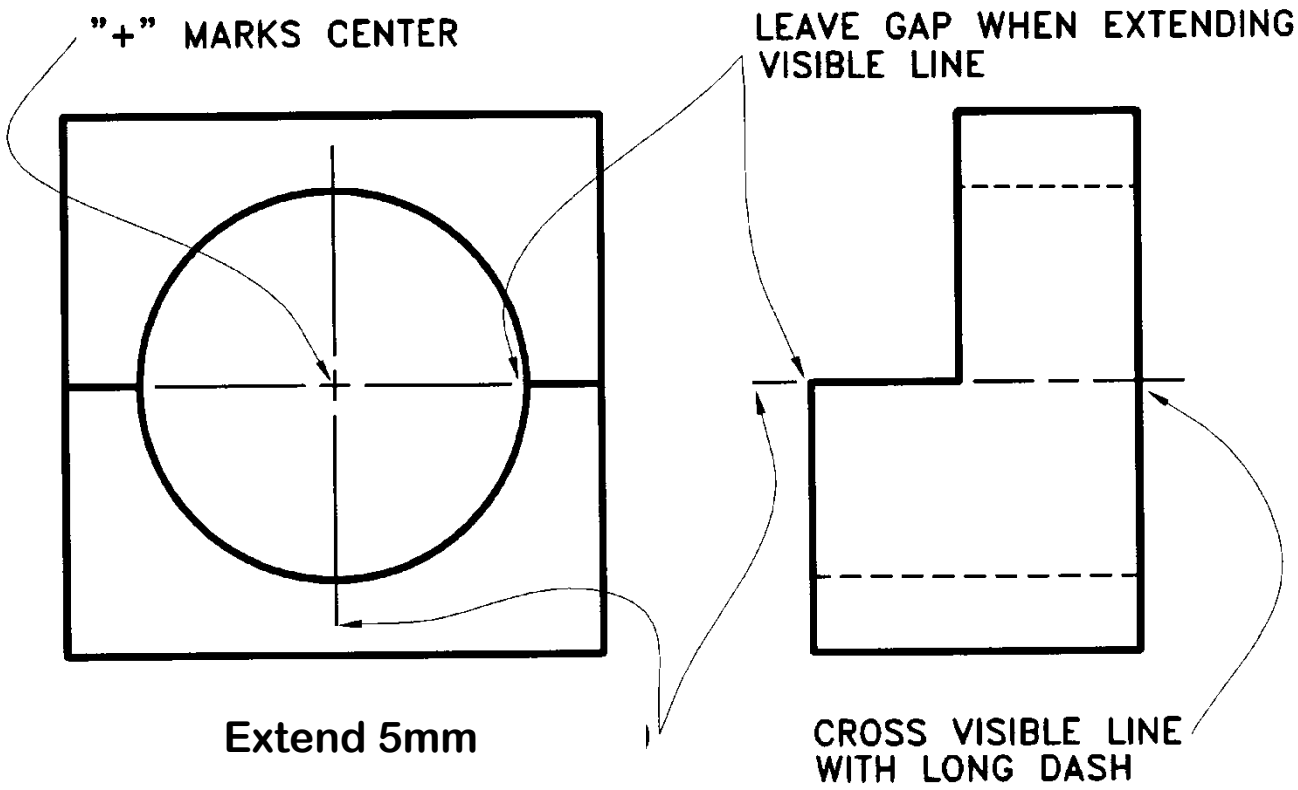


1. Visible
2. Hidden
3. Center

Example : Line conventions in engineering drawing



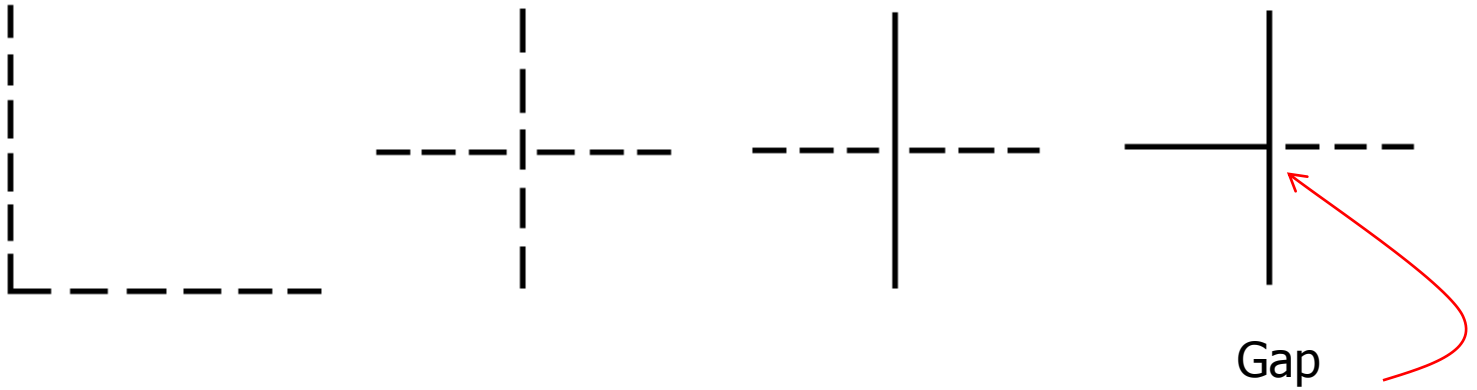
Centerline Conventions



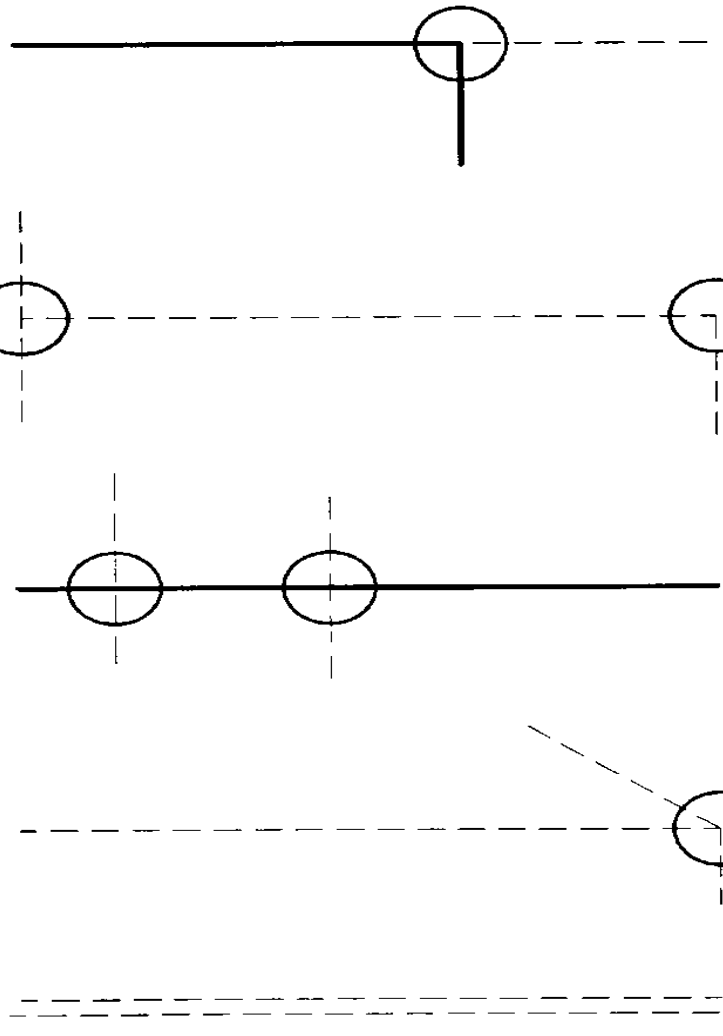
Intersection of Lines

Solid Line Intersections

Dashed Line Intersections



Hidden Line Conventions



(a) LEAVE GAP – DO NOT EXTEND VISIBLE LINE

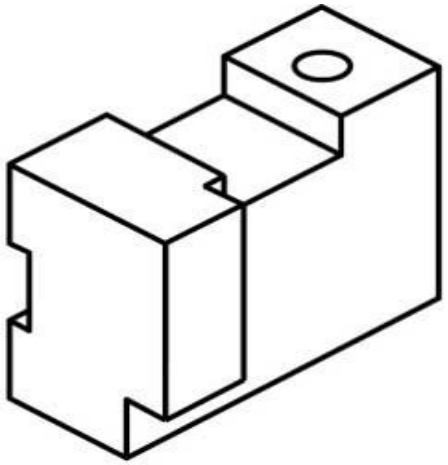
(b) DASHES FORM "T" OR "L"

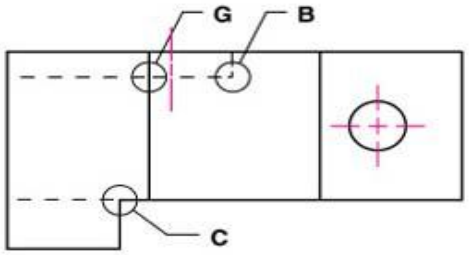
(c) PASS THROUGH GAP OR CUT DASH IN HALF

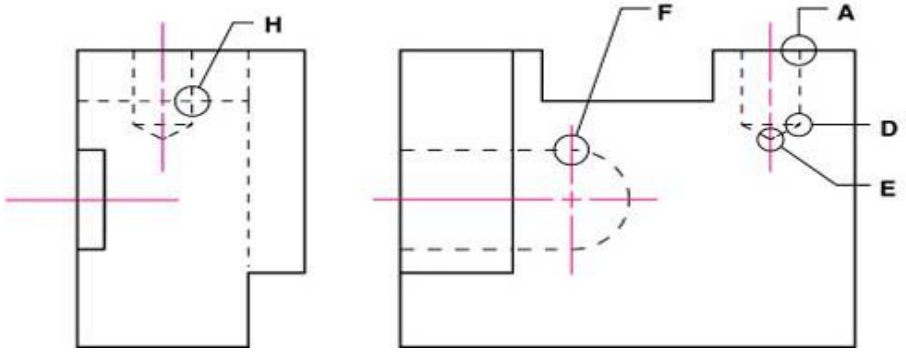
(d) DASHES MEET AT POINT

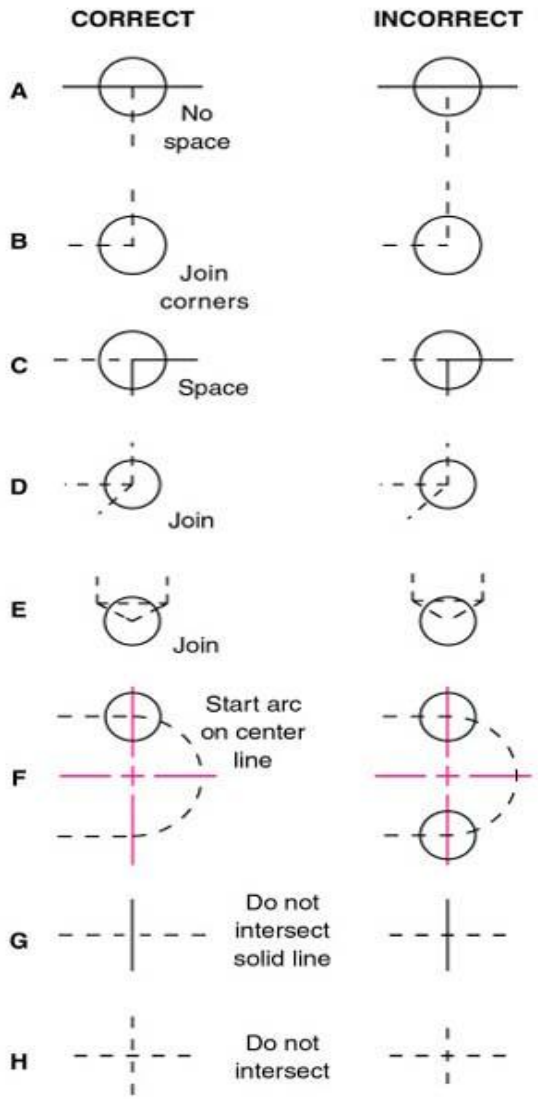
(e) STAGGER DASHES WHEN CLOSE TOGETHER

Example:Hidden Line Conventions









Lettering

Text on Drawings

Text on engineering drawing is used :

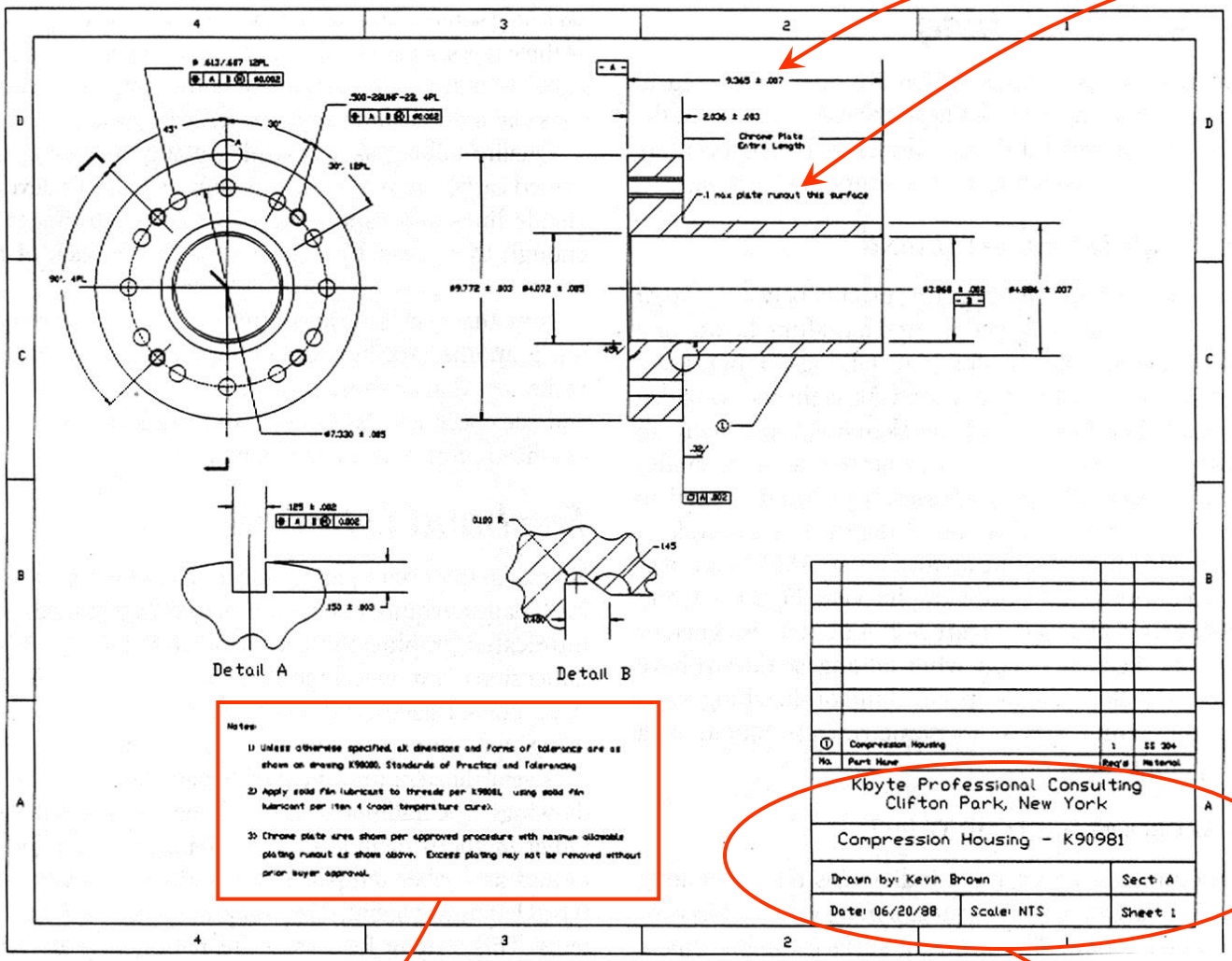
- To communicate monographic information.
- As a substitute for graphic information, in those instance where text can communicate the needed information more clearly and quickly.

Thus, it must be written with

Legibility - shape
- space between letters and words

Uniformity - size
- line thickness

Example: Placement of the text on drawing

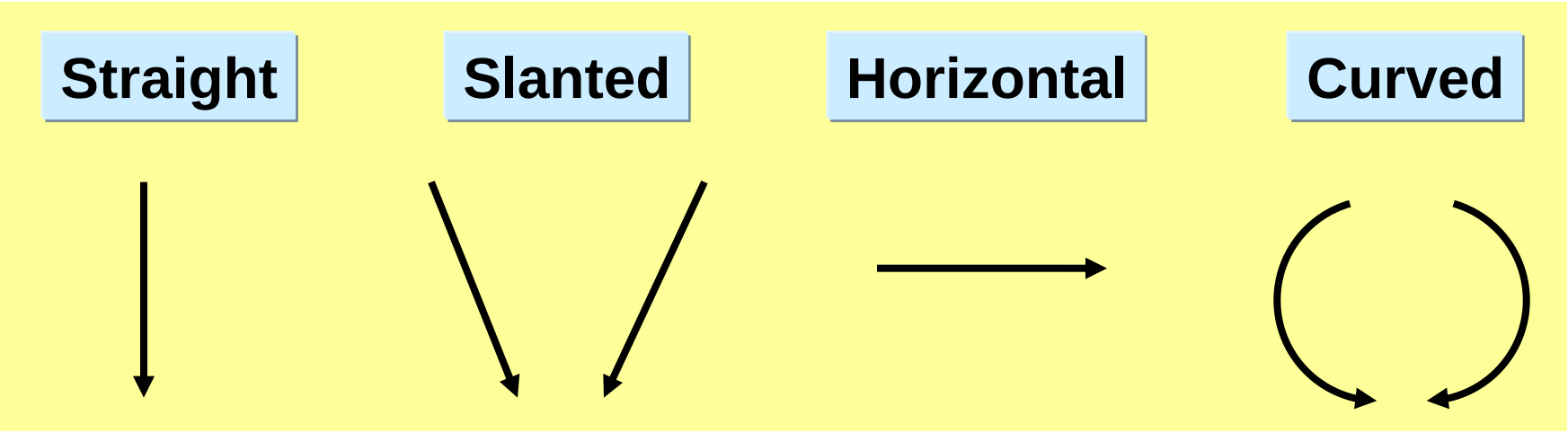


Dimension & Notes

Notes

Title Block

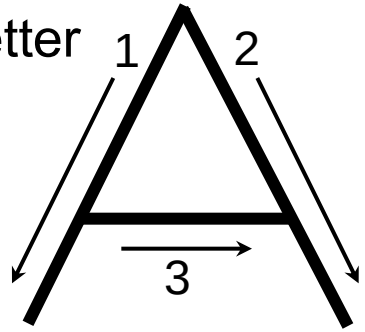
Basic Strokes



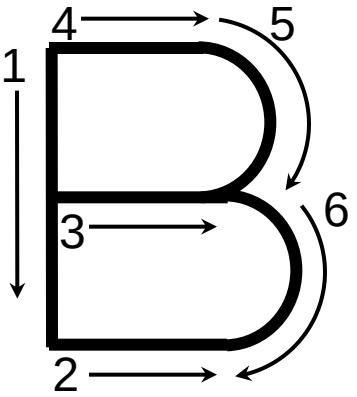
Examples : *Application of basic stroke*

"**I**" letter

"**A**" letter



"**B**" letter

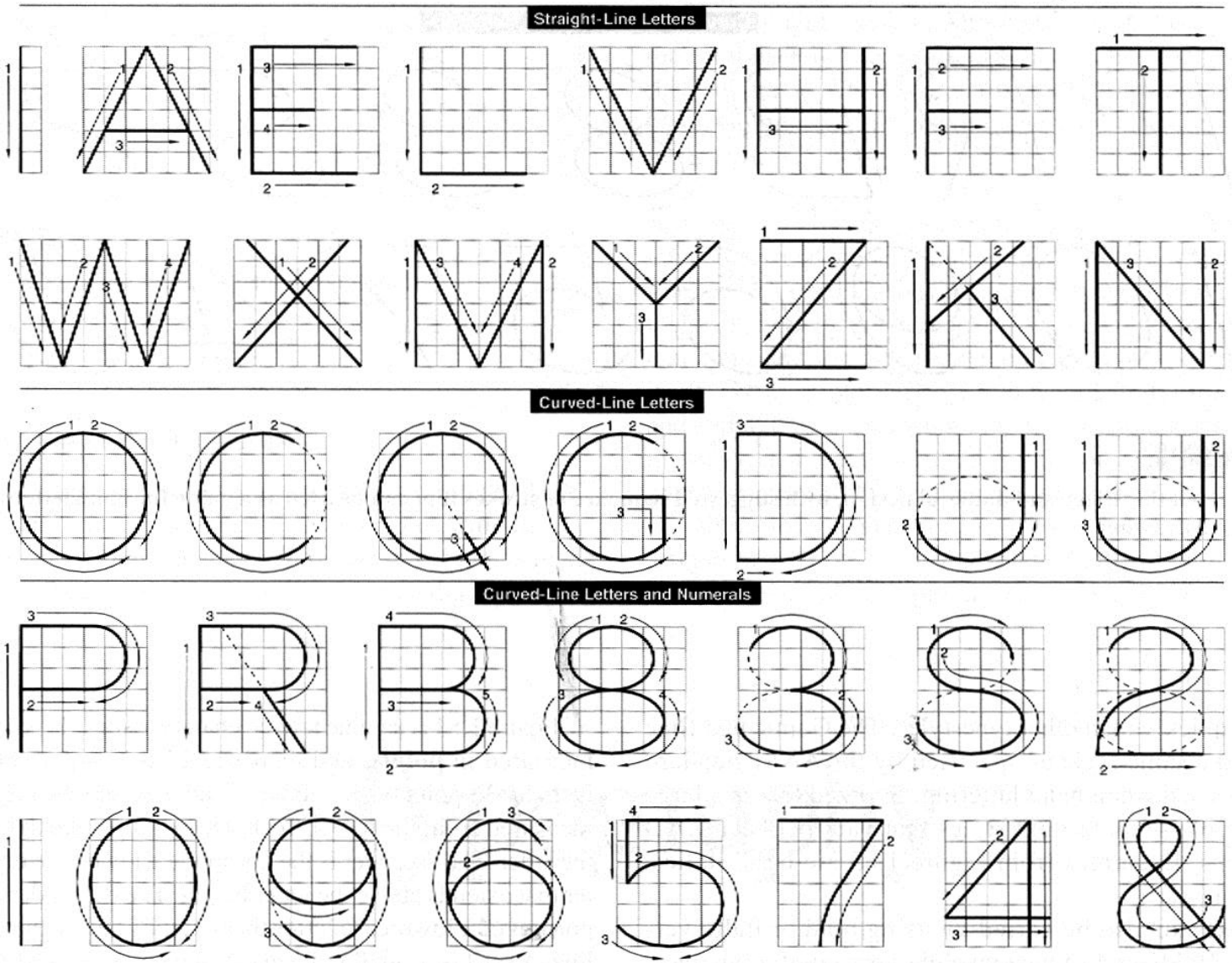


Upper-case letters & Numerals

Straight line letters

Curved line letters

Curved line letters & Numerals



Lettering Standard

ANSI Standard	**This course**
Use a text style, either inclined or vertical.	Use only a vertical text style.
Use all capital letters.	Same.
Use 3 mm for most text height.	Same. For letters in title block it is recommend to use 6 mm text height

Lettering Rules

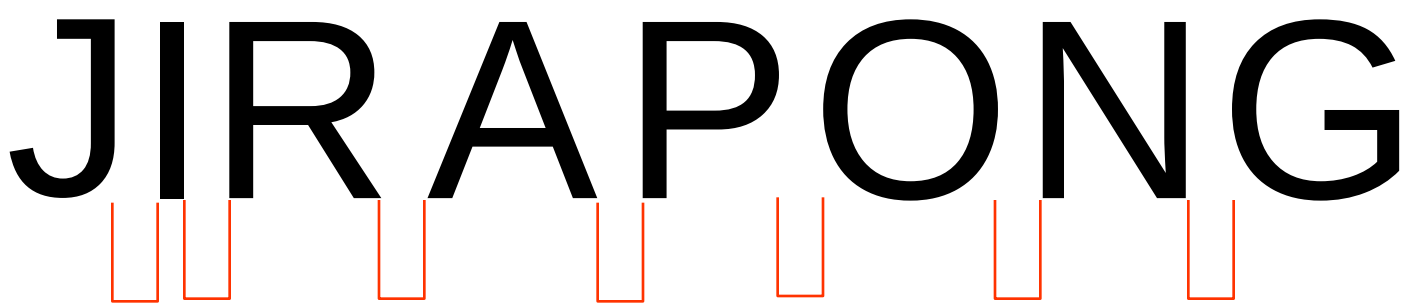
- Vertical style.
- Always use capital letters.
- Use HB pencil or 0.5 mm mechanical pencil(for visible lines and 4H for guiding lines .
- Text height (h=3~6 mm).(for most texts).
  Tex Width (d): for h= 3 mm ⟹ d=2 mm except letters(I,J,L,M,T,W) and number (1).
  Also for h= 6 mm; use the attached sheet.
- Space between letters of (h=3 mm) is (1 mm) and for letters of (h=6 mm) is (2mm).
- Space between words for (h=3 mm) is (2 mm) and for (h=6 mm) is (4 mm).

Word Composition

Look at the same word having different spacing between letters.

A) Non-uniform spacing

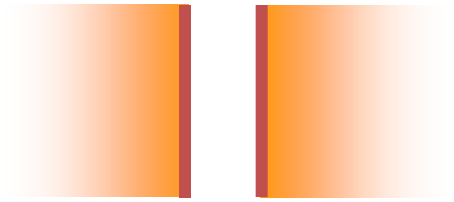
B) Uniform spacing



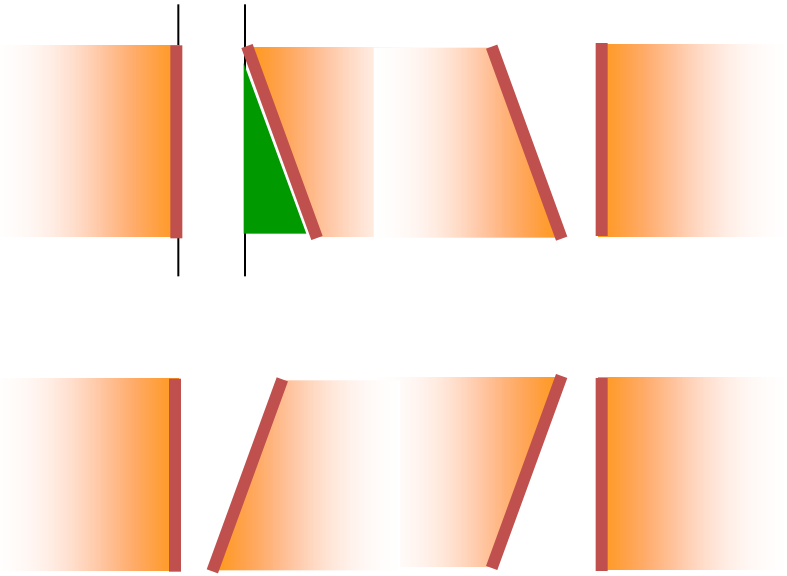
Which one is easier to read ?

Space between Letters

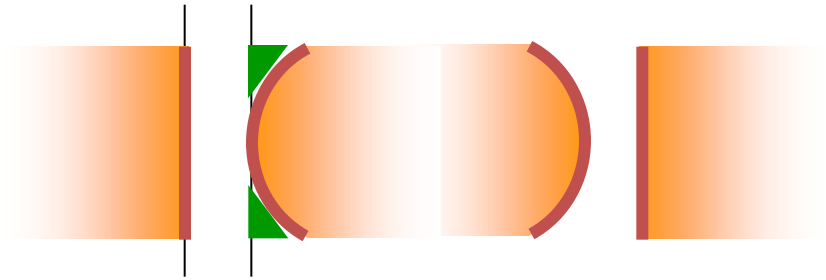
1. Straight - Straight



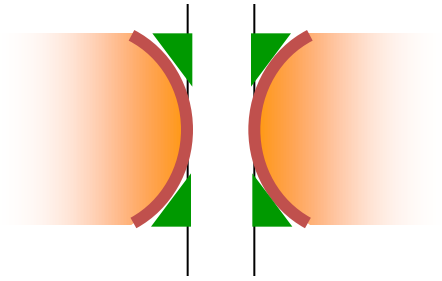
3. Straight - Slant



2. Straight - Curve

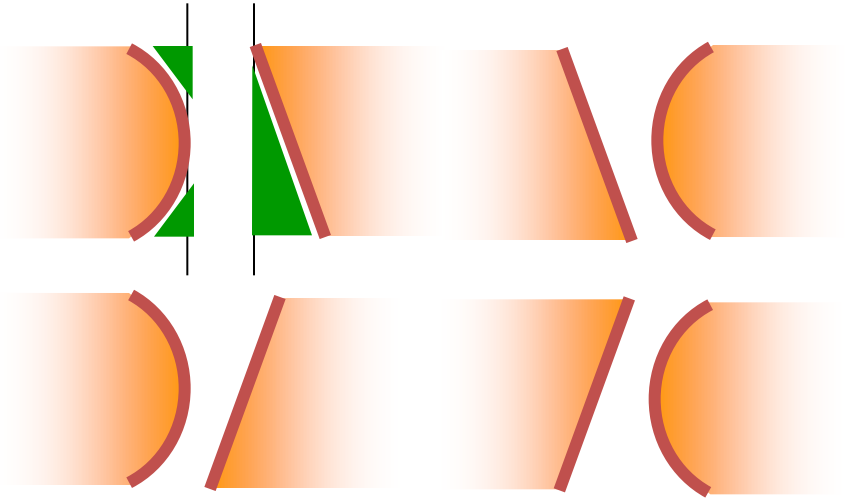


4. Curve - Curve



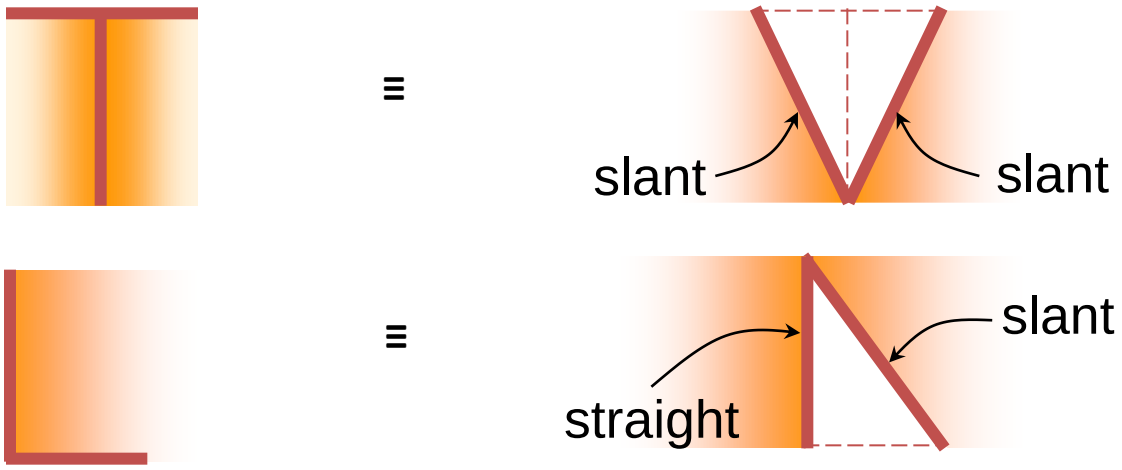
Space between Letters

5. Curve - Slant



6. Slant - Slant

7. The letter “L” and “T”



Example : Good and Poor Lettering

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 suitable space between words with respect to the letters height.

Example

ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE SPECIFIED.

Title Block Drawing

Required H.W./ Next Week

1- Using grid paper, draw letters from A to Z:

- For h=3 mm.
- For h= 6 mm(as in sheet).

2- Using grid paper(scale 1:1), draw title block for (5) times.

Notes:

1- Always bring your text book with you.

2- Write your name on white paper of(100 mm x 50 mm)dimensions.

3- Not allowed to leave your board also not allowed to Metaphor for any instruments.

END