Tishk International University
Engineering Faculty
Petroleum and Mining Engineering Department

Engineering Drawing

Lecture 1: Introduction to Engineering Drawing and Instruments

First Grade- Fall Semester 2020-2021

Instructor: Sheida Mostafa Sheikheh

General Rules and Regulations:

- Respect yourself, other students and lecturer.
- Be on time.
- Meet deadlines. There is no extension for deadlines.
- Your focus and attention is essential.
- Take notes.
- Ask questions!

Course Format

The Course will be tough in English.

Engineering Drawing course consists of:

1 Theory Lecture (1 hour) and 1 Practical Application (3 hours): Tuesdays from 10:00 A.M. to 2:00 P.M.

Room 504 (Studio No. 4)

Edmodo code for the Course: eugb8w

Course Objectives

- Provide students with understanding of the basics of engineering drawing.
- Provide knowledge of different geometrical construction methods and their applications.
- Familiarize students with the methods of pictorial and orthographic projection principles and applications.
- Familiarize students with the main three-dimensional illustration methods and isometric drawing principles.

Course Book/Textbook

1. Textbook of Engineering Drawing, Second Edition, By K. Venkata Reddy, BS Publications, 2008.
2. Engineering Drawing From Beginning, Volume 1, By M. F. Cousins, Pergamon Press, 1966.
3. Manual of Engineering Drawing to British & International Standards, 2nd. Edition, By Colin H. Simons and Dennis E. Maguire, Elsevier, 2004.

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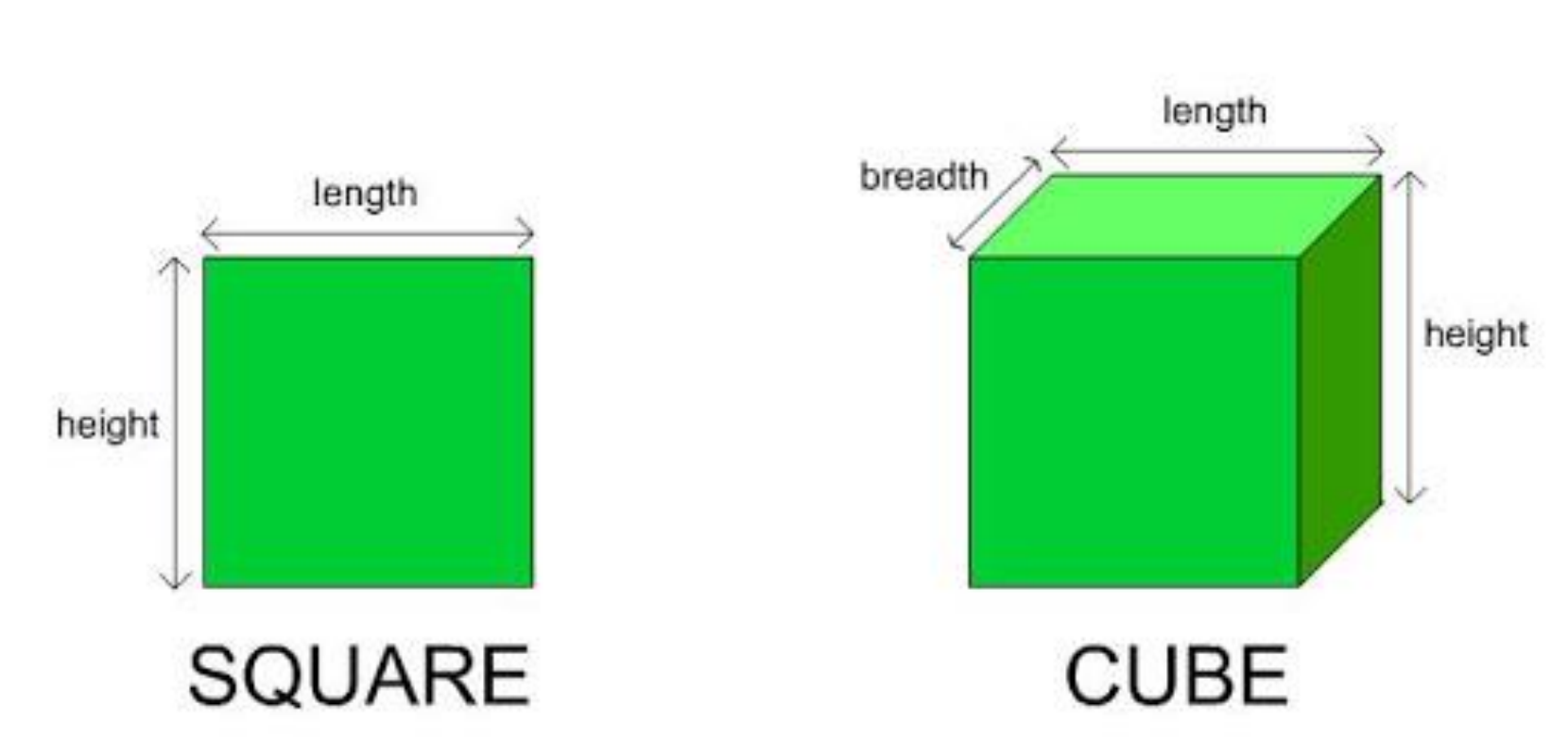
Content (Theory):

- Introduction to Engineering Drawing
- Role of Engineering Drawing
- Drawing Instrument and Aids

Introduction to Engineering Drawing:

- Engineering Drawing is a two-dimensional representation of three-dimensional objects.
- In general, it provides necessary information about the shape, size, surface quality, material, manufacturing process, etc. of the object.
- It is the graphic language from which a trained person can visualize objects.

Introduction to Engineering Drawing:



Introduction to Engineering Drawing:

- Drawings prepared in one country may be utilized in any other country irrespective of the language spoken.
- Hence, engineering drawing is called the universal language of engineers.
- Any language to be communitive, should follow certain rules so that it conveys the same meaning to everyone.
- Similarly, drawing practice must follow certain rules, if it is to serve as a means of communication.
- For this purpose, Bureau of Indian Standards (BIS) adapted the International Standards on code of practice for drawing. The other foreign standards are: DIN of Germany, BS of Britain and ANSI of America.

Role of Engineering Drawing:

- The ability to read drawing is the most important requirement of all technical people in any profession.
- As compared to verbal or written description, this method is brief and clearer. Some of the applications are:

- Building drawing for civil engineers
- Machine drawing for mechanical engineers
- Circuit diagrams for electrical and electronics engineers
- Computer graphics
- Developing Piping and Instrument Diagram

Role of Engineering Drawing:

- The engineering drawing subject is designed to impart the following skills:

1. Ability to read and prepare engineering drawings.
2. Ability to make free - hand sketching of objects.
3. Power to imagine, analyze and communicate.
4. Capacity to understand other subjects.

Drawing Instrument and Aids:

- The Instruments and other aids used in draughting work are listed below:

1. Drawing board.
2. Mini draughter.
3. Instrument box.
4. Set squares.
5. Protractor.
6. Set of scales.
7. French curves.
8. Drawing sheets.
9. Pencils.
10. Templates.

Drawing Instrument and Aids:

1. **Drawing board:**

- Until recently drawing boards used are made of well seasoned softwood of about 25 mm thick with a working edge for T-square.
- Nowadays mini-draughters are used instead of T-squares which can be fixed on any board. The standard size of board depends on the size of drawing sheet size required.

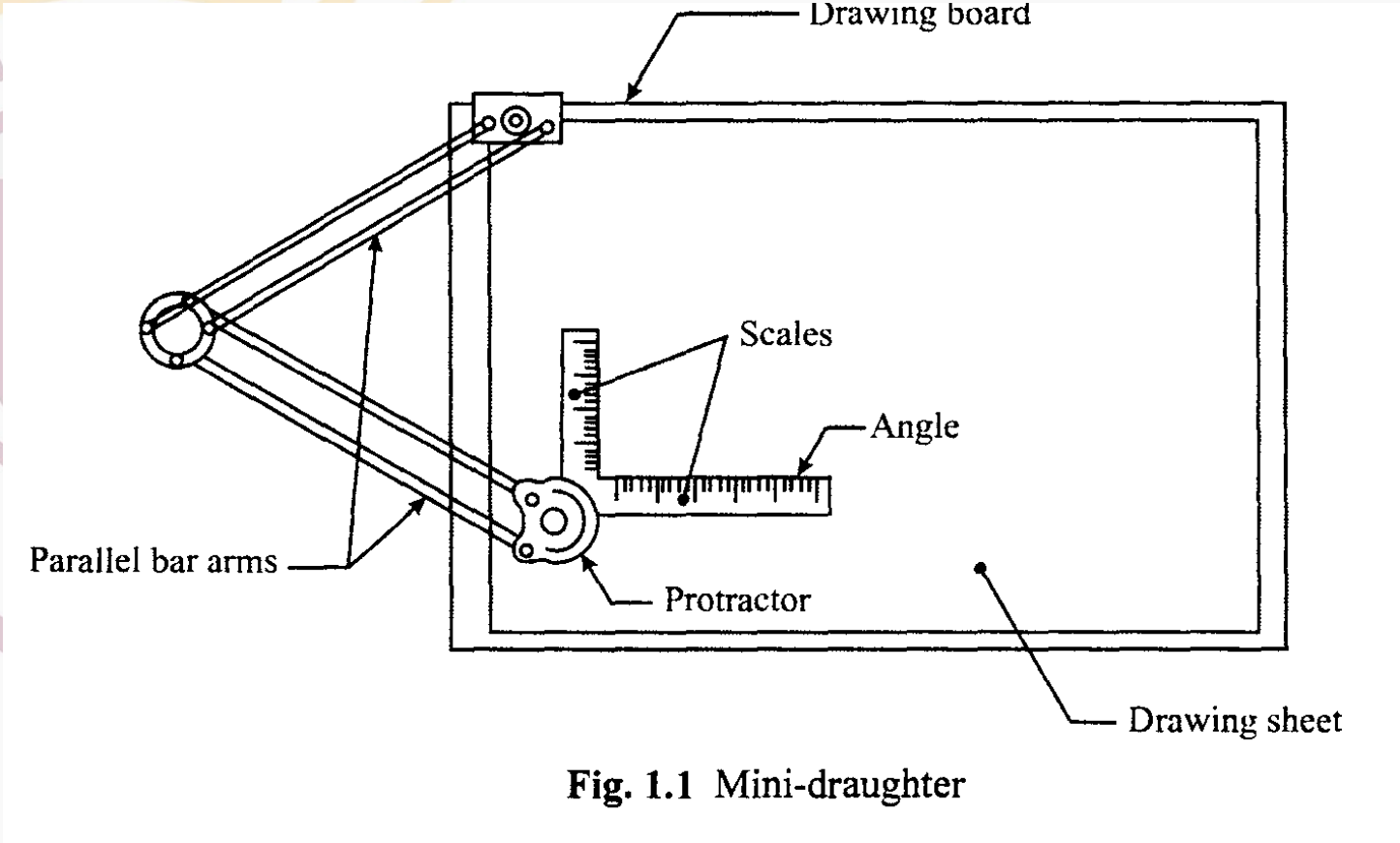
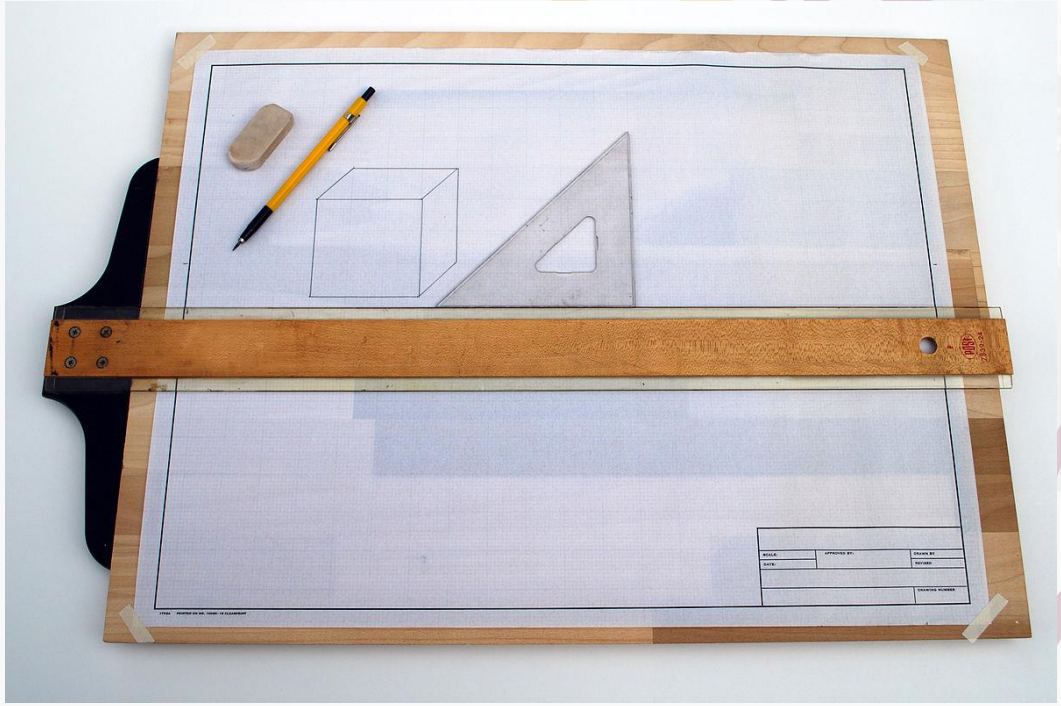


Fig. 1.1 Mini-draughter

Drawing Instrument and Aids:

1. Drawing board:



Drawing Instrument and Aids:

2. Mini draughter:

- Mini-draughter consists of an angle formed by two arms with scales marked and rigidly hinged to each other (Fig. I. I).
- It combines the functions of T-square, set-squares, scales and protractor.
- It is used for drawing horizontal, vertical and inclined lines, parallel and perpendicular lines and for measuring lines and angles.

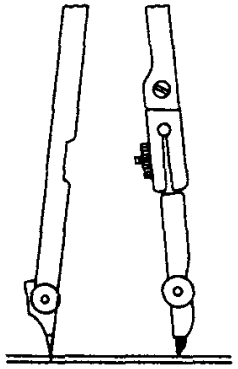
Drawing Instrument and Aids:

3. Instrument box:

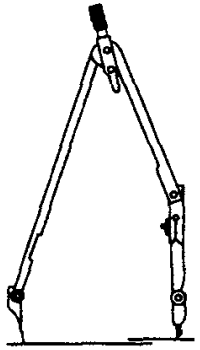
- Instrument box contains:

1. Compasses
2. Dividers
3. Inking pens.

- What is important is the position of the pencil lead with respect to the tip of the compass. It should be at least I mm above as shown in Fig. 1.2 because the tip goes into the board for grip by 1 mm.



(a) Sharpening and position of compass lead



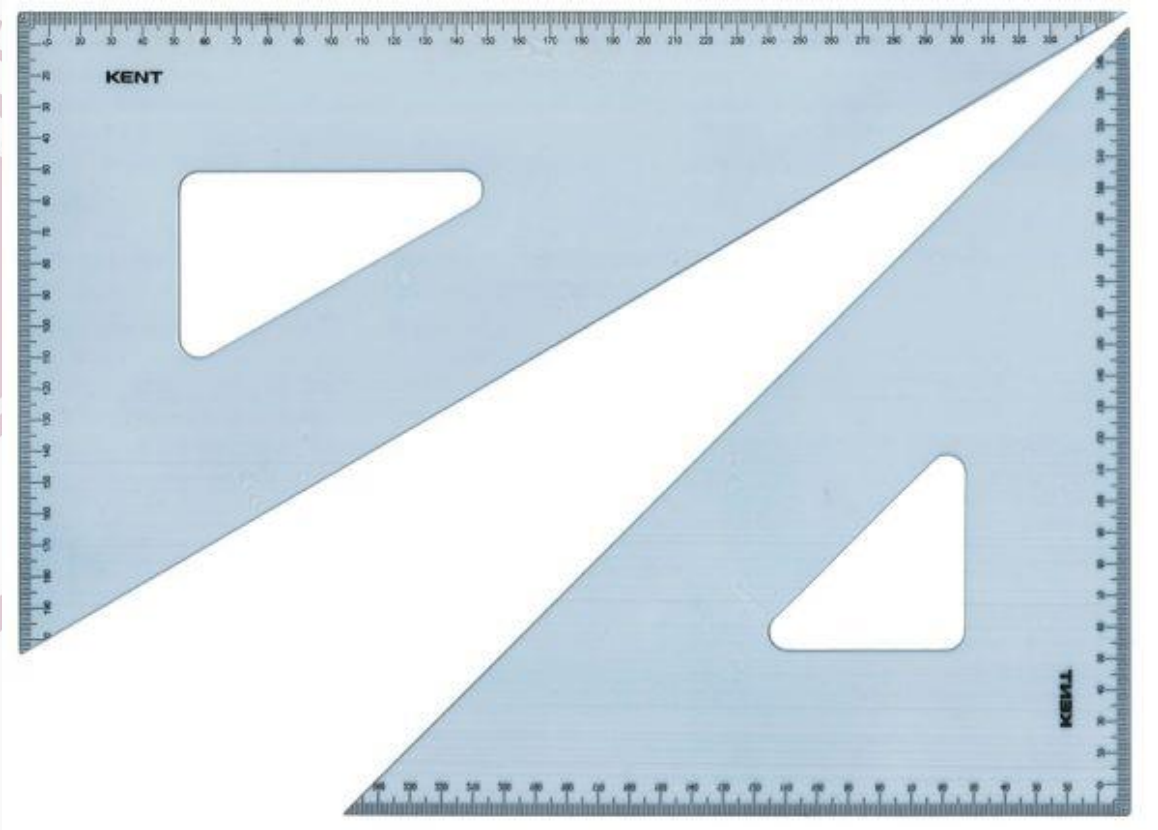
(b) Position of the lead leg to draw larger circles

Fig. 1.2

Drawing Instrument and Aids:

4. Set squares:

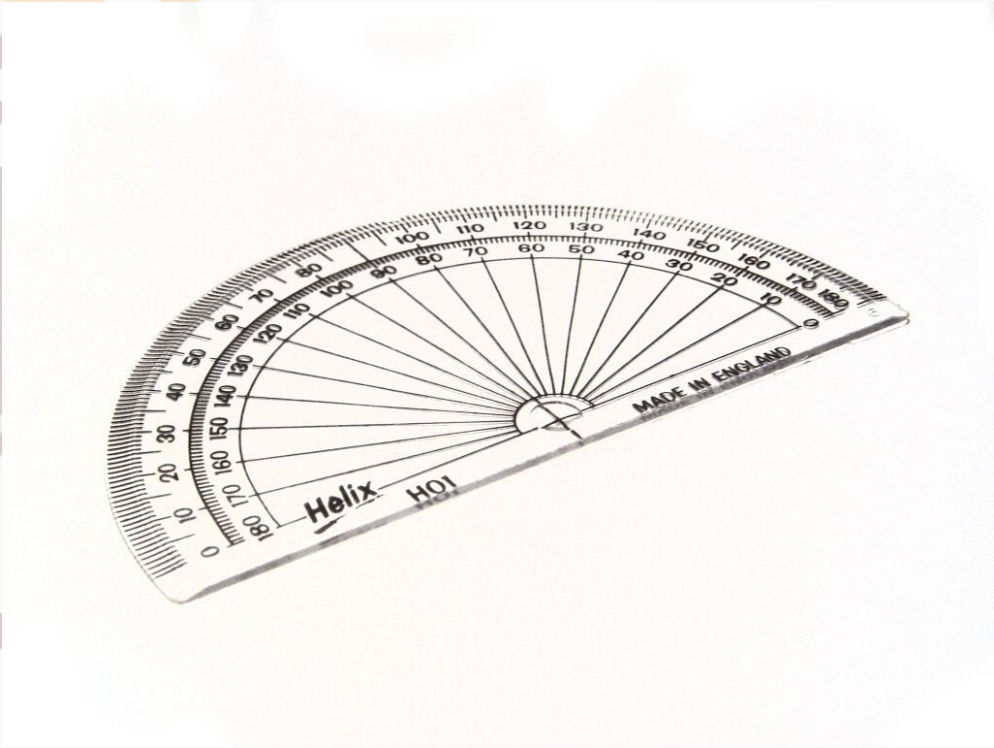
- A set square or triangle is an object is an object used in engineering and technical drawing, with the aim of providing a straightedge at a right angle or other particular planar angle to a baseline.



Drawing Instrument and Aids:

5. Protractor:

- The protractor is an instrument used for measuring angles.



Drawing Instrument and Aids:

6. Set of scales:

- Scales are used to make drawing of the objects to proportionate size desired. These are made of wood, steel or plastic (Fig.I.3). BIS recommends eight set-scales in plastic/cardboard with designations MI, M2 and so on as shown in Table 1.1 Set of scales:

Table 1.1 Set of Scales

	M1	M2	M3	M4	M5	M6	M7	M8
Scale on one edge	1:1	1:2.5	1:10	1:50	1:200	1:300	1:400	1:1000
Scale on other edge	1:2	1:5	1:20	1:100	1:500	1.600	1:800	1:2000

Drawing Instrument and Aids:

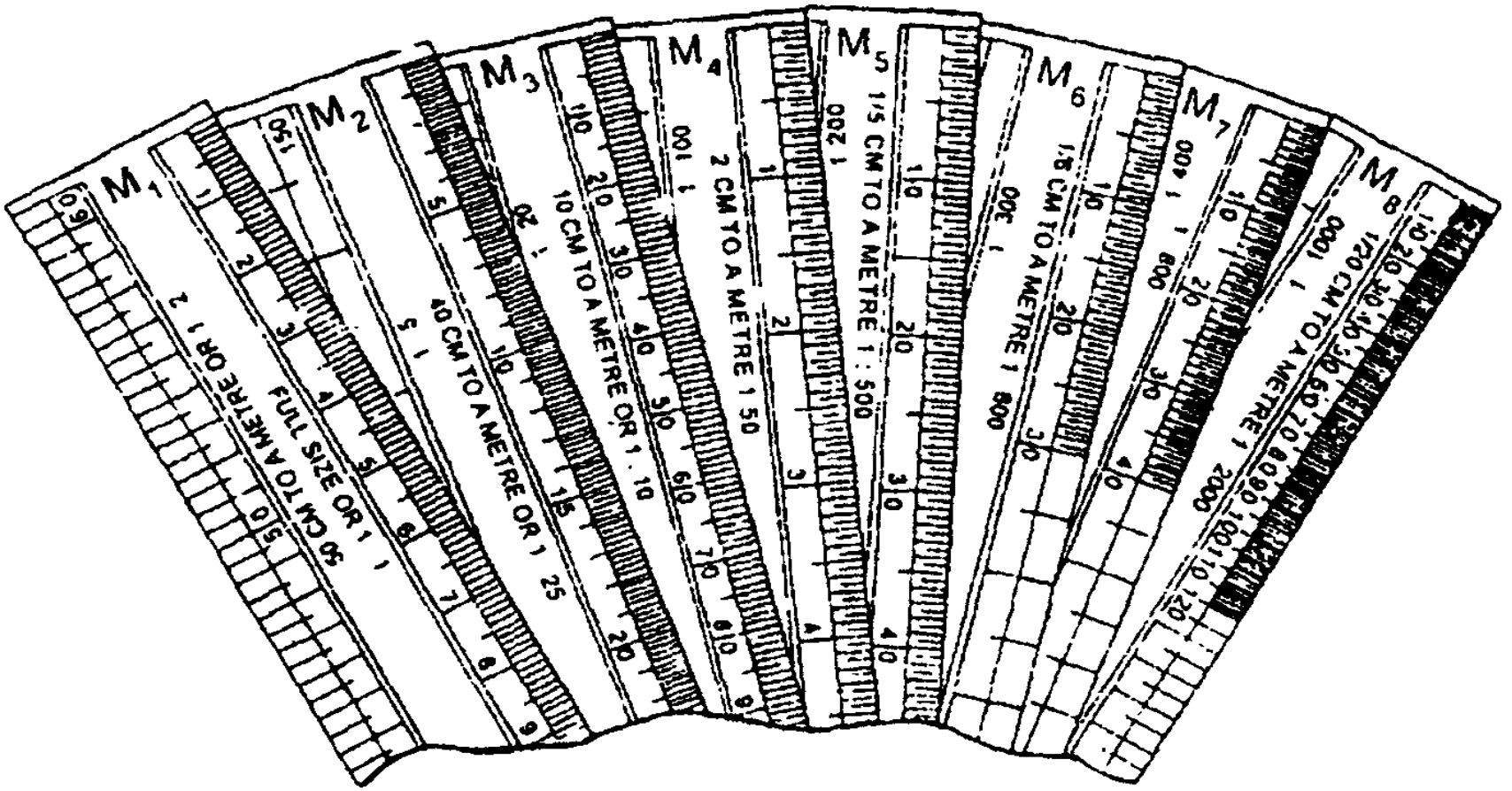


Fig. 1.3 Set of scales

Drawing Instrument and Aids:

- *Note: Do not use the scales as a straight edge for drawing straight lines.*
- These are used for drawing irregular curved lines, other than circles or arcs of circles.

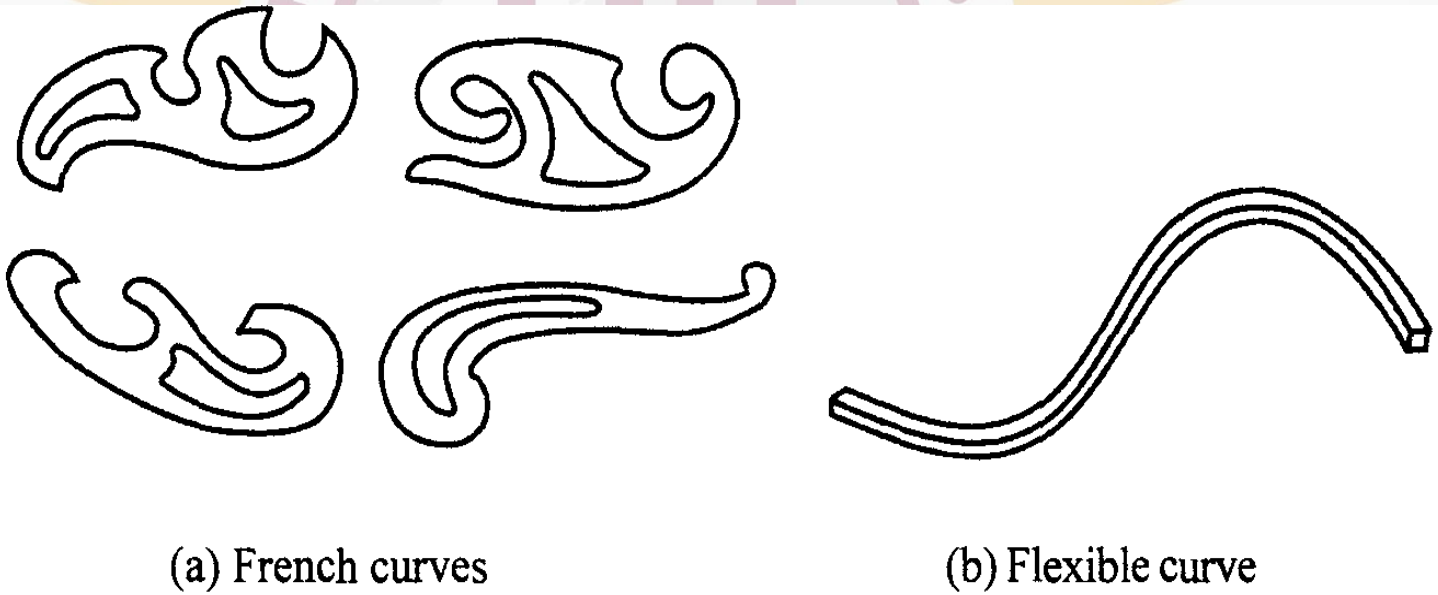
Table 1.2

Scales for use on technical drawings (IS : 46–1988)			
Category	**Recommended scales**		
Enlargement scales	50 : 1 5 : 1	20 : 1 2 : 1	10 : 1
Full size	1 : 1		
Reduction scales	1 : 2 1 : 20 1 : 200 1 . 2000	1 : 5 1 : 50 1 : 500 1 · 5000	1 : 10 1 : 100 1 . 1000 1 10000

Drawing Instrument and Aids:

7. French Curves:

- French curves are available in different shapes (Fig. 1.4). First a series of points are plotted along the desired path and then the most suitable curve is made along the edge of the curve. A flexible curve consists of a lead bar inside rubber which bends conveniently to draw a smooth curve through any set of points.



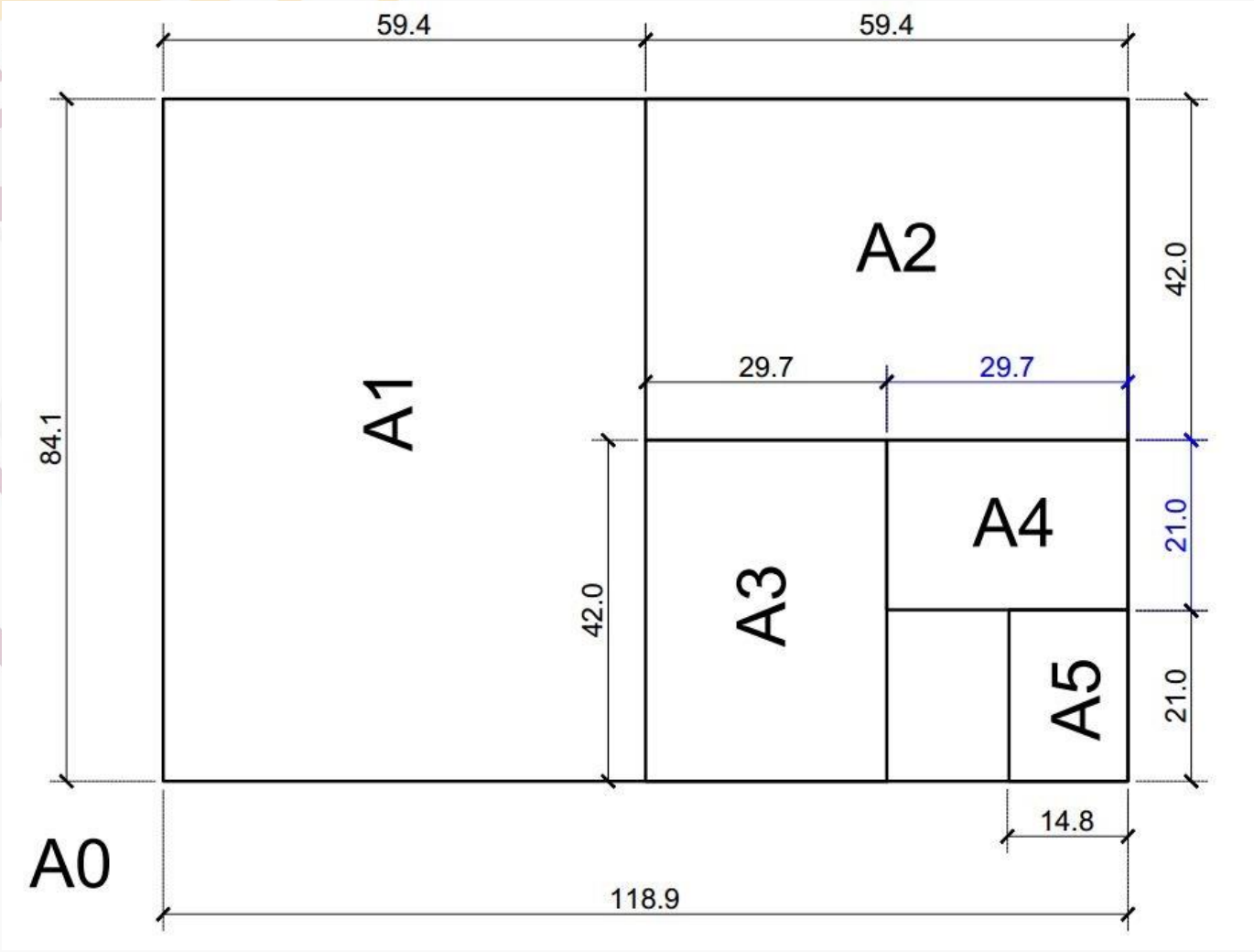
(a) French curves (b) Flexible curve

Fig. 1.4

Drawing Instrument and Aids:

8. Drawing sheets:

For class work and homework use of A2 size drawing sheet is preferred.



Drawing Instrument and Aids:

9. Pencils:

- Pencils with leads of different degrees of hardness or grades are available in the market. The hardness or softness of the lead is indicated by 3H, 2H, H, HB, B, 2B, 3B, etc. The grade HB denotes medium hardness of lead used for general purpose. The hardness increases as the value of the numeral before the letter H increases. The lead becomes softer, as the value of the numeral before B increases (Fig.I.6)

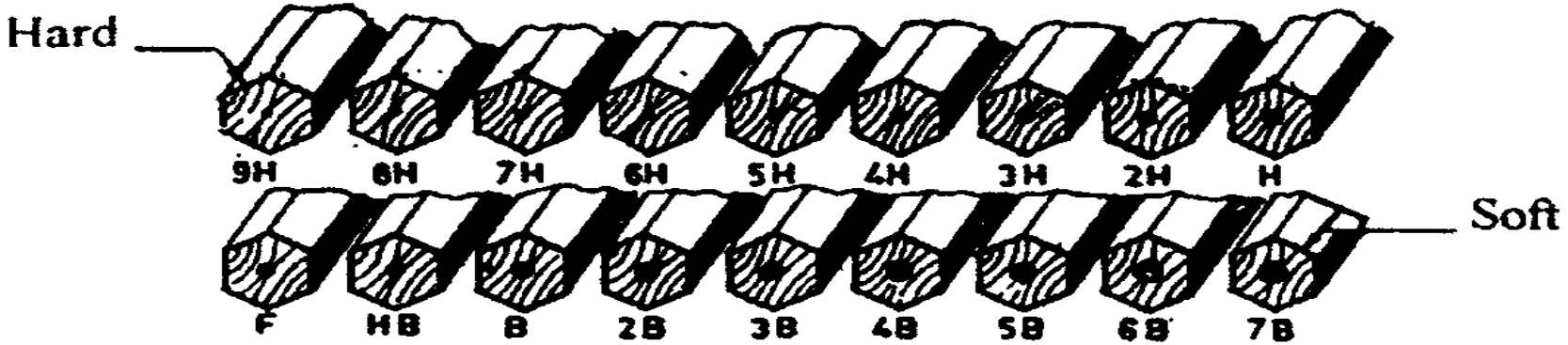


Fig. 1.6 Pencil Leads

Drawing Instrument and Aids:

9. Pencils:

- The selection of the grade depends on the line quality desired for the drawing. Pencils of grades H or 2H may be used for finishing a pencil drawing as these give a sharp black line. Softer grade pencils are used for sketching work. HB grade is recommended for lettering and dimensioning.
- Nowadays mechanical pencils are widely used in place of wooden pencils. When these are used, much of the sharpening time can be saved. The number 0.5,0.70 of the pen indicates the
- thickness of the line obtained with the lead and the size of the lead diameter.
- Micro-tip pencils with 0.5 mm thick leads with the following grades are recommended.

Drawing Instrument and Aids:

9. Pencils:

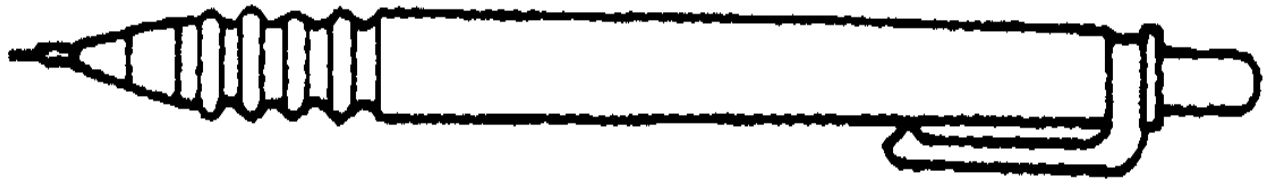


Fig. 1.7 Mechanical Pencil

HB Soft grade for Border lines, lettering and free sketching

H Medium grade for Visible outlines, visible edges and boundary lines

2H Hard grade for construction lines, Dimension lines, Leader lines, Extension lines, Centre lines, Hatching lines and Hidden lines.

Drawing Instrument and Aids:

10. Templates:

- These are aids used for drawing small features such as circles, arcs, triangular, square and other shapes and symbols used in various science and engineering fields (Fig.I.5).

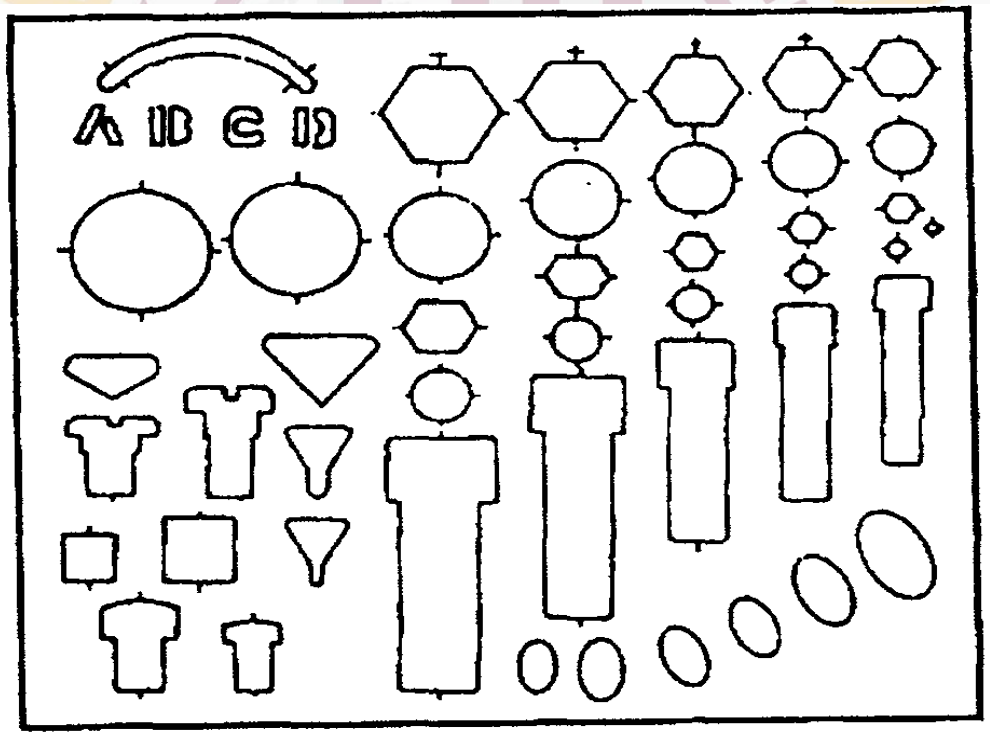


Fig. 1.5 Template

Content (Practical):

- How to use instruments
- Fastening paper to the drafting board
- Title block
- Sharpening the pencil
- Basic Line types
- Draw horizontal line
- Draw vertical line
- Draw angles

Drawing Board

Drawing Sheets:

Table 2.1

Designation	Dimension, mm Trimmed size
A0	841 × 1189
A1	594 × 841
A2	420 × 594
A3	297 × 420
A4	210 × 297

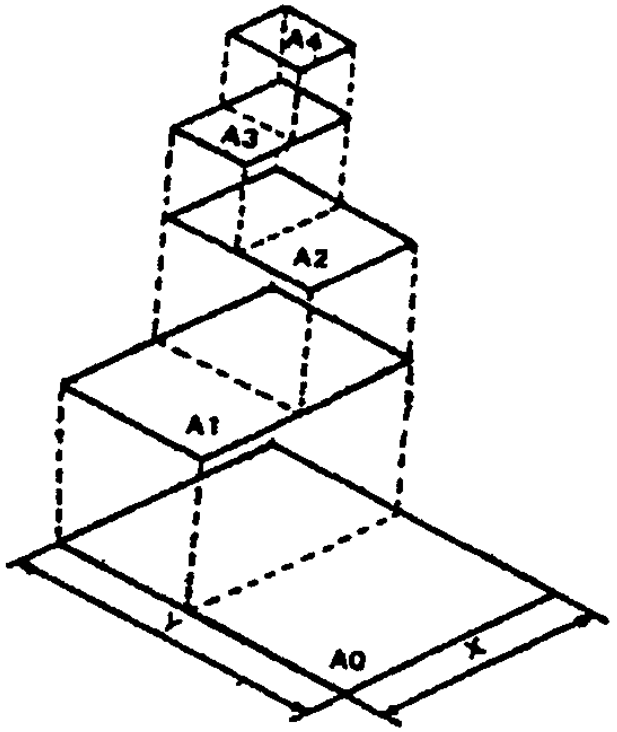
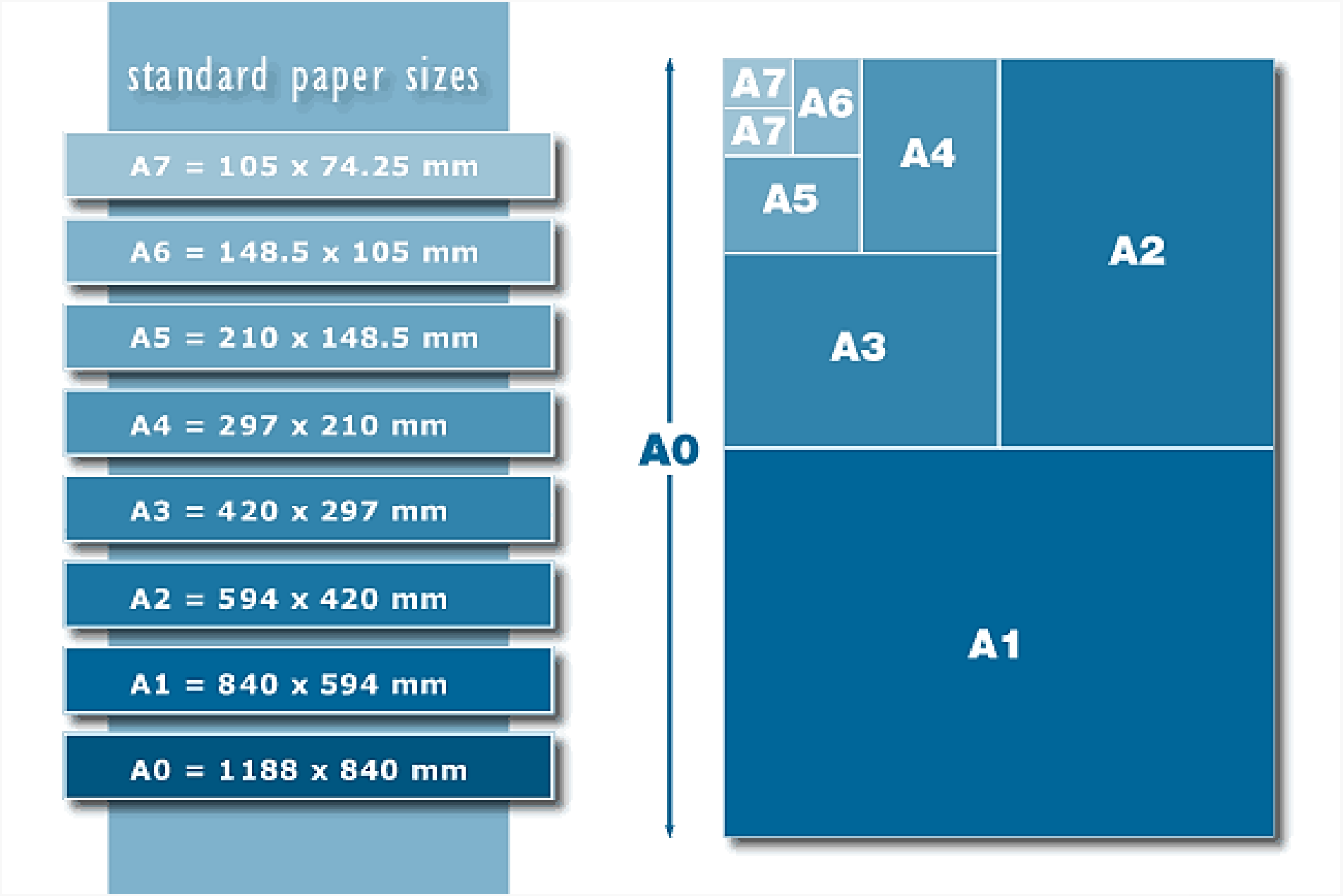
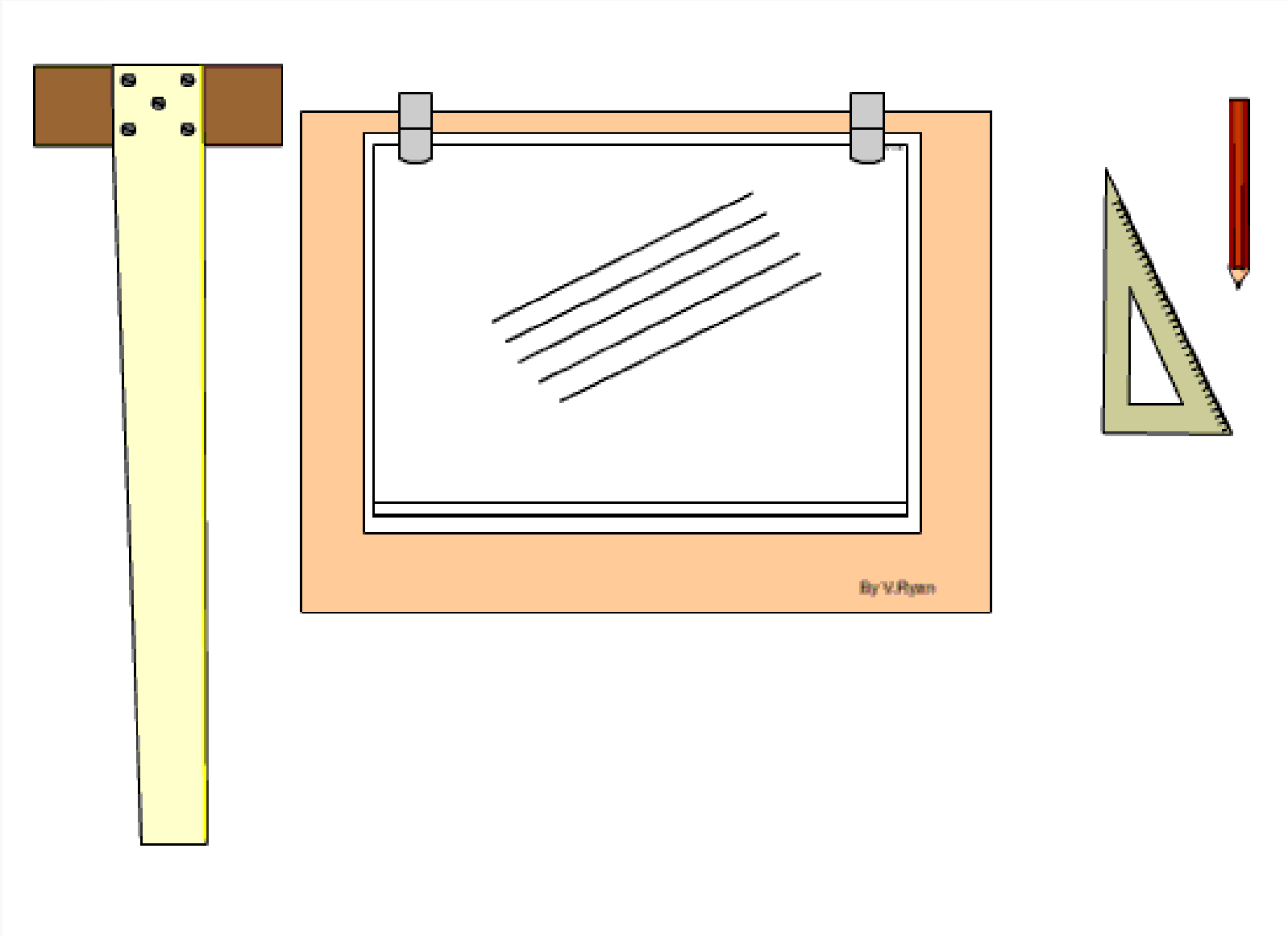
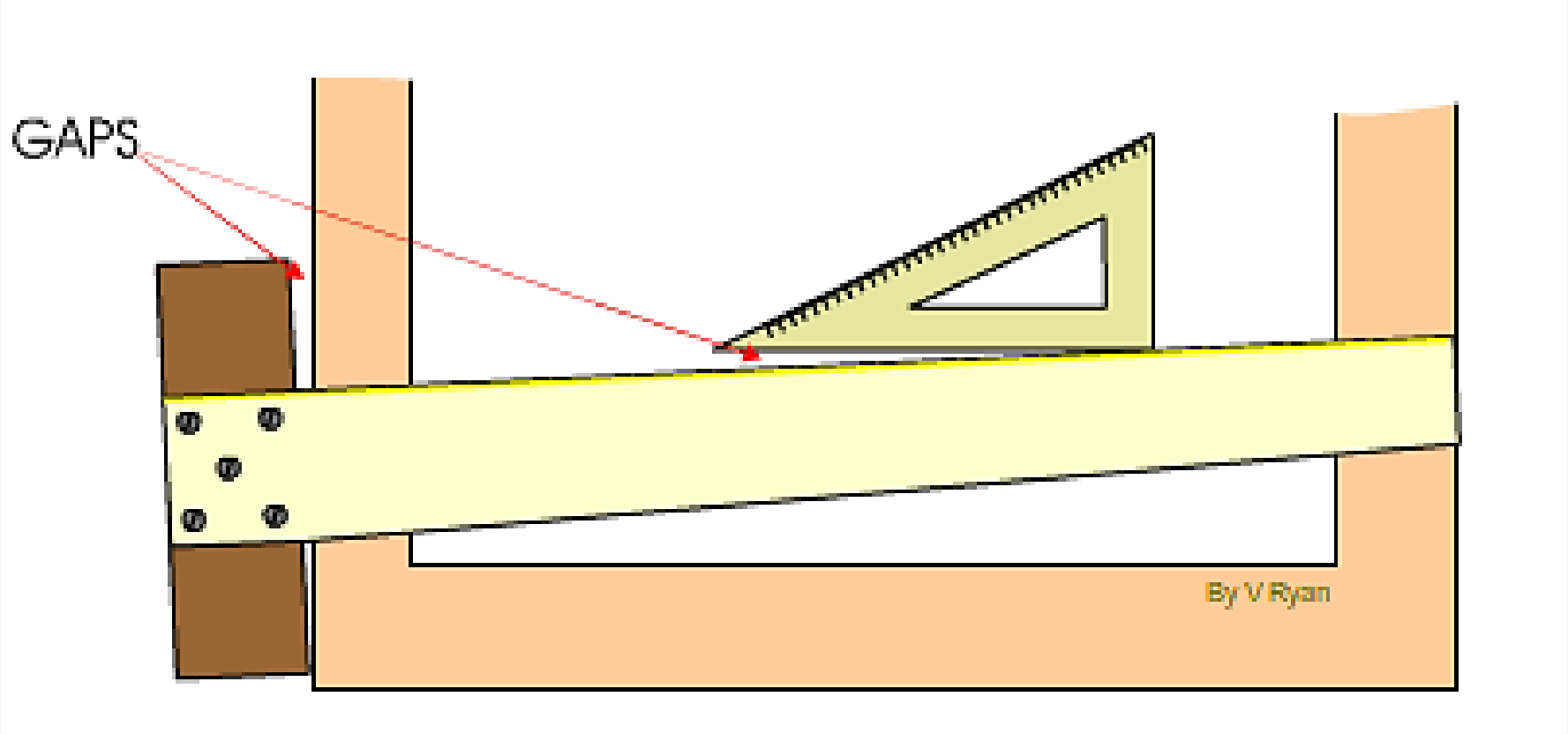


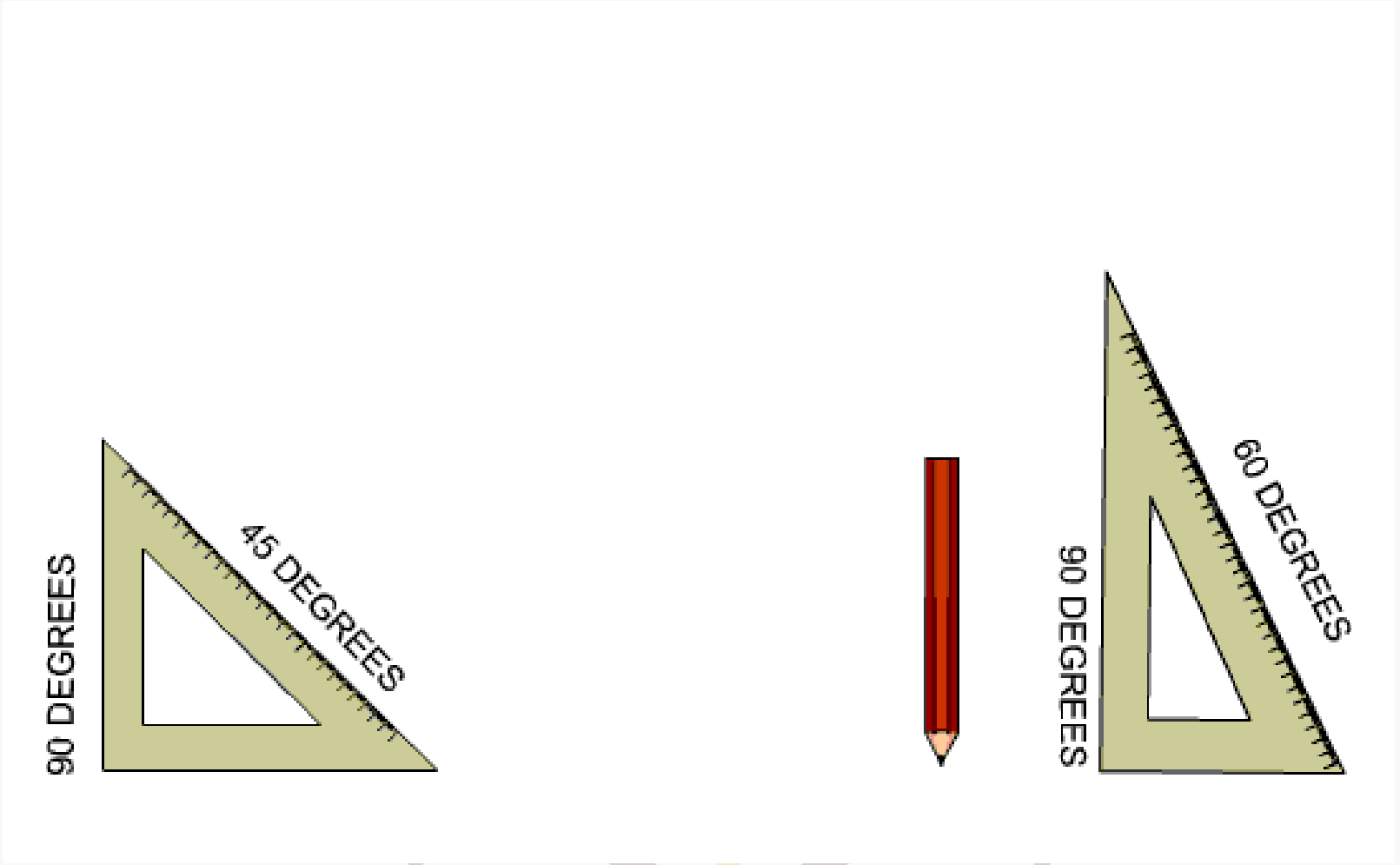
Fig. 2.1 Drawing Sheet Formats


standard paper sizes
A7 = 105 x 74.25 mm
A6 = 148.5 x 105 mm
A5 = 210 x 148.5 mm
A4 = 297 x 210 mm
A3 = 420 x 297 mm
A2 = 594 x 420 mm
A1 = 840 x 594 mm
A0 = 1188 x 840 mm
A0
A7
A7
A6
A5
A4
A3
A2
A1



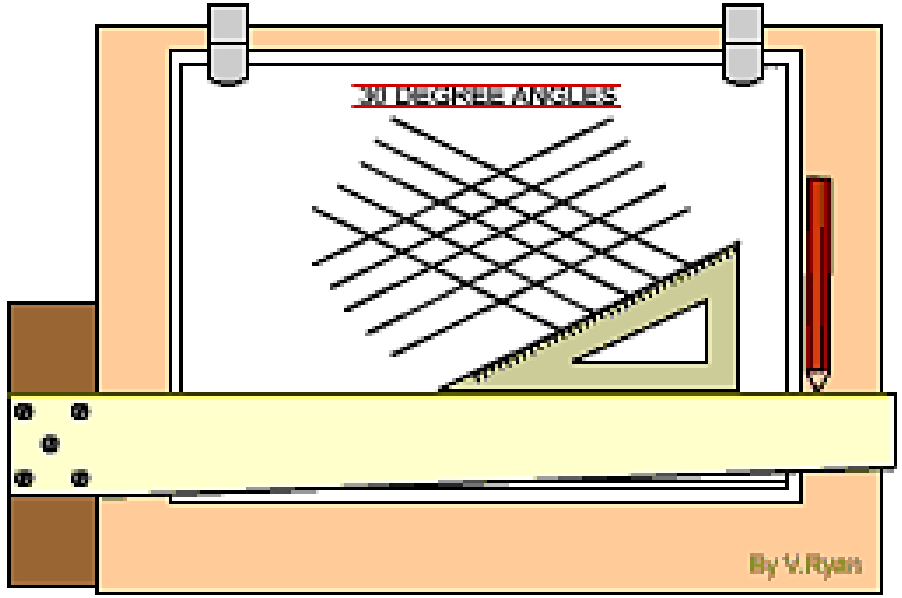
1. T-Square


GAPS
By V Ryan

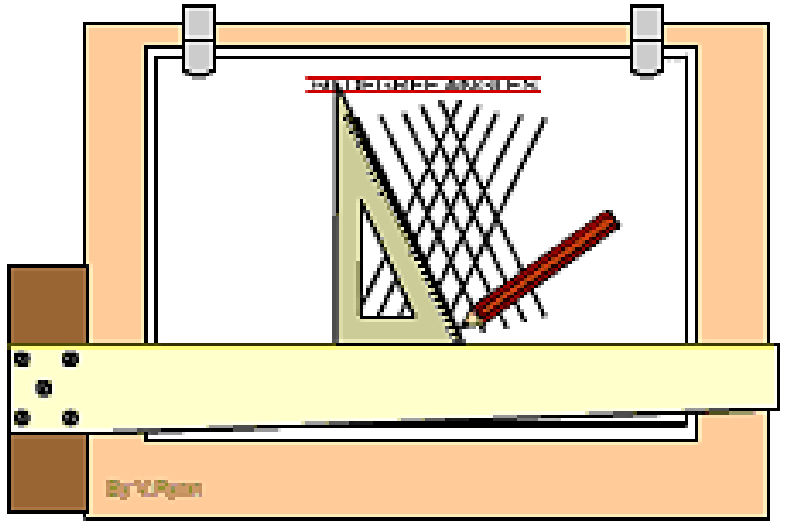


2. Set-squares or triangles

30 DEGREE ANGLES



60 DEGREE ANGLES



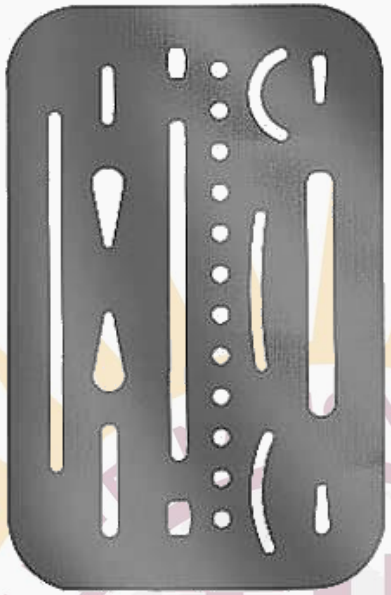
3. Adhesive Tape

4. Compass

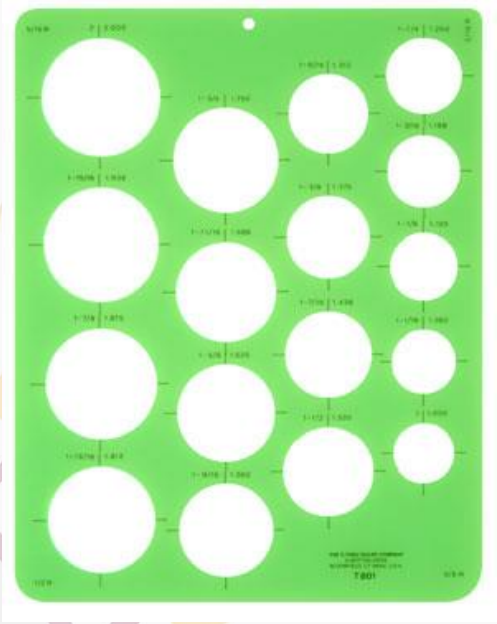
2H or HB for thick line
4H for thin line

5. Pencils

6. Pencil Eraser



7. Erasing Shield



8. Circle Template

9. Sharpener

Fastening Paper to Drafting Board

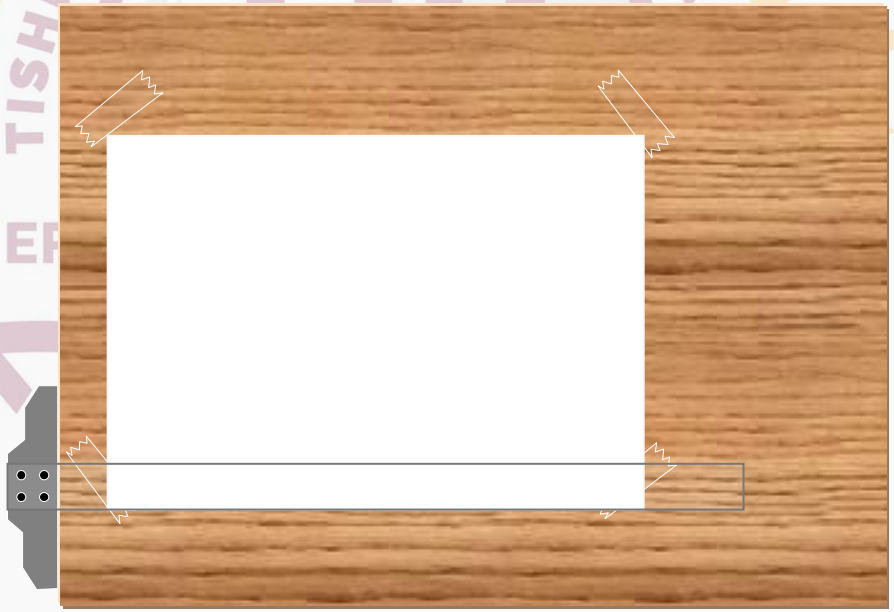
1. Place the paper close to the table's left edge.

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.



Preparing the drawing sheet
Title Block

- The title block should lie within the drawing space at the bottom right hand comer of the sheet. The title block can have a maximum length of 170 mm providing the following information.

1. Title of the drawing.
2. Drawing number.
3. Scale.
4. Symbol denoting the method of projection.
5. Name of the class, group number etc.

---Put the title block at the right lower corner

Title Block

- The title block should lie within the drawing space at the bottom right hand corner of the sheet.
- The title block can have a maximum length of 170 mm providing the following information.

1. Title of the drawing.
2. Drawing number.
3. Scale.
4. Symbol denoting the method of projection.
5. Name of the firm, and
6. Initials of staff who have designed, checked and approved.

- The title block used on shop floor and one suggested for students class work are shown in Fig.2.2.

Title Block

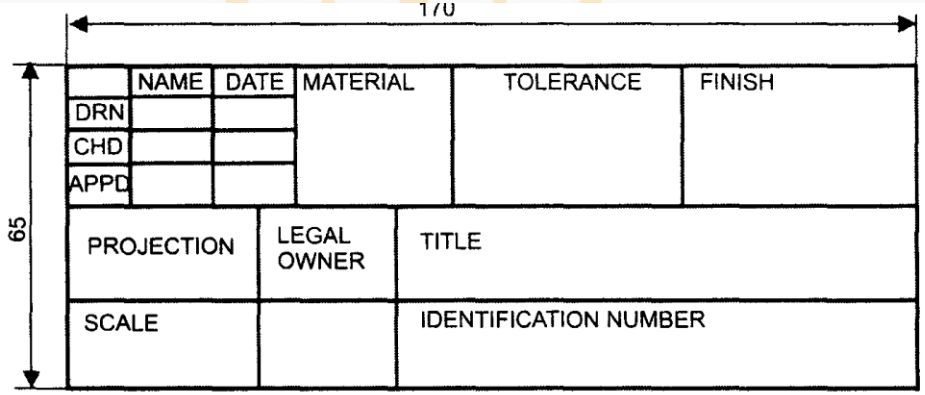


Fig. 2.2(a)

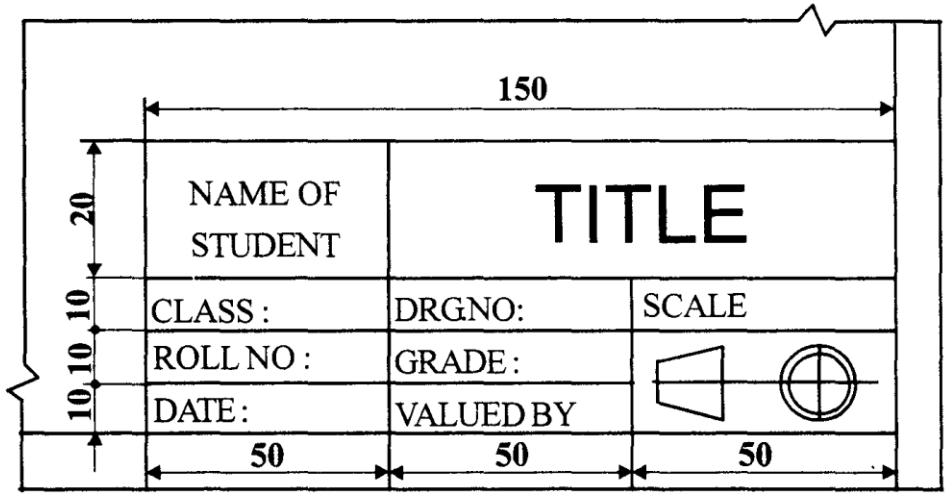


Fig. 2.2(b)

Title Block

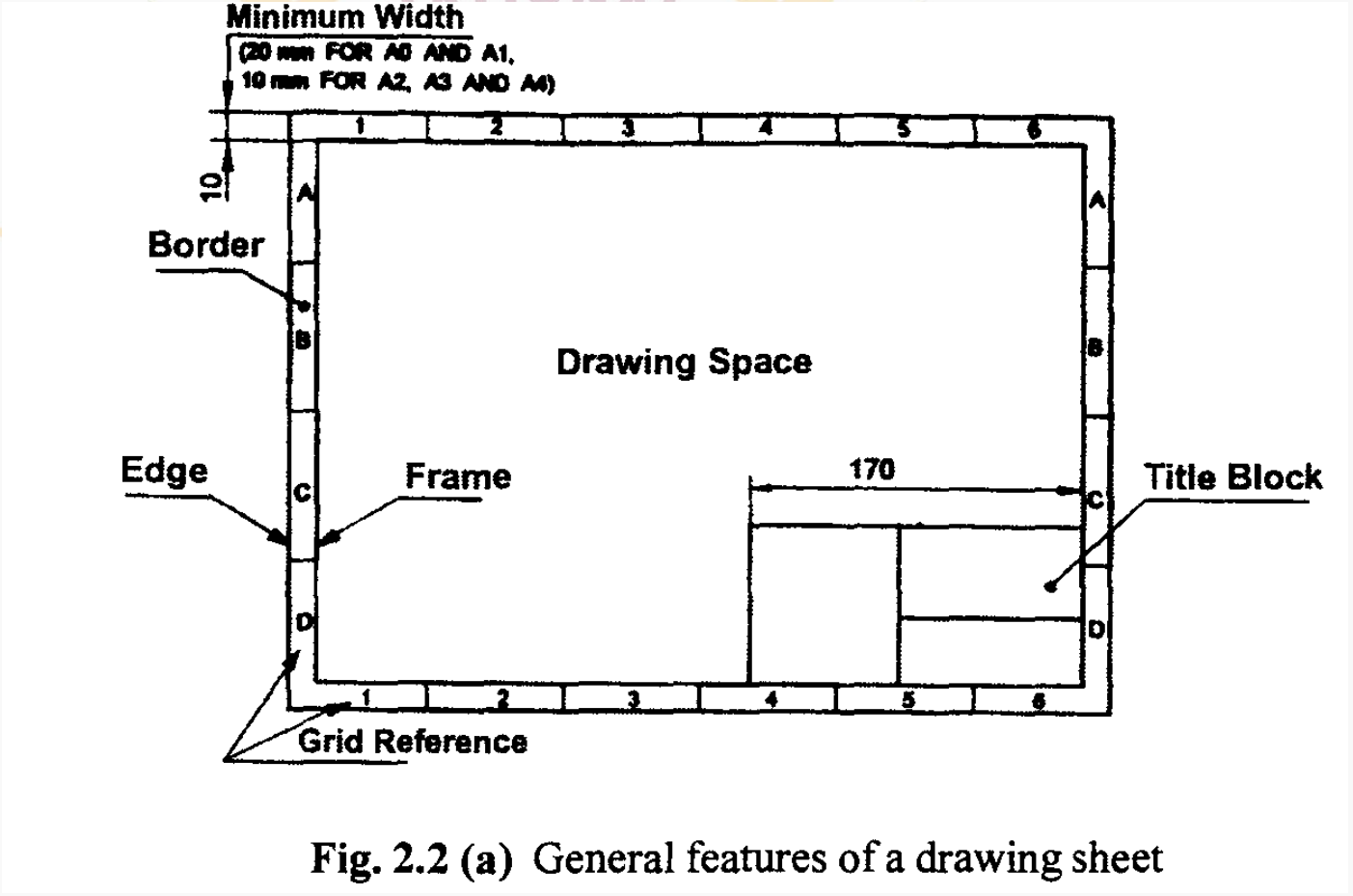
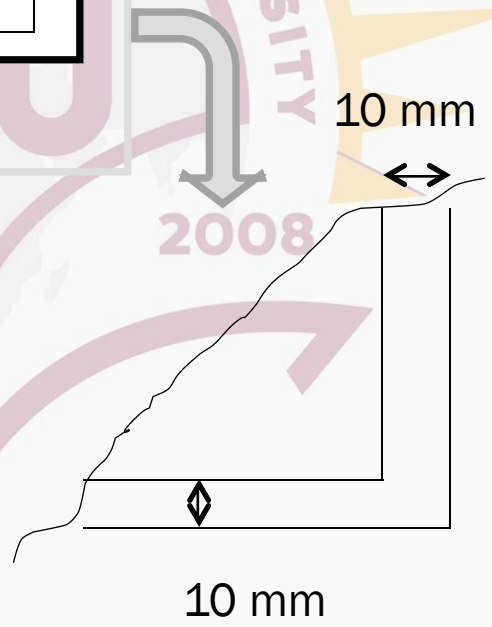


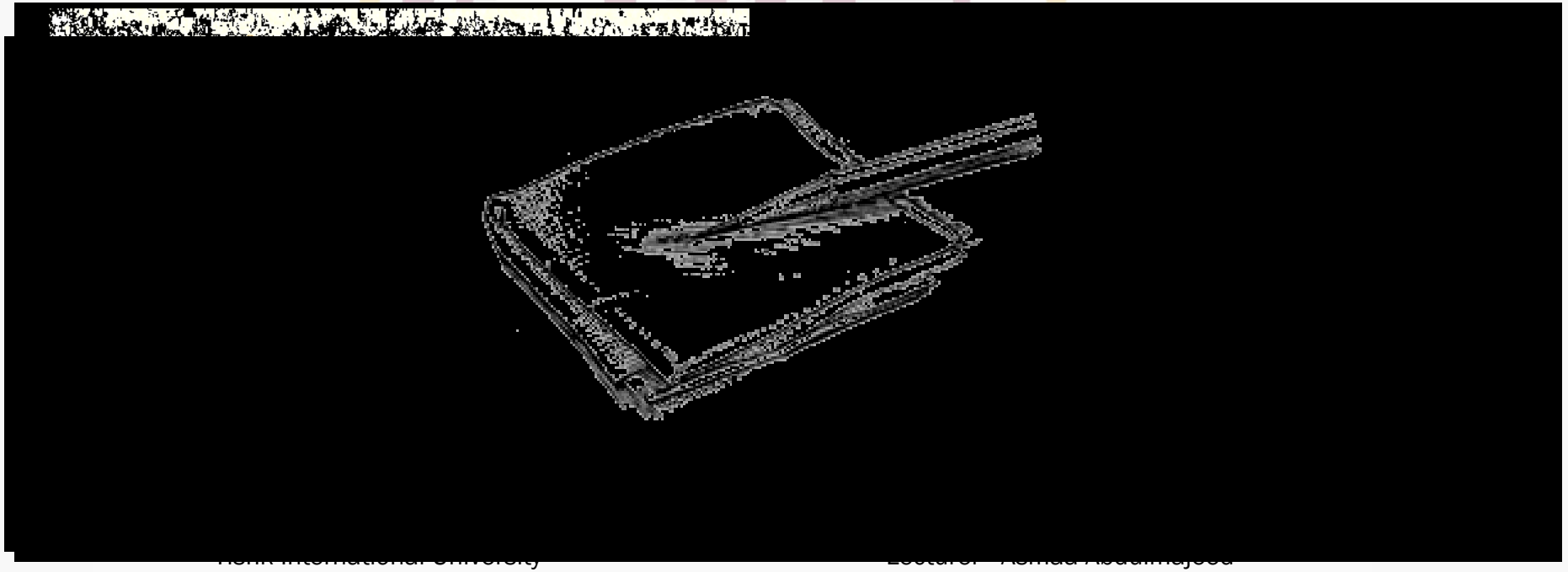
Fig. 2.2 (a) General features of a drawing sheet

Draw a border line 10 mm from the edge all round the sheet



Sharpening the Pencil

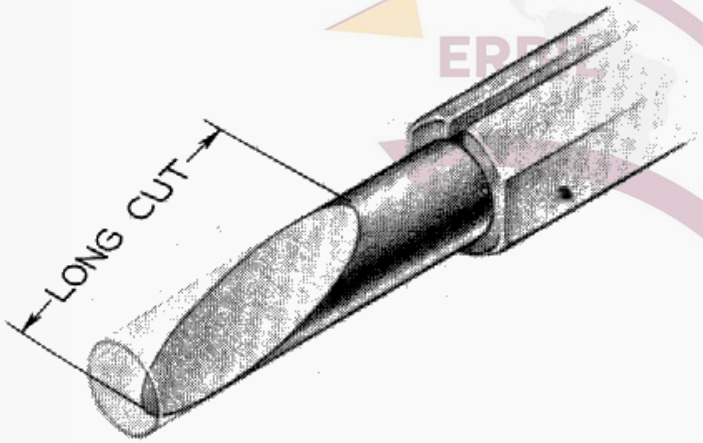
1. Remove the wood with penknife while expose a lead about 8-10 mm.
2. Polish the lead into a conical shape with a sandpaper.
3. Clean the lead with tissue paper.

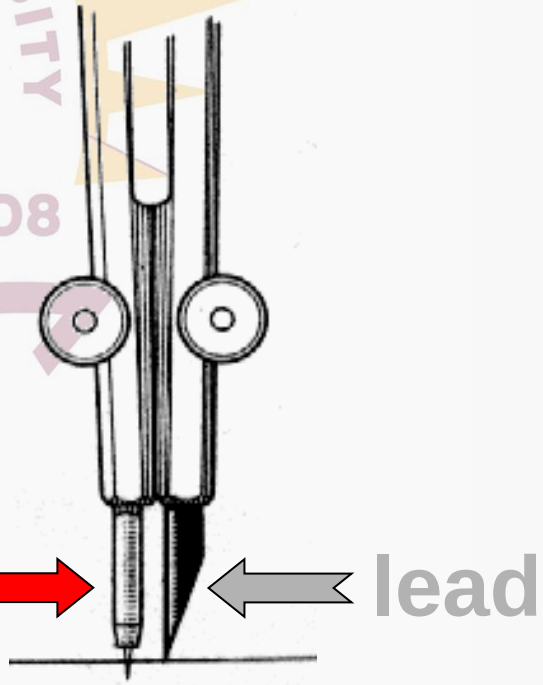


Preparing the Compass

1. Sharpen the lead with a sandpaper.

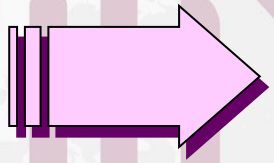
2. Adjust the **needle** and the **lead** so that the tip of the needle extends slightly more than the lead.

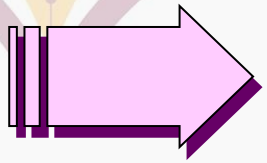




Function of the Tools

Tools	Shape to be drawn
1. T-square	Straight line
2. Set-squares	
3. Compass	Arc, Circle
4. Circle template	





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

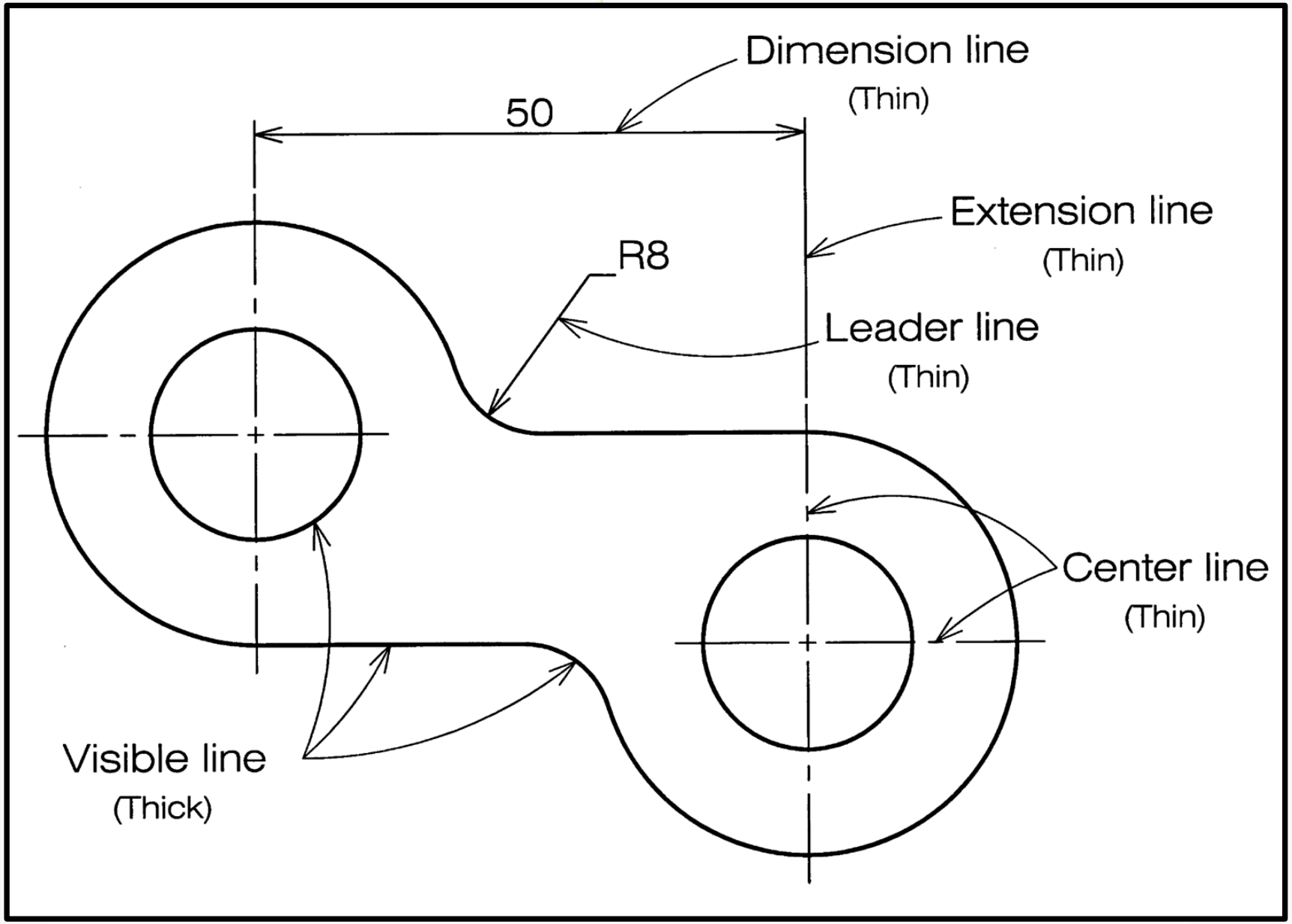
Visible lines represent features that can be seen in the current view

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

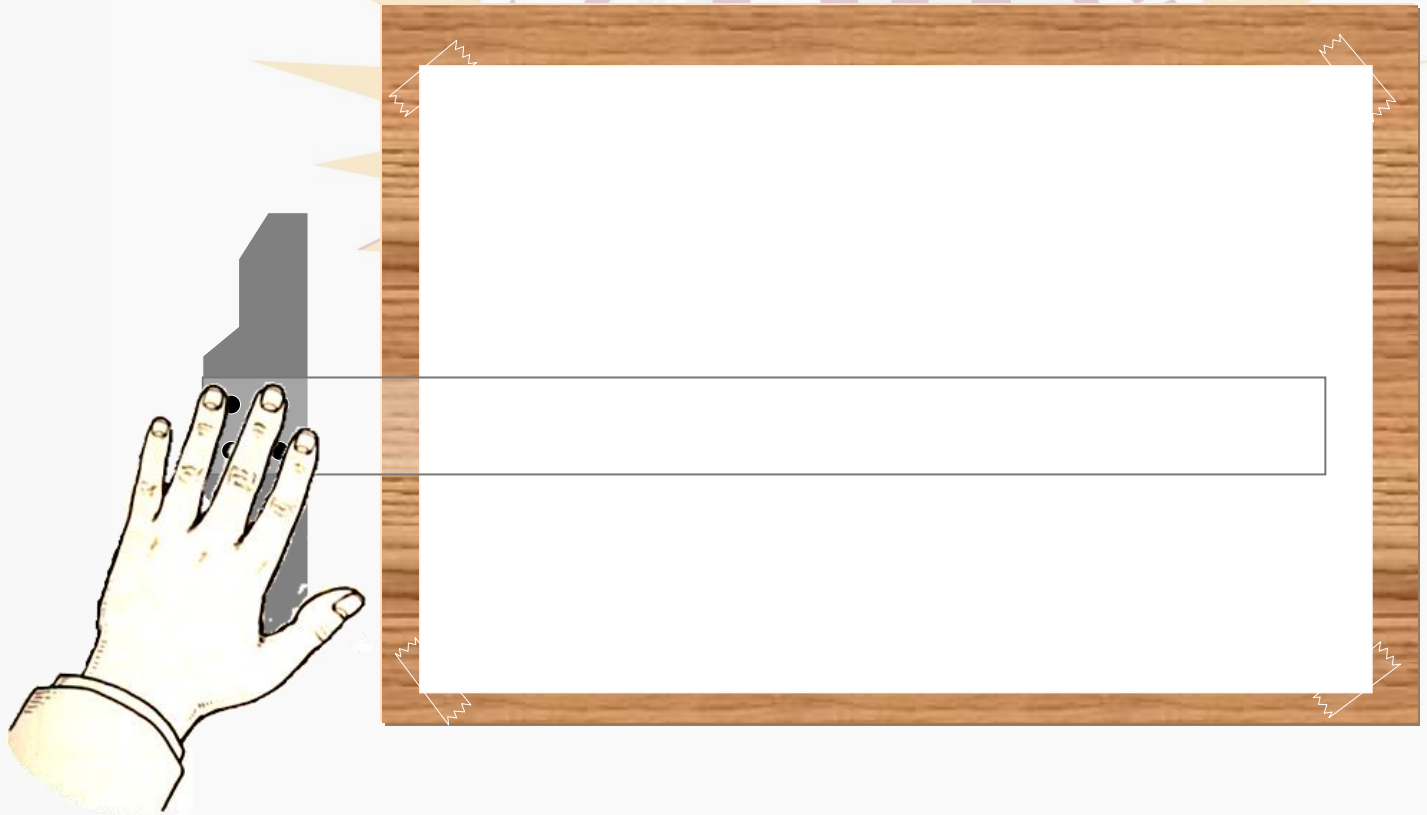
Dimension and Extension lines indicate the sizes and location of features on a drawing

Example: *Line conventions in engineering drawing*



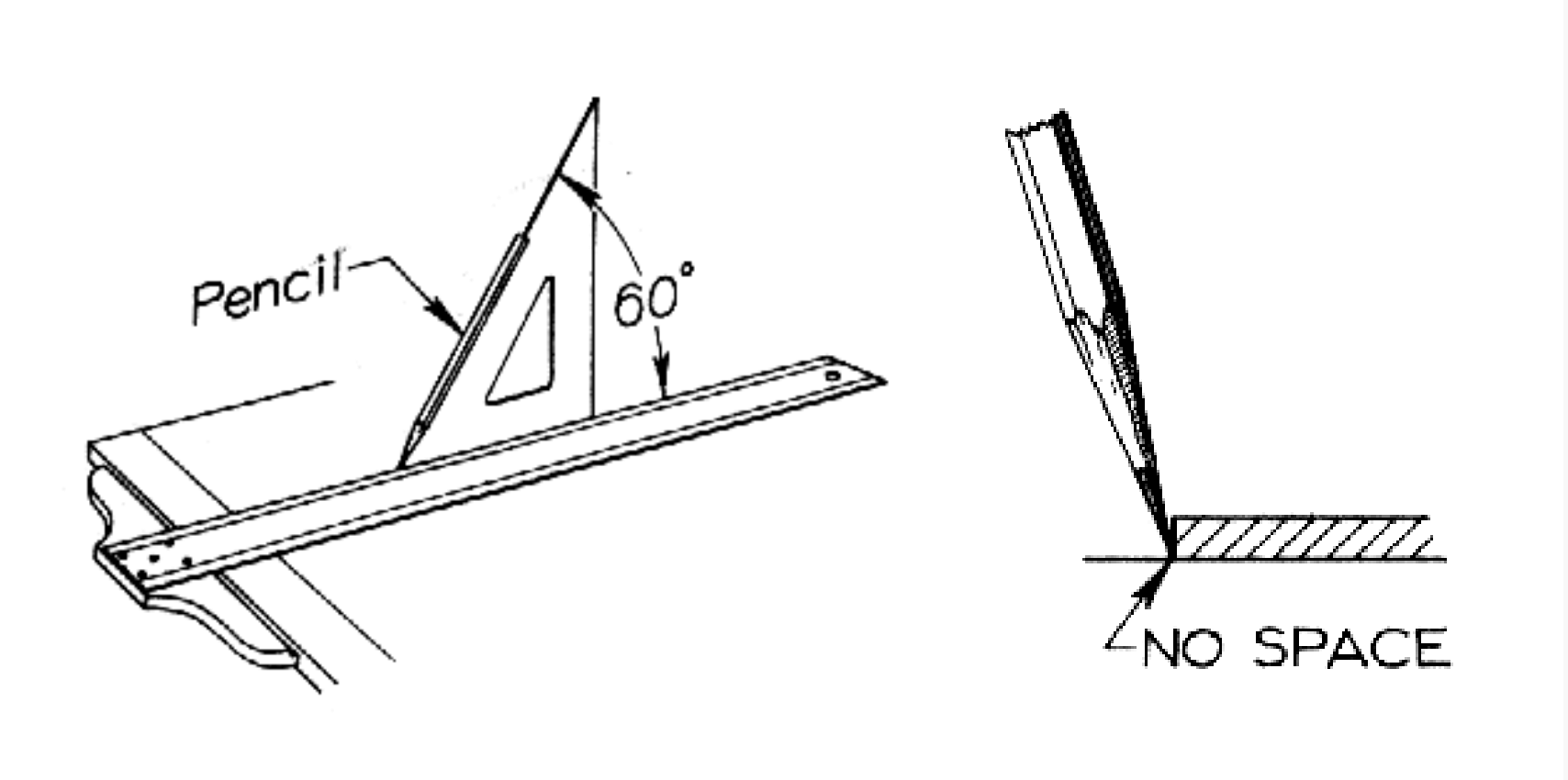
Draw a Horizontal Line

1. Press the T-square head against the left edge of the table.
2. Smooth the blade to the right.



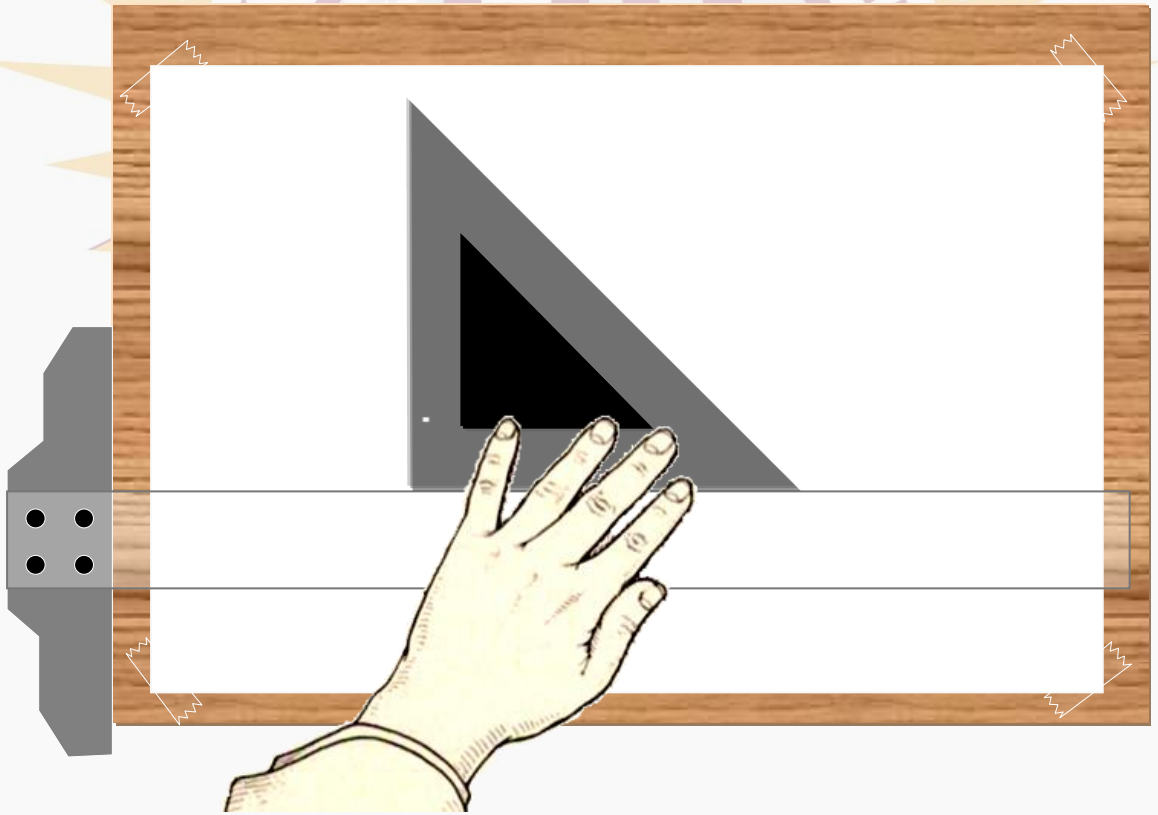
Draw a Horizontal Line

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

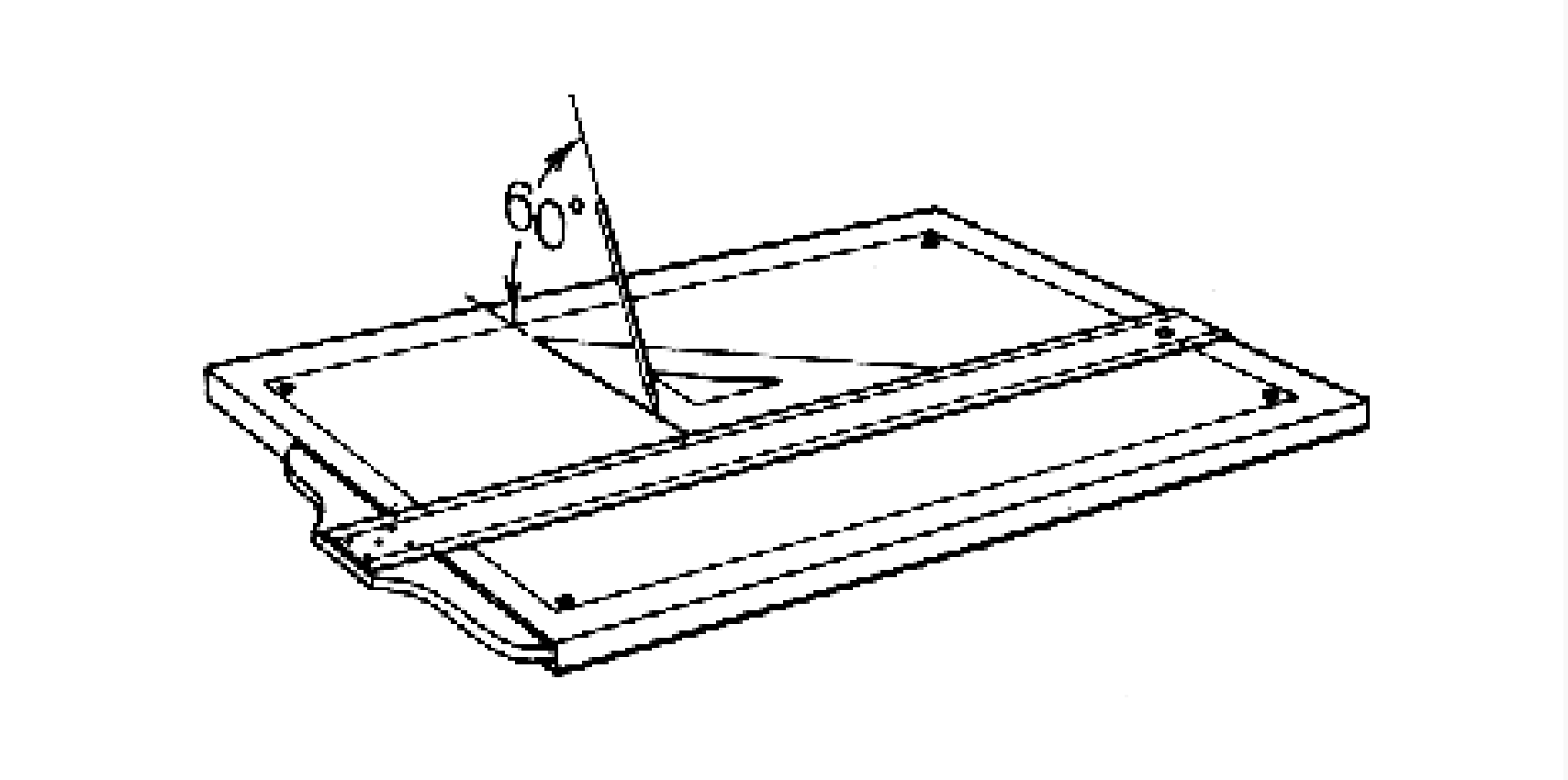
1. Set T-square as before. Place any triangle on T-square edge.
2. Slide your left hand to hold both T-square and triangle in position.



Draw a Vertical Line

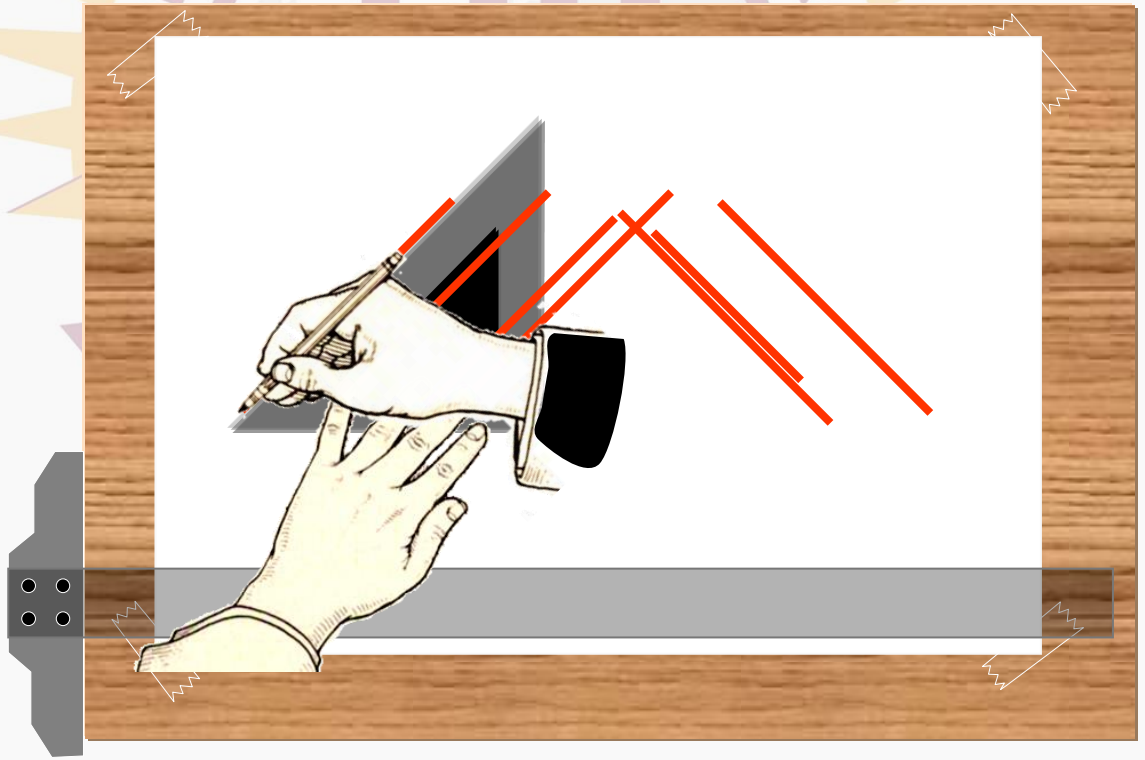
3. Lean the pencil to the triangle.

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



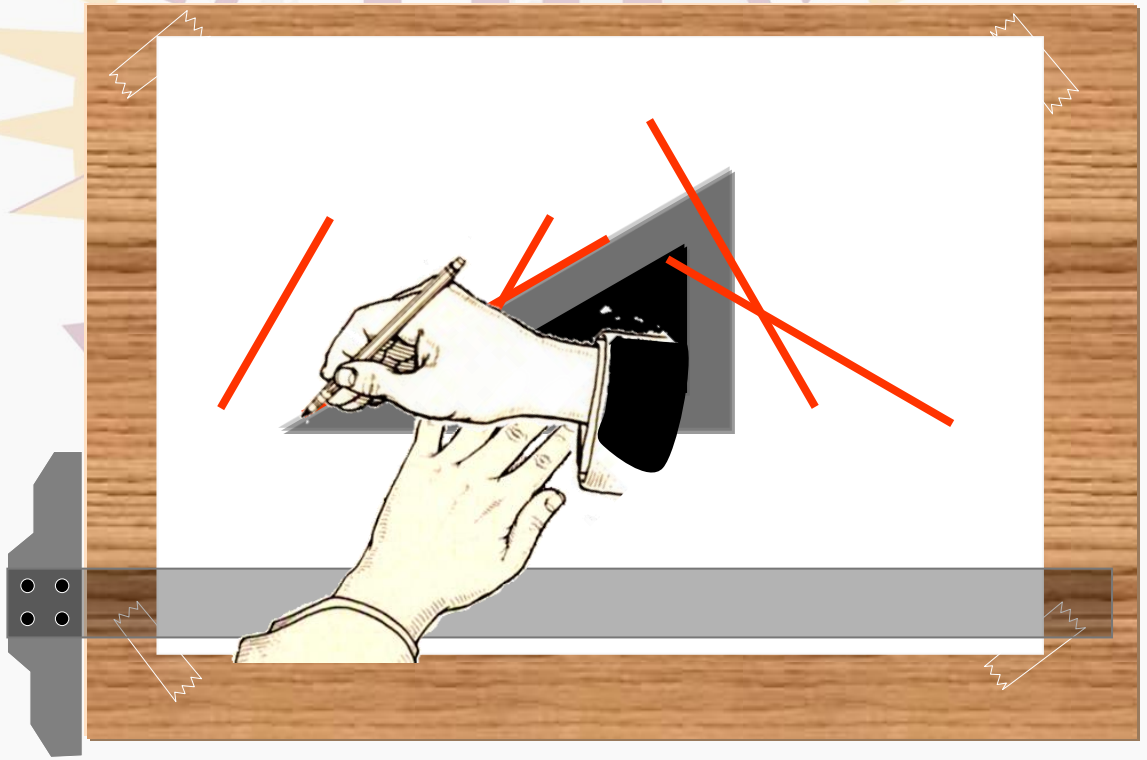
Draw a line at 45º with horizontal

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 increment

0 deg.

15 deg. = –30 + 45 deg

30 deg.

45 deg. Already demonstrated.

60 deg.

75 deg. = 30 + 45 deg

90 deg. Already demonstrated.