TVET CERTIFICATE IV IN TAILORING

TECHNICAL DRAWING

TALTD 401

APPLY TECHNICAL DRAWING

Competence

Learning hours: 60

Credits: 6

Sector: Art and Craft

Sub-sector: Tailoring

Module Note Issue date: August, 2020

PURPOSE STATEMENT

This module describes the skills and knowledge required to prepare drawing equipment, tools, and to identify tailoring drawing symbols. After this module trainees will be able to differentiate and apply lines and lettering in drawing. Also the learners will be able to make different figures or drawings and to apply the dimensioning on drawing.

By the end of the module, the trainee will be able to:

Elements of competence and performance criteria		Page No.
Learning Unit	Performance Criteria	
1.Prepare of workplace drawing symbols	1.1. Appropriate preparation of drawing equipment	3
	1. 2. Appropriate preparation of tools	
	1.3 Appropriate identification of tailoring	
2. Differentiate lines and lettering	2.1. Proper categorization of lines	43
	2.2. Correct application types of lines	
	2.3. Proper classification of letter styles	
3. Make Dimension on drawing	3.1. Proper setting of drawing on drawing sheet	64
	3.2. Appropriate of selection of scale	
	3.3. Proper application of dimensioning on drawing	

Total Number of Pages: 81

Learning unit 1- Prepare of workplace drawing symbols

Learning outcome 1.1- Prepare drawing equipment

- Content/topic 1. introduction of technical drawing

People have expressed thought and concept for many centuries e by the use of drawing some drawing are pur art as it is the painting of vase of flowers or sea scape

A music scare on a sheet of paper is a form of drawing which relies on symbols to convey meaning

Our object is to study the language of engineering graphics so that we can write it cleary for these familiar with it and reading when written by another to do this we must now the basic theory and be familiar with with it accepted conventions and abbreviations

Since its principles are essentials the same thought out of the world of person who has been trained in the practices of one nation can reading adapt to the practice of another

A technical person can use the graphic language as powerful means of communication with others for conveying ideas on technical matters. However, for effective exchange of ideas with others, the engineer must have proficiency in
Language, both written and oral,
Symbols associated with basic sciences and the graphic language.
Engineering drawing is a suitable graphic language from which any trained person can visualize the required object. As an engineering drawing displays the exact picture of an object, it obviously conveys the same ideas to every trained eye. Irrespective of language barriers, the drawings can be effectively used in other countries, in addition to the country where they are prepared. **Thus, the engineering drawing is the universal language of all engineers**.

We will treat "**sketching**" and "**drawing**" as one. "S**ketching**" generally means freehand drawing. "**Drawing**" usually means using drawing instruments, from compasses to computers to bring precision to the drawings.

Definitions

Drawing is a graphic representation of an object, or a part of it, and is the result of creative thought by an engineer or technician. When one person sketches a rough map in giving direction to another, this is graphic communication. Graphic communication involves using visual materials to relate ideas. Drawings, photographs, slides, transparencies, and sketches are all forms of graphic communication.
Drawing usually means using drawing instruments, from compasses to computers to bring precision to the drawing.
Sketching generally means freehand drawing.
Why we learn Technical drawing

1. Technical drawing is a universal language of graphic expression and many people can understand drawing and other form of graphics more easy and quicky than they can understand words

2. Technical drawing are means by which those working in industrial such as **mechanical engineering ,building** ,**architecture** or **electrical engineering** communicate the ideas of the shape ,forms and dimensions of article being made

3. Technical drawing encourages tidy and accurate methods of presenting those ideas in the of drawing

4. A knowledge of technical drawing allow you to think three dimension (height, width and depth of the drawing

5. Technical drawing is a basic for vocational training a good knowledge will help us if you with to be employed in industries such as engineering and building

6. Technical drawing is important as a designs tool for communicating ideas between people working on any project

    a. In industries
    b. Between organisation
    c. Between country
    d. In Medea -newspaper, magazines and Television

Technical drawing

It is a formal and precise way of communicating information about the shape, size, featuring and precision of physical objects.

A universal language of engineering used in the design process for solving problems, quickly and accurately visualizing objects, and conducting analysis.
A graphical representation of objects and structures.

Also known as **drafting** or **draughting** is the act and **discipline** of composing **plans** that **visually communicate** how something functions or is to be constructed.

Technical drawing is essential for communicating ideas in **industry** and **engineering**. To make the drawings easier to understand, people use familiar **symbols**, **perspectives**, **units of measurement, notation** systems, visual styles, and **page layout**.
Together, such **conventions** constitute a **visual language**, and help to ensure that the drawing is **unambiguous** and relatively easy to understand.
It can be done by using **freehand or computer methods.**

Classification of Technical drawing
-Artistic drawing (free hand or model drawing)

-Engineering drawing (Instrument drawing)

Artistic drawing

The art of representation of an object such as painting, cinema slide, advertisement boards, etc by the artist by his imagination or by keeping the object before him is known as artistic drawing.
Engineering drawing

The art of representation engineering object such as buildings, roads, machines, etc on paper is called Engineering drawing.
The subject of engineering drawing can be divided into the following categories:

THE DISCIPLINE OF TECHNICAL DRAWING

The disciplines of technical drawing involves

1. Gaining a good draughting skills for the production of clear and precise draughting

2. Technical drawing is based in geometrical this following are necessary

    a. A good knowledge of **plane geometry** in 2 dimensions
    b. A good knowledge of **solid geometry** in 3 dimensions
    c. A good knowledge **orthographic projection**

3. Application of plane and solid geometry and orthographic projection the production of good quality technical which will fully describe object

Geometrical drawing

Plane geometrical drawing.

The art of representation objects having two dimensions i.e. length and breadth (width) such as square, rectangle, triangle, etc. On paper is called plane geometrical drawing.

Solid geometrical drawing.

The art of representation of objects having three dimensions i.e. length, breadth and thickness such as cube, prism, cylinder, sphere, etc. on paper is called solid geometry drawing. It is also called **descriptive** or **practical solid** geometrical drawing.

Mechanical engineering drawing

The art of representation mechanical engineering object such as machines, machine parts, etc. on a paper is called mechanical engineering drawing or machine drawing.

Machine Drawing

It is pertaining to machine parts or components. It is presented through a number of orthographic views, so that the size and shape of the component is fully understood. Part drawings and assembly drawings belong to this classification.

Production drawing

A production drawing, also referred to as working drawing, should furnish all the dimensions, limits and special finishing processes such as heat treatment, honing, lapping, surface finish, etc., to guide the craftsman on the shop floor in producing the component. The title should also mention the material used for the product, number of parts required for the assembled unit, etc.

Part drawing Component or part drawing

Is a detailed drawing of a component to facilitate its manufacture. Detail drawings completely describe a single part with multi-view orthographic projections. A part drawing with production a detail is rightly called as a **production drawing** or **working drawing**. ***Part Drawings*** Should provide all the information necessary to economically manufacture a high quality part.

Assembly drawing

A drawing that shows the various parts of a machine in their correct working locations is an assembly drawing. Assembly drawings are used to show the position and functional relationship of parts in an assembly, also via multi-view orthographic projections.

Generally they have no dimensions on them. Parts are 'balloon' identified and referenced to either detail drawing numbers or catalogue ,numbers, via a Bill of Materials (BOM)

Civil engineering drawing

The art of representation of civil engineering object such as roads, buildings, bridges, dams, etc. on paper is called civil engineering drawing.

Electrical and electronic engineering drawing

The art of representation of electrical objects such as motors, generators, transformers, poles towers, wiring diagram, etc. on paper is called electrical engineering drawing or electrical drawing.

- Content/ Topic 2. Importance of drawing equipment

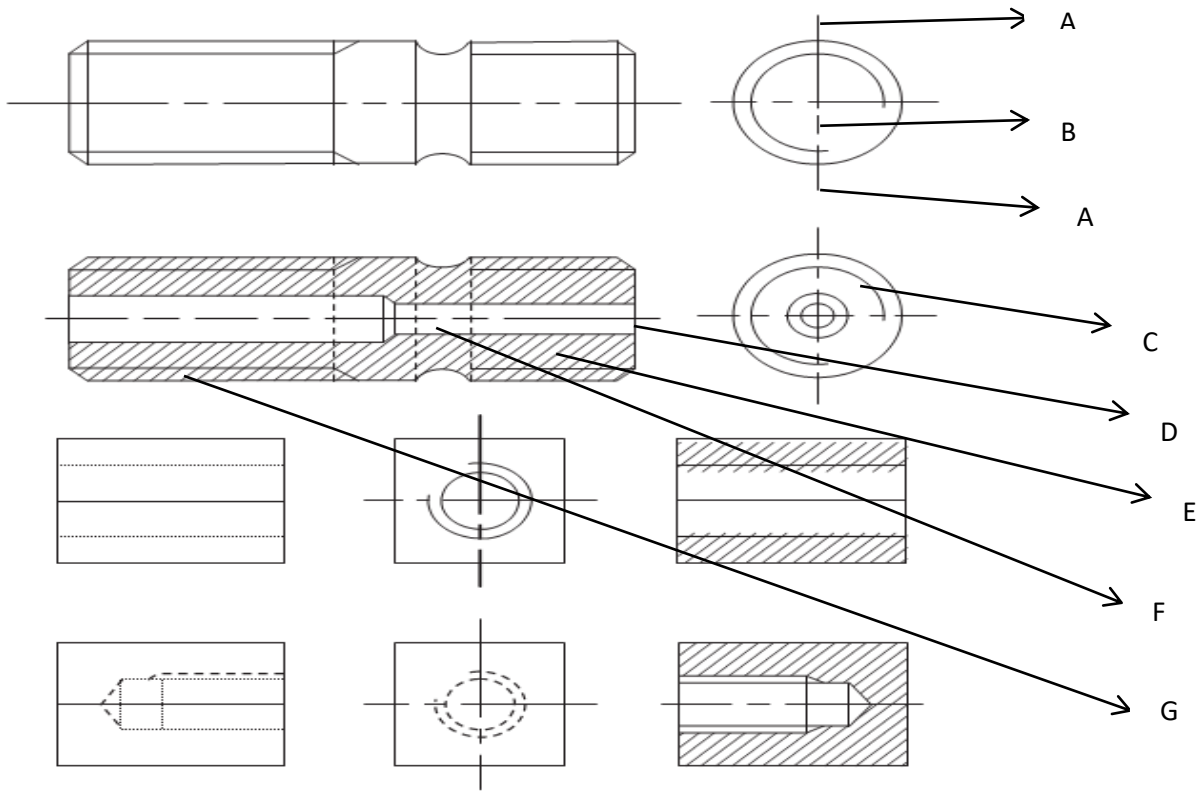
Technical drawings, graphic images and sketches can be created using a variety of instruments, ranging from traditional tools such as pencils, compasses, rulers and a variety of triangles as well as by computer. Drawing tools are used to make accurate and legible drawings and models. Whilst the computer can be used for most drawing and modeling requirements today, traditional drawing instruments such as those mentioned above are still important very important, particularly for freehand sketching and experimenting with shapes and lines. When drawing, sketching or attempting basic graphics work the pieces of equipment shown below are very useful and often essential.

- **Content/ Topic 3. Drawing equipment**

Specific materials and drawing instruments are required to undertake technical drawing as technical drawing is an universal language it is governed by the rules regarding methods of drawing and the symbols used those rules and symbols are laid down in **ISO** (International Standard Organisation) and BS (British Standard follow the ISO

EXAMPLE OF SYMBOLS FROM BS:308

BS 308 engineering drawing practice and BS:1192 Are both based on ISO:128 says Technical drawing general principles
FIG SHOWS SAME EXAMPLES OF SYMBOLS FROM BS 308 Engineering practice of symbols would be found in ISO :128 Technical drawing general principles



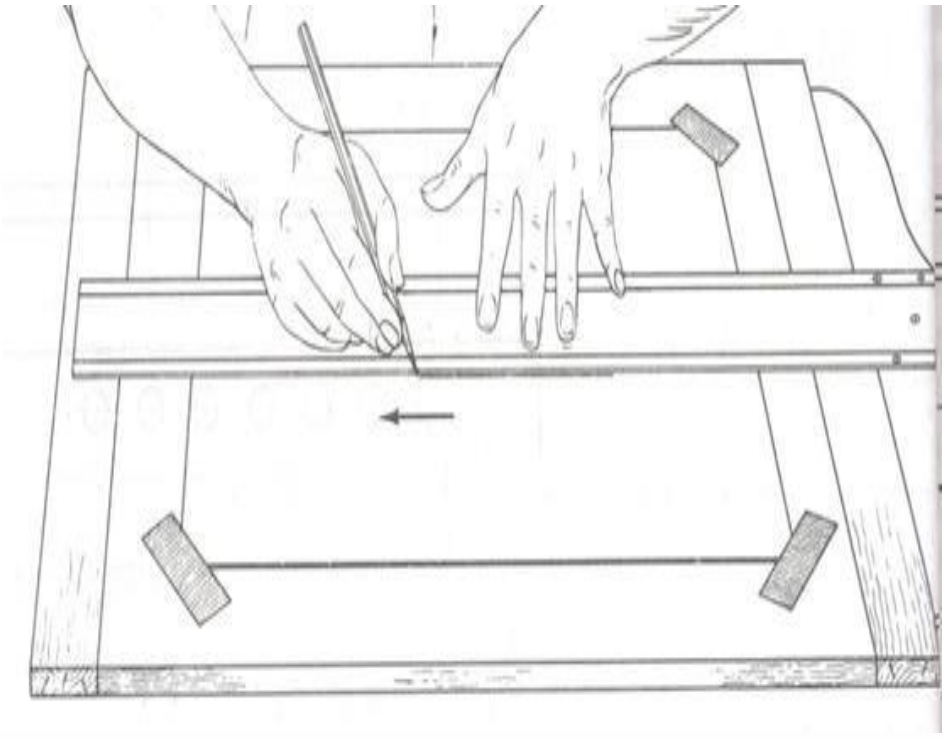
Conventional representation of threads

A-A: SECTION LABEL
B: SECTION PLANE LINE
C: HIDDEN DETAIL LINE
D: THICK OUTLINE
E: HATCH LINE
F: CENTER LINE
G: SCREW THREAD LINE

DRAWING BOARD

The Drawing Board serves as the workstation in drawing and is made with a smooth level top surface onto which drawing paper is fixed using **clamps**, **thumbnails** (board pins), or using drawing tape.

Most often made from wood ,made from 12mm thick playwoods sizes vary but for school and college work for one measuring 650mm by 470 mm is suitable for working with A2 sizes or (smaller)
Paper the surface for all drawing should be cleaned at the regular intervals by diping with paper or cloth and occasionallyby re-sandpapering to ensuire the surface are flat ,smooth and clean



Drawing Board

A drawing board is a flat, smooth board on which to attach paper for making drawings or designs. Traditionally they are made of timber however modern day boards are constructed out of plastic. The board can be purchased in A4 size although they are more commonly found in schools as an A3 size format.

Board Clips

Board clips are used to hold the drawing paper in position when drawing board is not available. They are designed to clip on to the edge of a table or portable timber board and hold the paper down firmly against the flat surface. (Drawing board or table)

DRAWING SHEET
DRAWING PAPER OR DRAWING SHEET

Introduction
Drawing paper must when fixed onto the drawing board be aligned such that its top and bottom edges run parallel to the straight edge of the T-Square or the Parallel Straight Edge. If properly cut, this alignment ensures that the orthogonal edge of the drawing paper is perpendicular to the Parallel Straight Edge. In engineering drawing the preparation of drawing sheet depends to a large extent on the layout of the drawing sheet. An engineer has to keep in his mind the other aspect such as margin, title block, parts list, folding marks etc so as to facilitate the reading and interpretation of the drawing.

Paper are commonly measured as also GRAM PERQUARE METER (GSM) technical drawing are measured in this way paper suitable for technical drawing

1. **CARTRIGDE PAPER**
   Good quality of paper for pencils drawing a weight often used id 90 gsm and
   Are made from esporton grass
2. **Detail paper**
   A lighter paper for pencil and color work
   A common weight is 50 Gsm
3. **Grid paper**
   Often of A4 size very suitable for free hand sketching out of lay out for a technical drawing square ,isometric and perspective grids
4. **Tracing paper** 38Gsm to 63 Gsm for marking and tracing of technical drawing
5. **Paper and board for ink work** : if wishing to draw with ink black and colored ink a large variety of different paper board available

Layout of the Drawing sheet

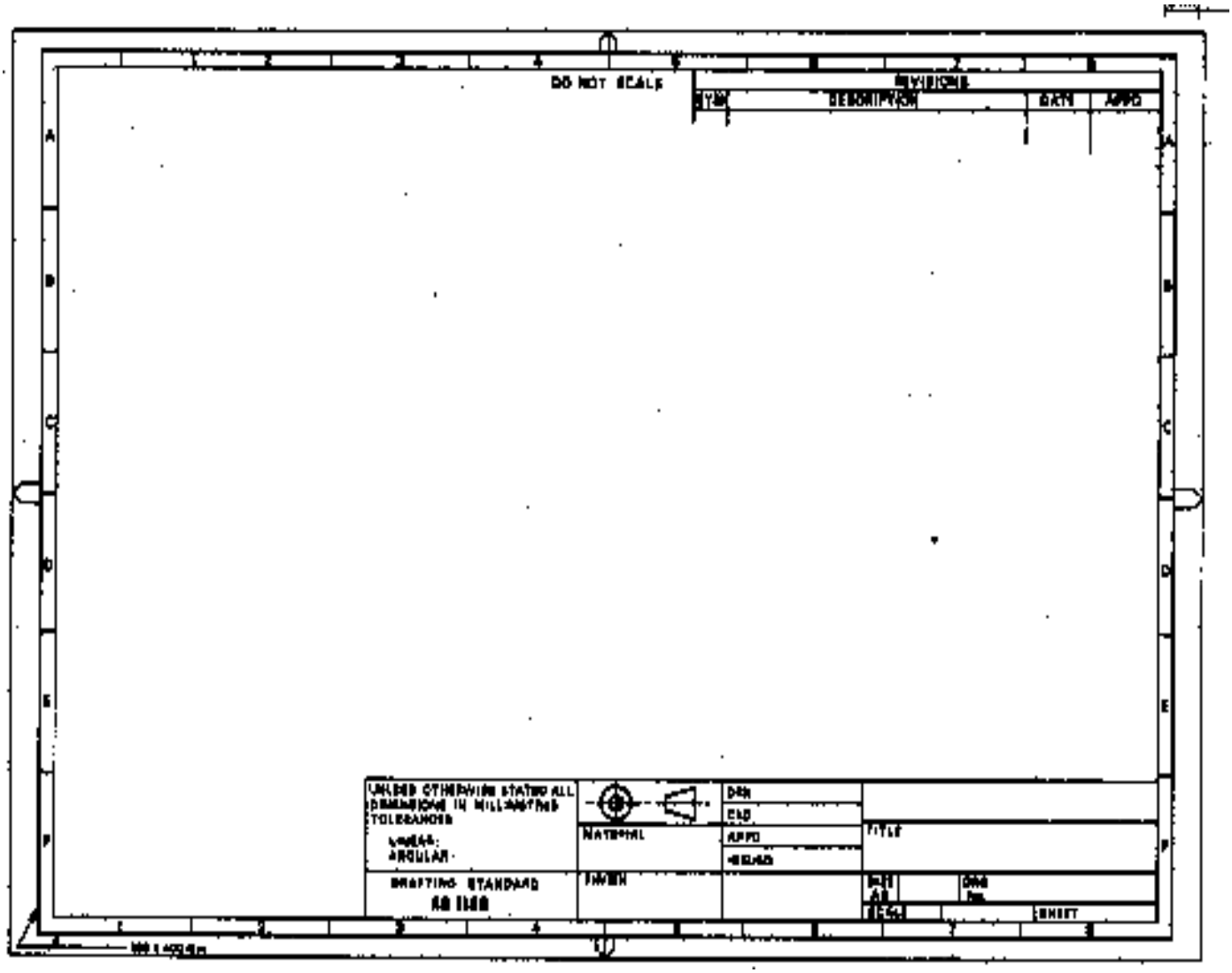
The selection of suitable scale and allotment of proper space for margin, title block, part list, folding marks etc. on the drawing sheet is known as layout of drawing sheet.

Definition of lay: put down and set in position for use.

Lay out:

Layout of the Drawing sheet

The selection of suitable scale and allotment of proper space for margin, title block, part list, folding marks etc. on the drawing sheet is known as layout of drawing sheet.



Layout of drawing sheet A0 (841x1189)

- **Content/ Topic 4 . Size of drawing sheet**

TYPES OF DRAWING PAPER

They are mainly classified as per their sizes from A0 to A6. There are also larger size like 2A0 and 4A0 however at school we will be using A4 size. A0 is a rectangle with an area of **$1m^2$**.

All A size sheets have their edge lengths in the same proportion. This proportion is in the ratio of short side to the long side and is equal to $\frac{1}{\sqrt{2}}$

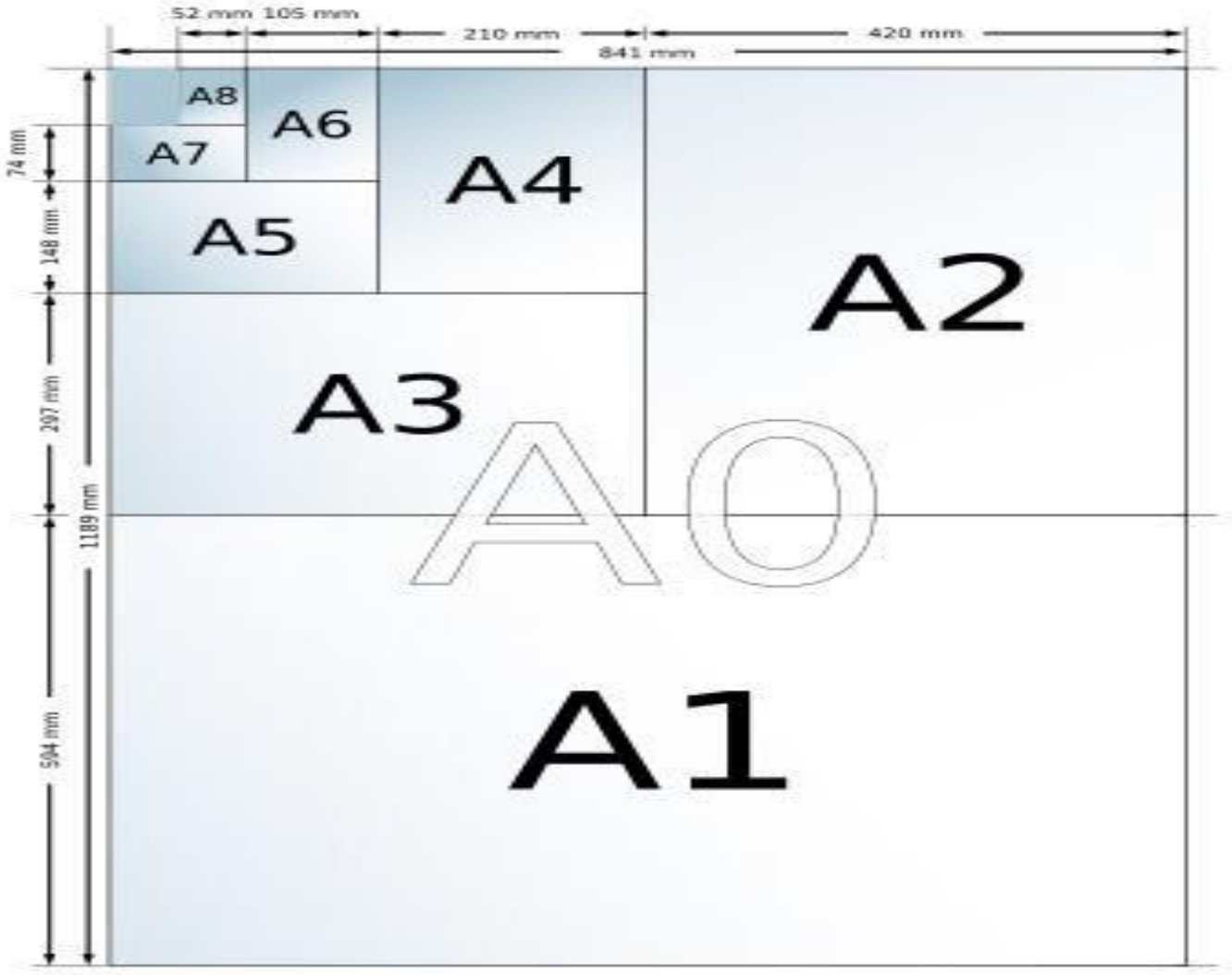
Each lower size in the A series is obtained by exactly dividing

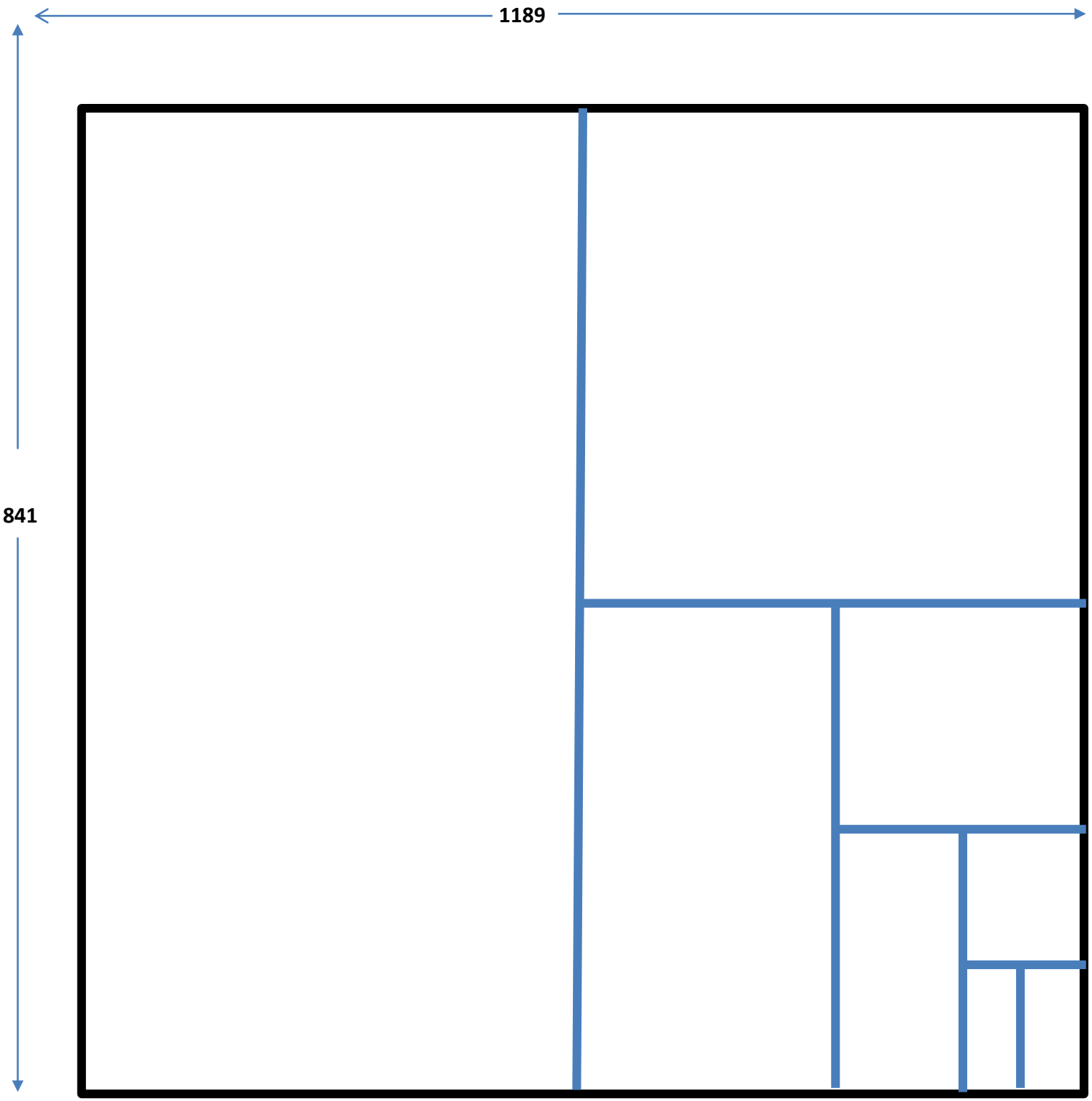
The A sheet along its middle as shown in the following figure

TYPES OF PAPER

Table of sheets sizes

Format	Measurements in mm
A0	**841 x 1189**
A1	**594 x 841**
A2	**420 x 594**
A3	**297 x 420**
A4	**210 x 297**
A5	**148 x 210**
A6	**105 x 148**

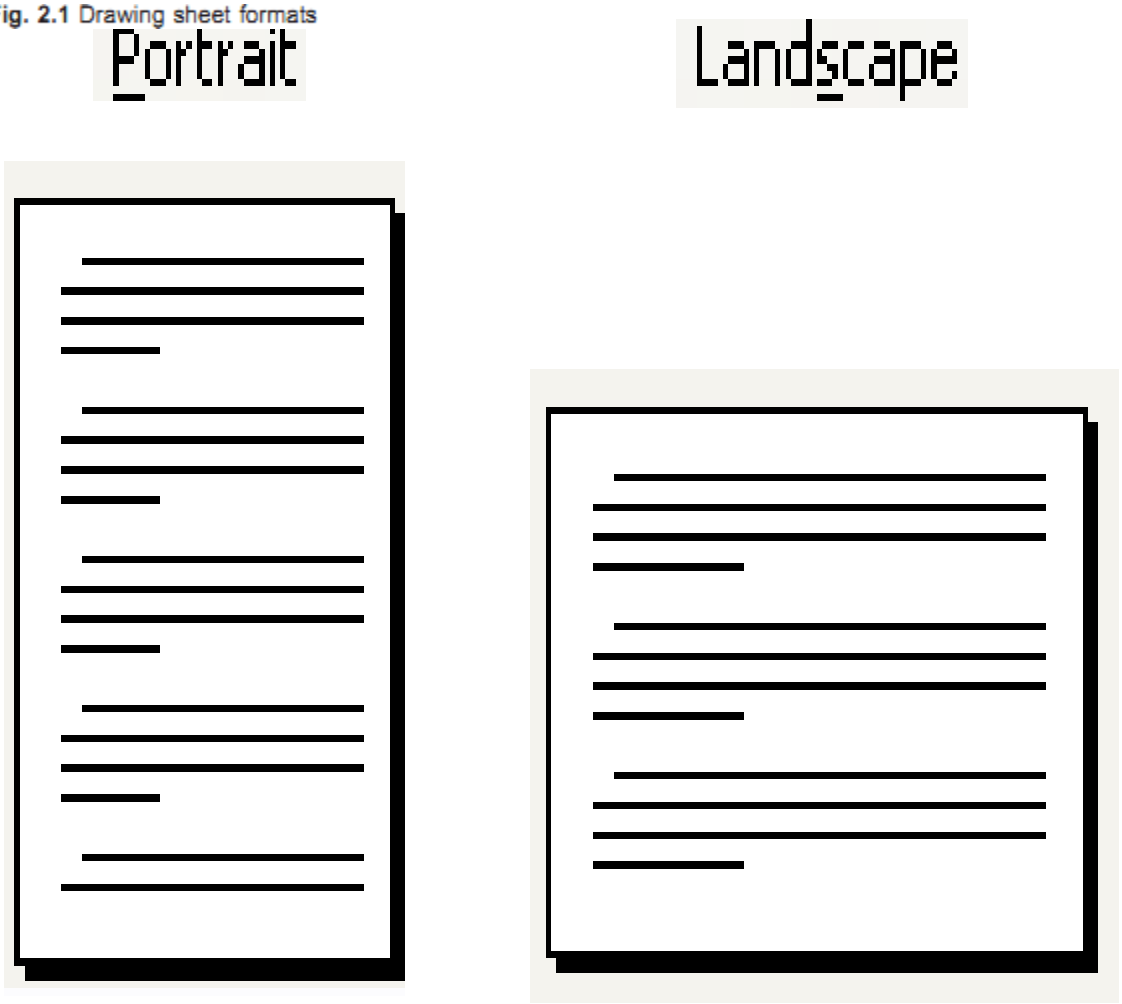



1189
841

❖ Content/ Topic 5 Lay out of drawing sheet

Drawing sheet layout

Fig. 2.1 Drawing sheet formats

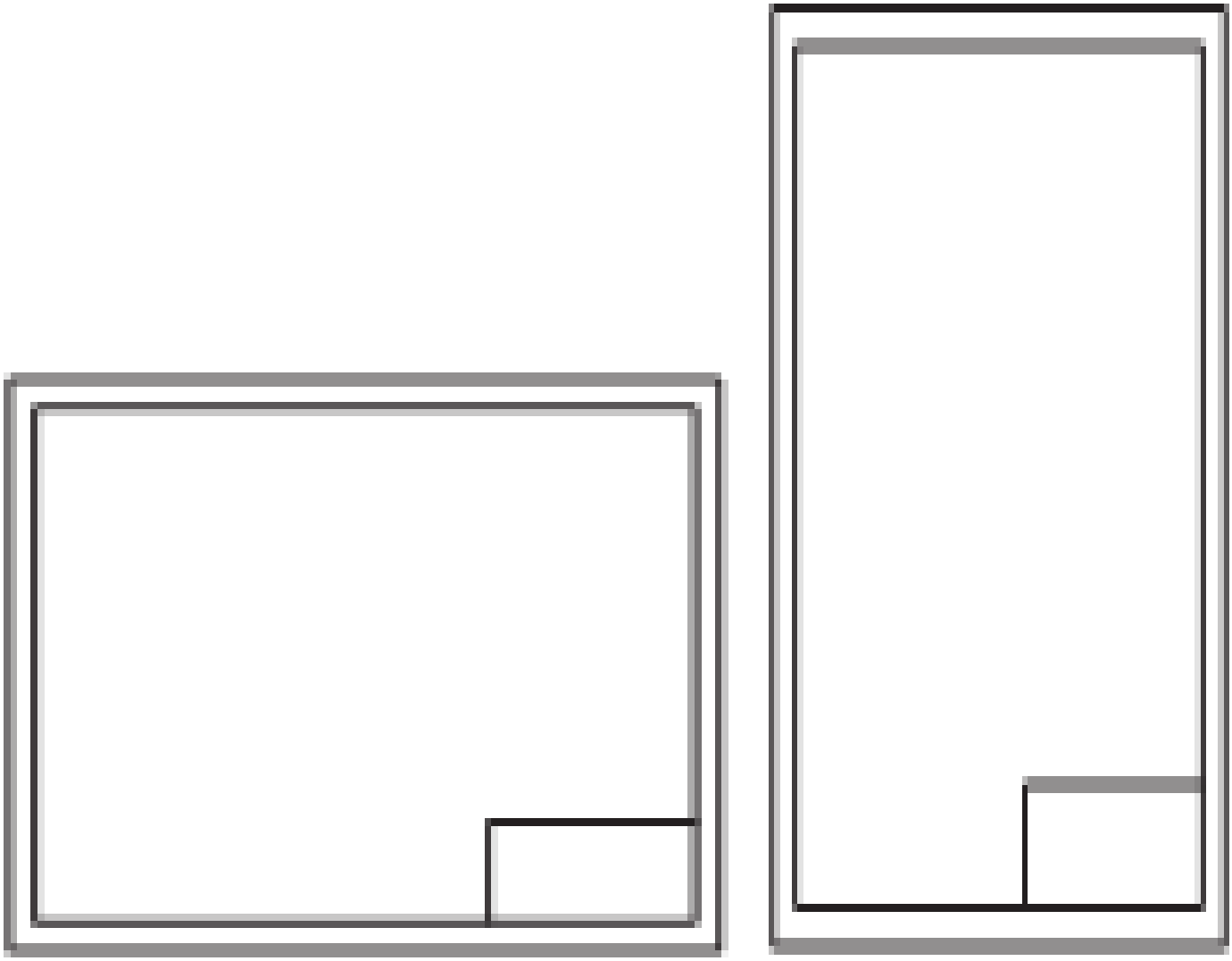


Depending on the shape and size of the object being represented on the drawing, the drawing sheet can be taken in the Portrait or Landscape position.

Important terms

TITLE BLOCK

The title block should lie within the drawing space such that, the location of it, containing the identification of the drawing, is at the bottom right hand corner. This must be followed, both for sheets positioned horizontally or vertically



Location of title block

The direction of viewing of the title block should correspond in general with that of the drawing. The title block can have a maximum length of 170mm.figure below shows a typical title block, providing the following information:

The designation of the represented object,

The scale selected,

The enterprise (or educational institution) where the drawing has been prepared

The day when it has been finished

The date of testing

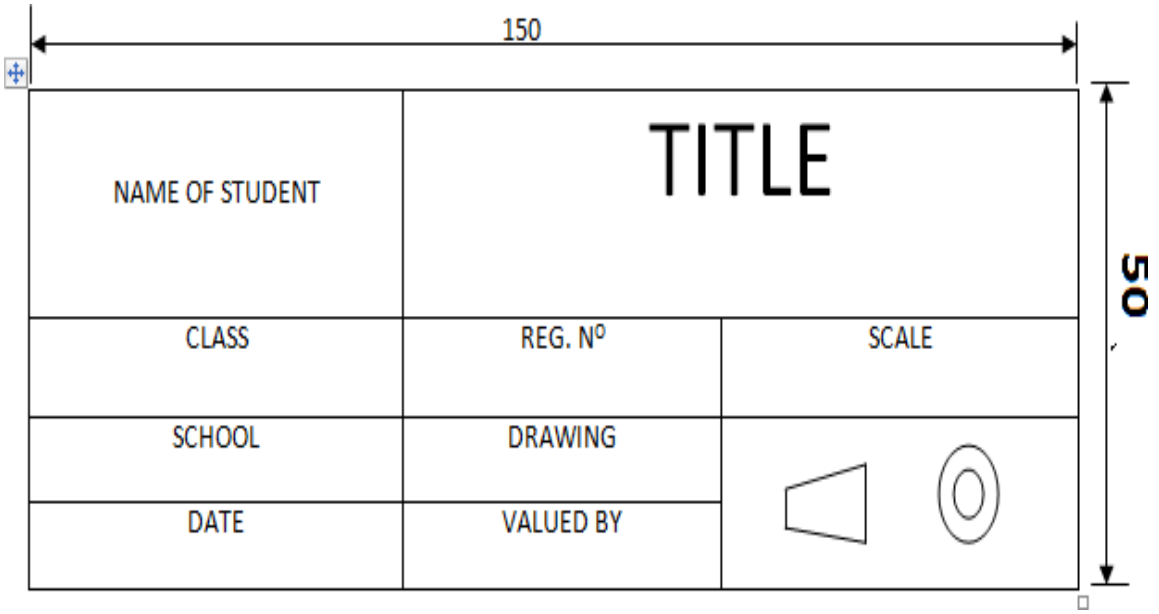
The registration number

−The title f the drawing

−Sheet number

−Symbole, denoting the method of projection

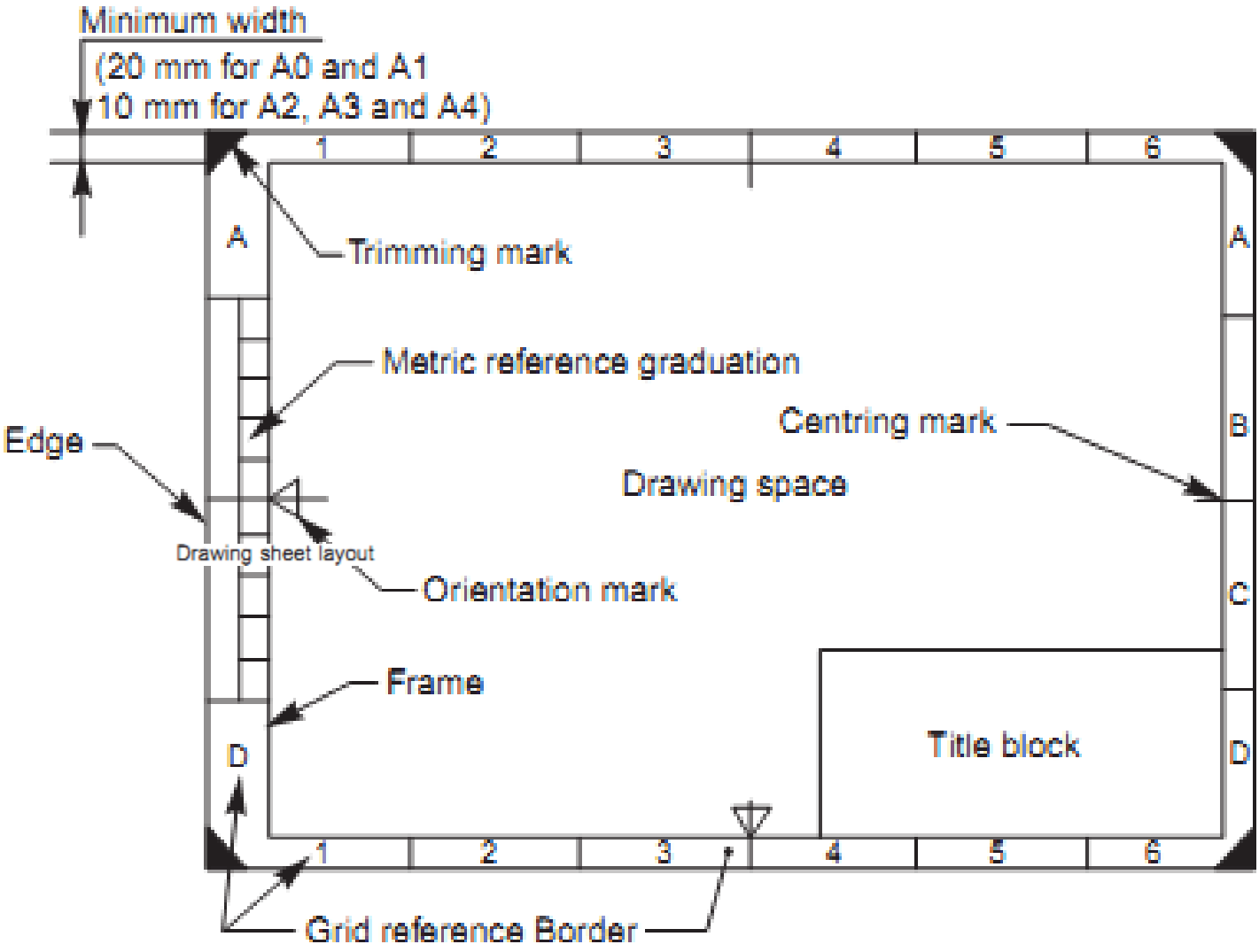
−Initial of staff drawn, checked approved.



Details in title block

Borders and Frames

Borders enclosed by the edges of the trimmed sheet and the frame, limiting the drawing space, should be provided with all sheet sizes. It is recommended that these borders have a minimum width of 20 mm for the size A0 and A1 and a minimum width of 10 mm for the sizes A2,A3 and A4. A filing margin for taking perforatios, may be provided on the edge,



Learning Outcome 1.2- Prepare drawing tools

❖ **Content /Topic 1. Drawing tools**

1. Set- Squares

The set squares are made of transparent celluloid or plastic materials, etc. The set- square made of transparent celluloid are most satisfactory as the line underneath the set- square can be seen quite easily and this often prevents another line being drawn in the wrong place.

TYPES OF SET SQUARES

1. **Thirty-sixty degree (30^0-60^0)**

2. **Forty five degree (45^0)**

The 30^0-60^0 set square has three edges, one of which forms 90^0 and other edges forming angle of 30^0 and 60^0 with the other sides respectively (see fig.) The 45^0 set square is similar to the 30^0-60^0 set square, but its edges form an isosceles triangle in which two of the angles are of 45^0 each and other one's 90^0(see fig…)

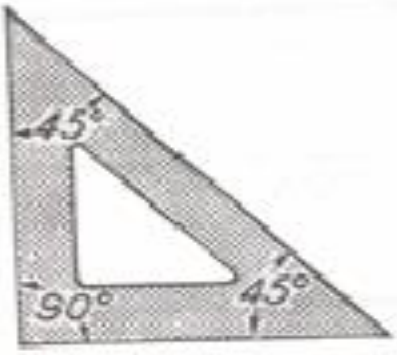
Sizes of set- squares

The set- squares can be available in different suitable lengths, but 30^0-60^0 setsquares of 250mm and 450 set- square of 200mm are suitable for general work.

Uses of set squares

1. The set-squares are used for drawing straight line except the horizontal lines which are usually drawn with T-square.
2. The perpendicular lines or the lines at30^0, 60^0 and 90^0 to the horizontal can be drawn by using the set squares.
3. The perpendicular lines or the lines inclined at 45^0 and 90^0 to the horizontal can be drawn by using the set- squares.
4. By using two set-squares, angle of 150^0, 750^0 and 105^0 can be drawn.

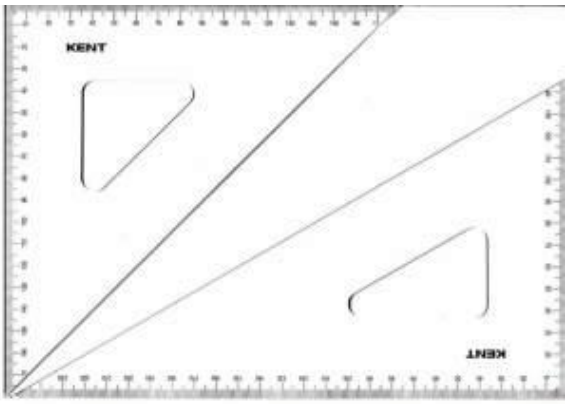
30^0-60^0 set square



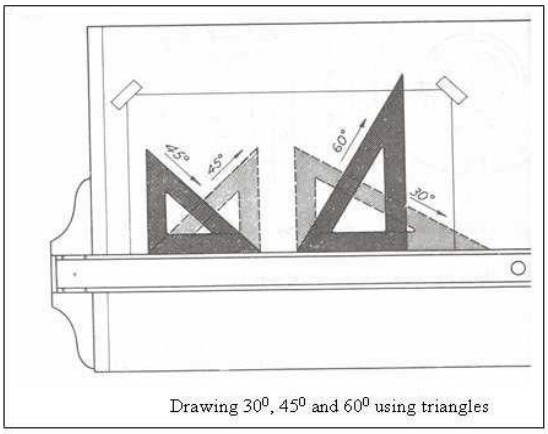
45^0-45^0 set square

Set squares

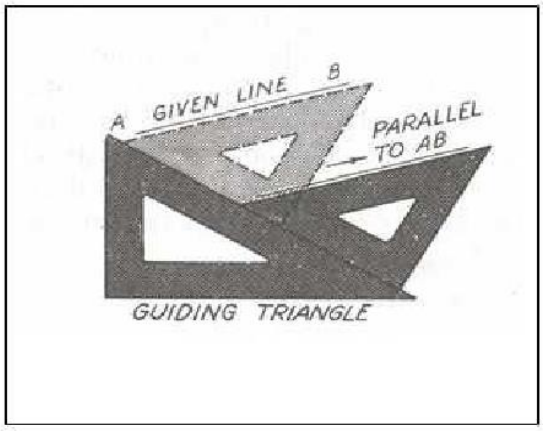
Set Squares are used to draw accurate angles. The most common set squares are 45 degrees and 60/30 degrees. When using set squares they should always be used along with a T-Square. The Set-square rest on the straight edge of the T-Square and this ensures that the angle is drawn straight and with accuracy.



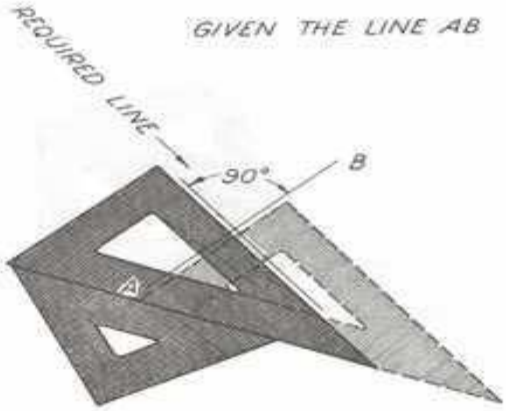
Drawing a parallel line using triangles



Drawing 30^0, 45^0 and 60^0 using triangles



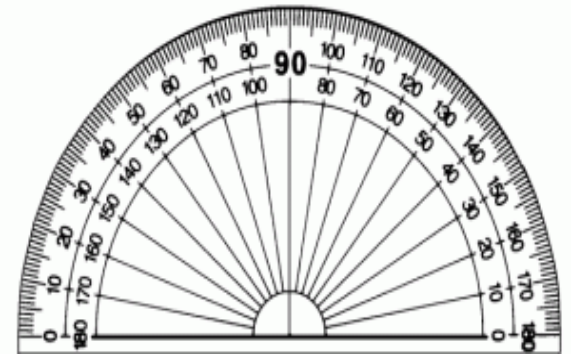
Drawing perpendicular line using triangles



Sliding triangle method

PROTRACTOR

Protractors are used for measuring or constructing angle which cannot be obtained by set squares. Protractor can be flat, circular or semi circular. Protractor are usually made from box wood or ivory



INSTRUMENT BOX

An Instruments Box contains several pairs of compasses and dividers It contains the following instrument:

Compasses: are used to draw circles and arcs.

Dividers are used:

-For divide straight curved lines into a number of equal parts
-For setting-off dimensions from the-scale to the drawing and
-For transferring dimensions from one part of the drawing to another part.

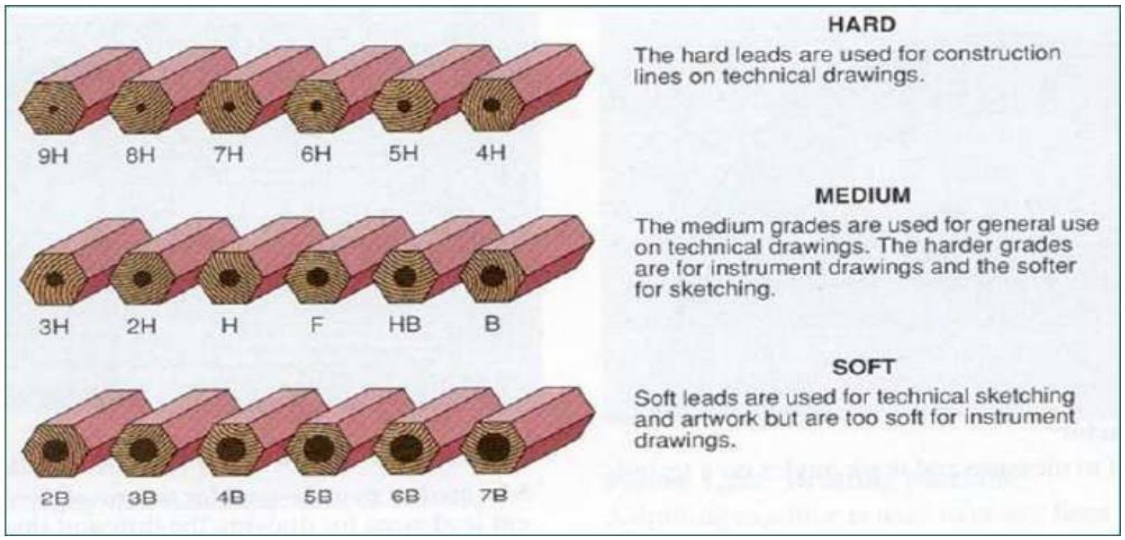
Ruling pens are not normally used in Mechanical Engineering drawing but more on Architectural Drawings.

Compasses are used to draw arcs and curves. Compasses can also be used to transfer distances and for dividing space into equal parts. Spring compasses are used to draw very small circles
Ruling pens are used for inking drawings and have capacity to change or the pencils or pen points

.

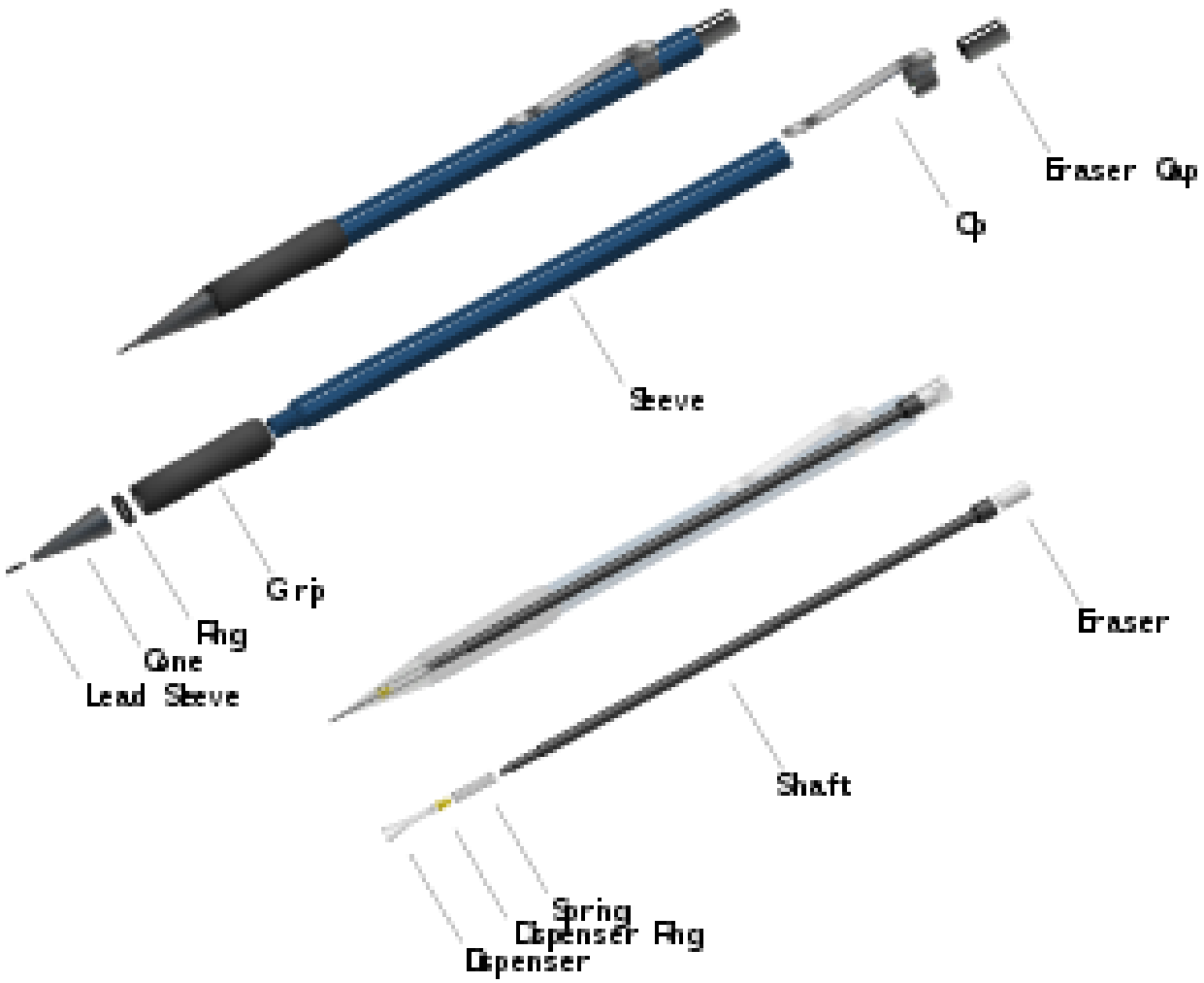
DRAWING PENCILS

The pencils are used for preparing the drawings on the sheets. The accuracy and appearance of drawing depend upon the quality of the pencil used. Pencils are of various grades easily recognized by the letters marked on the pencils.
The description of different grades of drawing pencils according to India Standard Institution (I.S.I)



HB - (Soft grade)…Used for drawing border lines, lettering and freehand sketching
H - (Medium grade)…Used for visible outline, visible edges and boundary lines
2H – (Hard grade)…Used for construction lines, dimension lines, leader lines, extension lines, centre line, hatching line and hidden lines.

MECHANICAL PENCILS



A **mechanical pencil**, also **clutch pencil**, is a pencil with a replaceable and mechanically extendable solid pigment core called a "lead"

The lead, often made of graphite, is not bonded to the outer casing, and can be mechanically extended as its point is worn away as it is being used. Other names include **microtip pencil**, **automatic pencil**, **drafting pencil**, **technical pencil**, **click pencil**, **pump pen**, **pump pencil**, **lead holder**, **pacer** (Australian English)

propelling pencil (Australian English), **pen pencil** (Indian English), and **lead pencil** (Bangladeshi and American English).

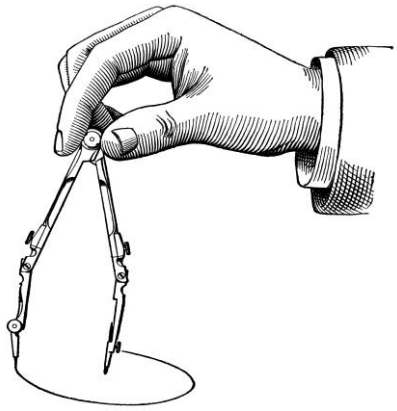
Mechanical pencils are used to provide lines of constant width without sharpening in technical drawing and in quick, neat writing. They have also been used for fine-art drawing. Since they do not have to be sharpened, they are also very popular with students. Mechanical pencils were first used in the 18th century, with many designs patented in the 19th and 20th centuries.

COMPASS

A **compass** (or **pair of compasses**) is a drawing tool that can be used to draw circles or arcs, parts of circles. They can also be used to measure distances, in particular on maps. Compasses can be used for mathematics, drafting, navigation, and more.

Compasses are usually made of metal, and have two parts called *legs* meeting at a hinge. The legs can be moved apart or together to change the size of the circle. One part has a spike, a sharp, pointy part at its end, and the other part has a pencil or a pen. There are two types of compasses: the mechanical compass and normal compass. The mechanical compass is a compass that has a mechanical pencil, and the normal compass is a compass that has a normal pen or pencil on it. To make the compass work, you need to change how far the pencil sticks out.

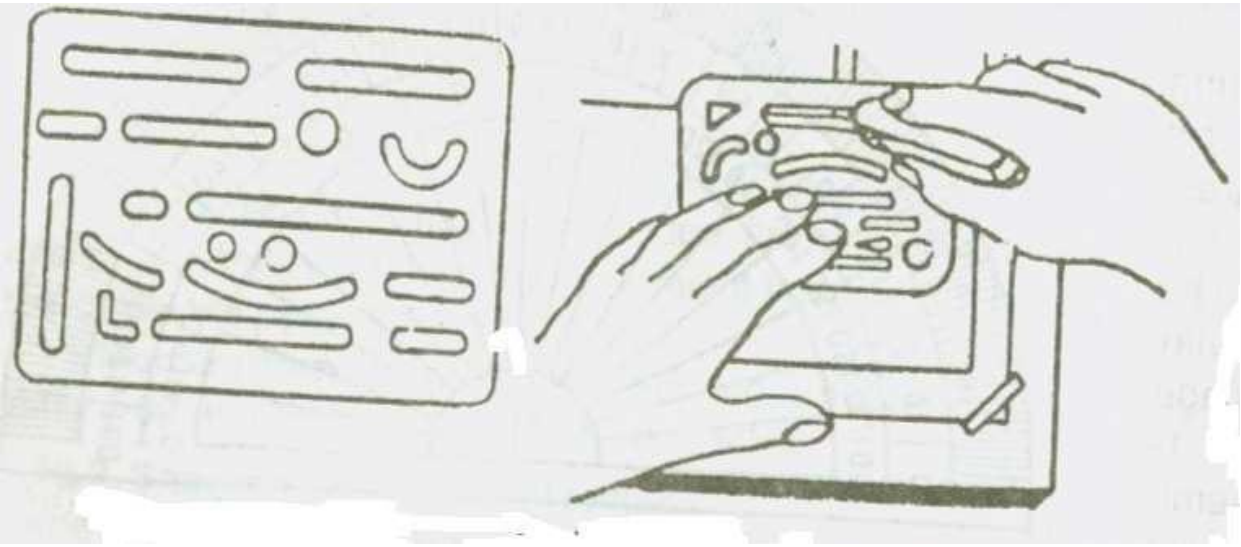
A divider is a compass that has two parts with a spike, and is used to show measurements of distances and lengths. It is called a divider because it is used to divide (make smaller things from a bigger thing) a distance in two, using geometry



RUBBER OR ERASER

The rubber is used for erasing extra pencil lines. Used for erasing or rubbing out unwanted pencil lines on your drawings. They are often used with the aid of an erasing shield

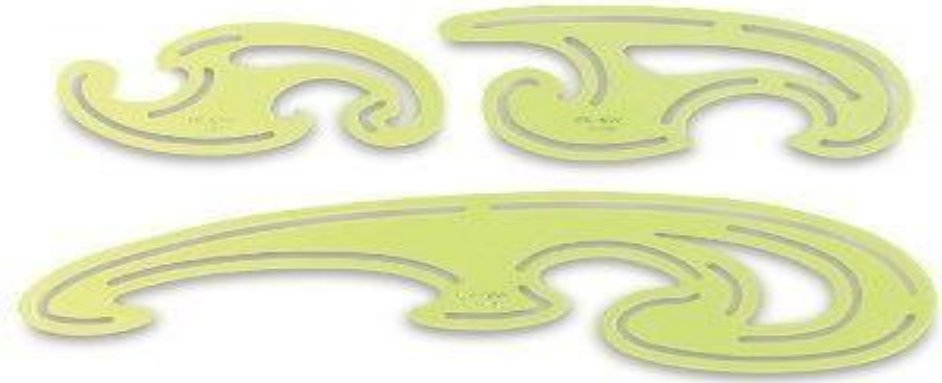
Erasing Shield: Erasing shield is used to protect the adjacent lines on the drawing when some part of a line is being erased. It is usually made of thin metal in which gaps of different widths, curves, small circles, arcs, etc. are cut according to the lines to be eraser.

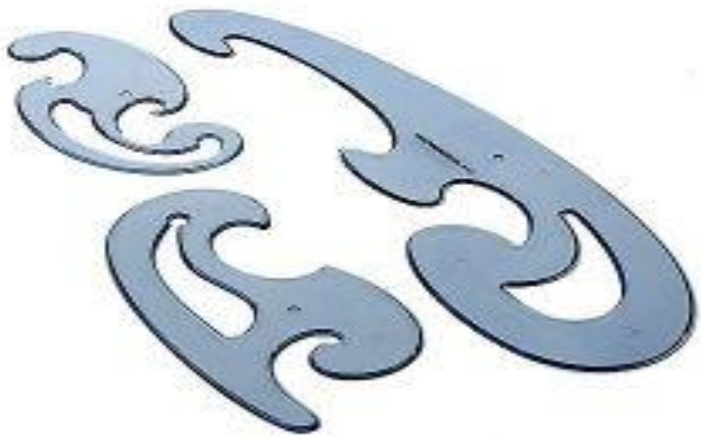


FRENCH CURVES

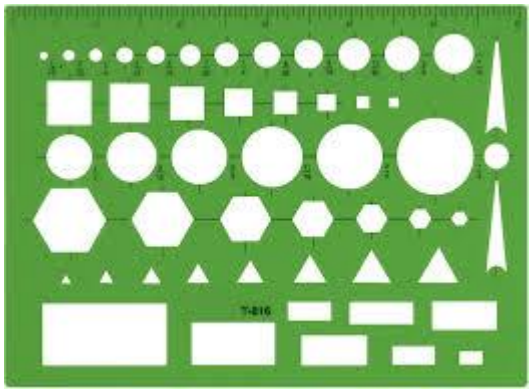
French Curves also referred to as Irregular Curves are used in drawing regular and smooth curves with varying radii or curvature that cannot otherwise be drawn using other drawing equipment.

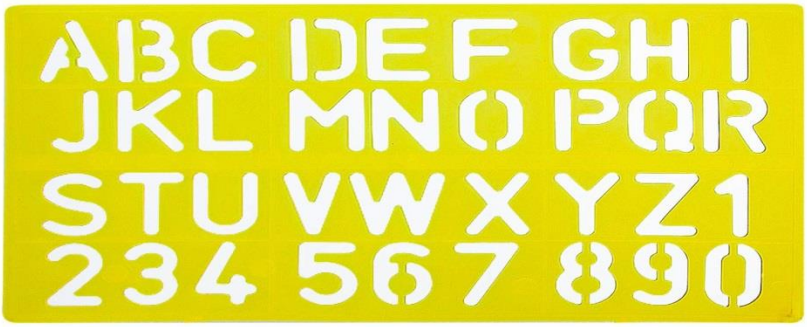
French Curves are based on various combinations of ellipses, spirals and other geometrical curves and are made in different shapes and sizes.





TEMPLATE





Types of template

- ✓ Metric circle template
- ✓ 45^0 Ellipse Template
- ✓ Template for electronic symbols
- ✓ Template for architectural symbols

- Content/Topic 2. Important of drawing tools

Most of us started drawing when we were young. Back then, materials and tools were not that important to us. Perhaps, they weren't even considered. A standard pencil on some notebook paper would often "do the trick".

But as we grew and developed as artists, the materials and tools that we chose became more important. The connection between quality art materials and quality artwork becomes noticeable along the way and it's no wonder that emerging artists desire to have the very best materials possible.

If you are starting to get serious about your artwork, no matter what age, you may also be starting to get serious about the materials that you use.

In this post, I'll offer 10 essential drawing materials and tools for artists that are just starting to get serious about their drawing. (This list is focused on black and white drawing media only.)

1. Quality Drawing Pencils

We'll start off with the most obvious essential – quality drawing pencils. When it comes to drawing pencils, each artist will find a brand that they connect with. There's no way to know which brand will become your favorite until you try a few.

Drawing Pencil Sets
Pencil sets usually come packaged in nice tins and can be great because they often include the full spectrum of graphite grades. Many sets include pencils with harder graphite (9H) through softer graphite (6B). Harder graphite makes lighter marks and keeps a sharp tip longer, while softer graphite makes a darker mark, but needs constant resharpening. These sets give the artist the ability to work with many different values and varieties of mark

As far as pencil brands go, there are plenty of great options. Derwent graphite pencils are consistent in their quality and is the brand I recommend.

Individual Pencils

Many artists will find that they don't use all of the pencils in a drawing pencil set. Instead, they may find that they only use a few of the pencils. For example, 2H, HB, 2B, and 4B pencils would be plenty of range for most of us. If this is the case, then a pencil set would not make sense. Instead, purchasing the individual pencils as they are needed may be the better approach.

Although graphite pencils aren't very expensive, purchasing individual pencils can be more pricey than just buying a full set of pencils. You may also find yourself hunting for them at the art store.

2. A Sketchbook

A sketchbook is one of the most important things an artist can have. I should point out that I am referring to an "active sketchbook" – one that receives attention on a daily basis. Anyone can "own" a book with blank pages of drawing paper. But the one that actively gets drawn in – on a daily basis is the one of value.

Let me make an analogy to a sketchbook's importance. Let's compare a professional athlete's life to that of an artist.

The professional athlete may workout for hours daily in the gym or on the track to enhance their performance on "game day". Though the world may never see the hours of hard work that have been put into the workout, the exercise is important – if not crucial to the athlete's success.

An active sketchbook is the artist's "exercise". It is the "hard work" that goes into the development of the artist and it is the breeding ground for innovative, artistic ideas. Though the sketchbook may never be seen by the world, it is the often driving factor in successful artworks and successful artists.

Since a sketchbook is recommended for daily practice, it is important to choose one that is durable and has plenty of pages for all of your ideas. I suggest a sketchbook that has a hardcover so that it will stand up to repeated use and travel. A hardcover keeps the corners of the pages inside nice and clean and will help keep the pages flat if you use mixed media applications.

3. Quality Drawing Surfaces

A drawing can be made on any surface, but the quality of that surface is sometimes just as important as the medium that it is used upon it.

There are a few considerations for choosing a drawing surface that will affect the finished result.

1. The "Tooth" – The "tooth" of the surface is the texture of the paper. The texture of the paper plays a role in how the drawing material is accepted on the surface. Heavier textures will produces lines that may appear

"broken", while smoother textures will produce smoother lines and gradations of value. Some artists will prefer heavier textures while others will prefer a smoother surface

2. Paper Weight

– The weight of the paper refers to how much a ream (500 sheets) of that paper weighs. For most papers, the weight of the paper will be directly related to the thickness of the paper. (It should be noted that some papers may have a heavier weight but actually be thinner.) For example, 80 lb. paper will typically be thicker than 60 lb. paper, while 100 lb. paper will be heavier than 80 lb. paper.

3. Acid Free – Paper that is "acid free", without going into all of the technical details, will stand "the test of time". This paper is will not yellow over time and is more resistant to fading that can occur when exposed to UV light.

Here are few recommended papers that you might experiment with…

Drawing Paper – Medium tooth paper that is suited for drawing with a variety of drawing media including graphite, charcoal, and colored pencils. There are ton of options for drawing papers, but Strathmore papers are recommended.

Charcoal paper – Heavier tooth paper that is lightweight – almost semi-transparent. Excellent for creating texture. (A variety of media can be used on charcoal paper – not just charcoal. I love it for graphite drawings.)

Bristol Paper – Smooth tooth paper that is heavier (think cardstock). This paper is quite rigid and is excellent for creating smooth gradations of value or detailed line work with ink.

4. Variety of Erasers

Erasers are for mistakes – right? Think again. Erasers can be a great mark-making tool as well. Each eraser creates a different mark and should be used as necessary according to the specific drawing medium.

Here are a few recommended erasers…

Rubber Eraser – Your standard eraser for erasing graphite. This eraser uses friction to remove any material from the surface.

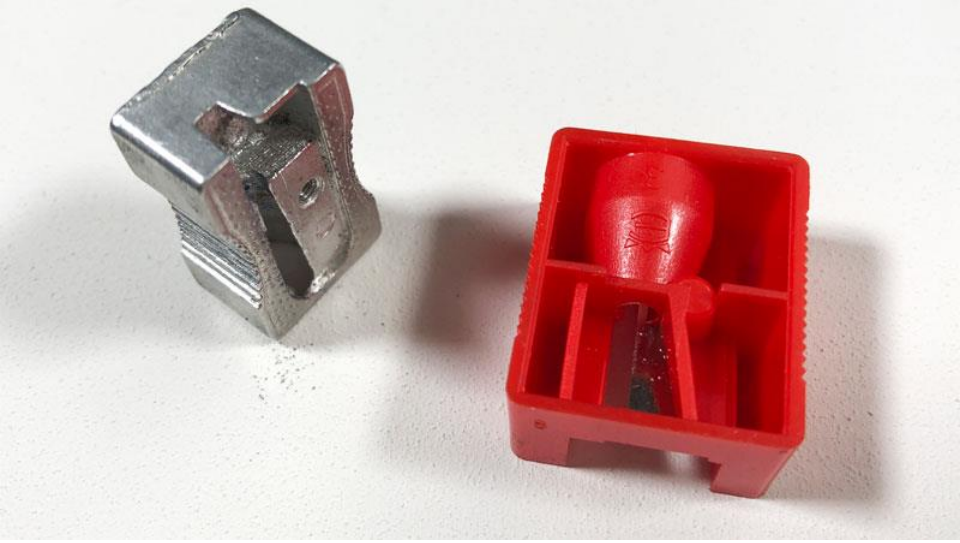
Kneaded Eraser – This eraser lifts material from the surface, instead of using friction to remove it. It can be pulled and fashioned into different forms to create specific marks. This eraser gets dirty over time, but can be cleaned by pulling and "kneading" it.

Gum Eraser – "The Crumbler". This eraser is great for removing media from surfaces that are sensitive to tearing. A gum eraser removes the medium through friction, but crumbles as it does so – preserving the surface.

Vinyl or Plastic Erasers – This eraser is the toughest of the bunch. It can erase almost anything. But be warned – this eraser can tear the paper if you're not careful.

Some manufacturers produce inexpensive sets of erasers like this one from Prismacolor

5. A Good Pencil Sharpener



Pencils need to be sharpened with a quality pencil sharpener. Use a poor quality sharpener and you could be out of a pencil in a matter of moments.

Pencil sharpeners generally fall into two categories – Manual and electric.

Electric Pencil Sharpeners

Electric pencil sharpeners can vary in price and the old saying, "you get what you pay for" is true for what you get here.

A quality electric pencil sharpener will sharpen your pencil without eating it all up.

Electric pencil sharpeners are nice to have for a quick sharpen of the pencil, but should not be used with colored pencils. The waxy binder found in colored pencils can build up within the blades of the sharpener, ruining the device.

An Extreme Solution

I've had the pleasure of working with the X-Acto Commercial sharpener. It is a MAJOR pencil sharpener. This pencil sharpener sharpens pencils in a split second and is incredibly durable. It should last you years.

The only negative is that smaller pencils can get caught inside of the sharpener. This sharpener is definitely on the extreme side of things, but a cool commodity to have around.

Manual Pencil Sharpeners

While an electric pencil sharpener has its appeal, a manual pencil sharpener will do for most of us.

Like electric pencil sharpeners, the manual varieties come in different forms. My favorite is a simple, handheld metal sharpener. It's a cheap and easy solution that is portable and easily replaced. Remember, if you're sharpening colored pencils, then a manual pencil sharpener is what you should be using.

6. Charcoal or Conté

There are more options to black and white drawing other than drawing with graphite. No artist's toolkit would be complete without charcoal or conté.

Charcoal provides a broader range of value and mark-making than what's possible with graphite. The manner in which marks are made is different as well.

Charcoal comes in both stick and pencil form. Sticks of charcoal are usually either "vine" or "compressed". Vine charcoal is softer and produces lighter marks, while compressed charcoal – which is concentrated, produces darker marks.

Charcoal pencils can be sharpened like graphite pencils, making them great for details.

Conté is similar to charcoal in richness of color – however the makeup of the material is different. Charcoal is burnt organic material, while conté is made of clay constituents.

7. Drawing Pens / Ink

When we draw with ink, we're forced to master the use of line. Line is used to develop the illusion of form, texture, and light. Technical drawing pens are affordable, easy to find, and portable – making them great for every budding artist to have. Sakura Micron pens and Steadtler technical ink liners are both fine choices.

When you're ready to take your ink drawings to another level, you may consider working with a dip or nib pen. This traditional approach to pen and ink drawing requires bottled ink. This approach does require a little more skill and is obviously less portable, but the resulting drawings have more character and are more interesting.

Felt tip pens are another option. I absolutely love felt tip pens. Felt tip pens allow the artist to create a variety of marks. The tip of the pen allows the artist to create a broad range of line quality.

An added benefit to a felt tip pen is the psychological effect that it can have on the artist.

Using a medium that cannot be erased forces the artist to be more deliberate with their marks. As a result, a bit more thought is put into the marks that are made. You can actually improve your drawing skills simply by using a felt tip pen while sketching.

Subjects with Pen and Ink

"Subjects with Pen and Ink" is a collection of 31 pen and ink drawing lessons on a variety of subjects (objects, flowers, food, animals, landscape, people) using a variety of ink techniques.

8. Blending Stumps / Tortillions

Blending stumps are essential for the artist wanting to smudge or move material around on the surface. A blending stump allows the artist to create gradations in value without introducing the oils of the finger (through finger smudging) which can make a drawing look dirty or uncontrolled.

Blending stumps also allow the artist to create gradations and smooth applications of value in areas of detail that may be hard to get to otherwise.

9. Quality Colored Pencils

Colored pencils are everywhere. You can buy them just but anywhere. But this doesn't mean that every colored pencil brand out there will get the best results. Quality matters and so does the type of colored pencil that you choose.

Prismacolor Premier

Prismacolor wax-based Premier pencils are soft and buttery, allowing the artist to layer colors to build up a solid application that often compares to a painting. Some people complain that they break easily and they do. But this is due partly to the soft core of the pencil which is also why they are so easy to use and build up on a surface.

Faber-Castell Polychromos

Faber-Castell's Polychromos pencils are oil-based and behave slightly differently from wax-based pencils. These pencils require several layers to build up depth in color, but the results are fantastic. They're expensive, but well worth the investment if colored pencils are your medium of choice.

Caran D'ache Luminance

Luminance pencils are wax-based, premium pencils. They layer nicely and are a little harder than Prismacolor Premier, meaning they break less often. These pencils are, in my opinion, the brightest colored pencils. So if you plan on working on darker surfaces, these pencils may be your best bet. They are expensive, so consider it an investment if you decide to go this route.

10. Artwork Storage / Portfolio

Your artwork is important. Even those works that you'd rather not let anyone else see are important. They need to be treated with respect and stored in manner that will keep them preserved and protected.

There are more than a few options for storing artwork, but the most popular option is a portfolio.

There are many different portfolio options out there on the market – each with their own benefits and drawbacks. If you are looking to add a portfolio to your collection, I would suggest looking for a couple features.

1. **Rigidness** – Look for a portfolio that will keep your artwork from bending. Most portfolios will do this, but there are a few cheaper versions that may not. Look for a portfolio that has a rigid support system.

2. Size – When purchasing a portfolio to store your work, be sure that you provide yourself some room for larger works. Don't just purchase the 18" by 24" portfolio because all of your works up to this point are smaller than this size. Chances are good that you'll produce drawings that are larger in the future and you'll wish you would have opted for a larger sized option.

You don't have to buy a portfolio when you can build your own. With a couple of rigid pieces of cardboard and tape, a portfolio can be created fairly quickly.

Taking care of your artwork is important – but taking care of your materials is important too.

Finding a suitable storage solution is easy. Let me offer three different solutions for three different situations.

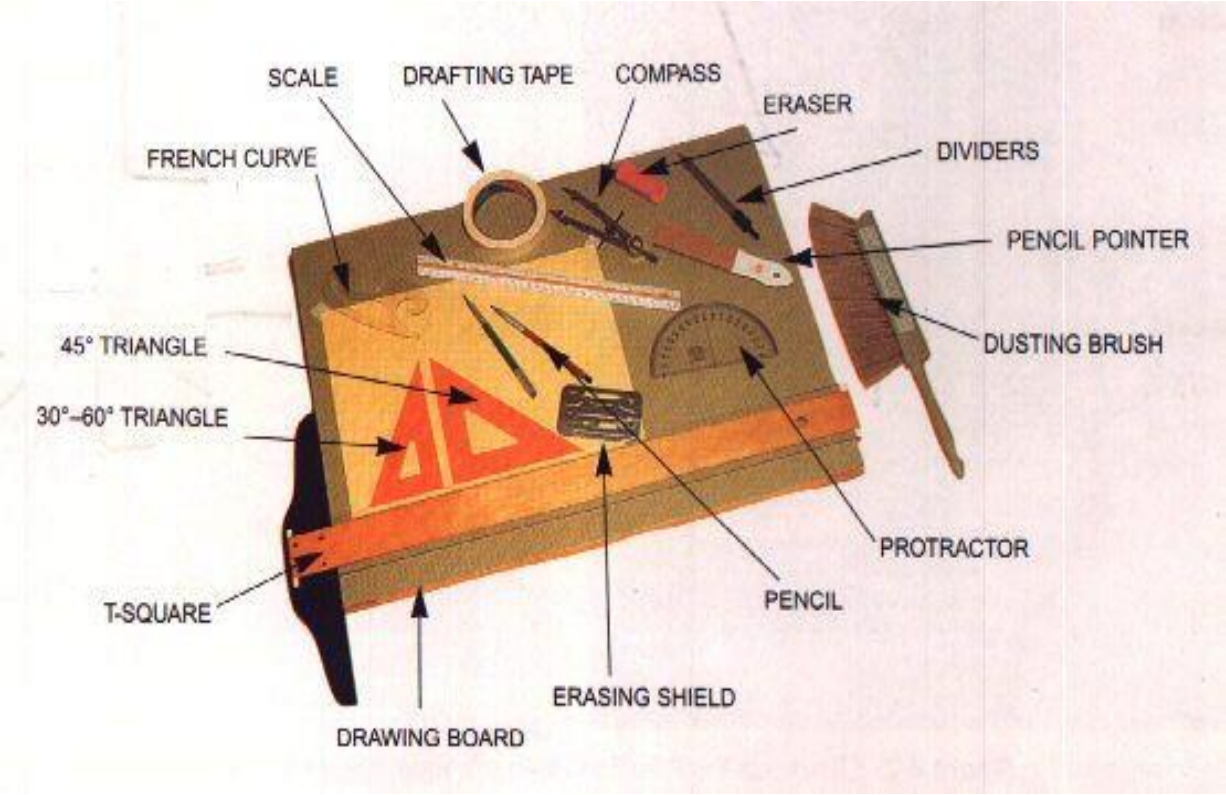
1. The Portable Container – When I was an art student in college, I carried around a tackle box filled with my art materials. No manufacturers had tapped into the demand for portable art storage containers back then, so we were all forced to carry around theses modified tackle boxes. They did the trick.

These days, there are plenty of portable solutions that are fortunately designed for artists. Many of these feature stackable trays and levels and are long and deep enough to accommodate brushes and other important tools.

2. The Semi-Portable Container – Larger varieties of the portable option exist as well. I call these "semi-portable" because while you can lug them around – they are really too large for daily use. But, they can provide exceptional organization for your art supplies and tools.

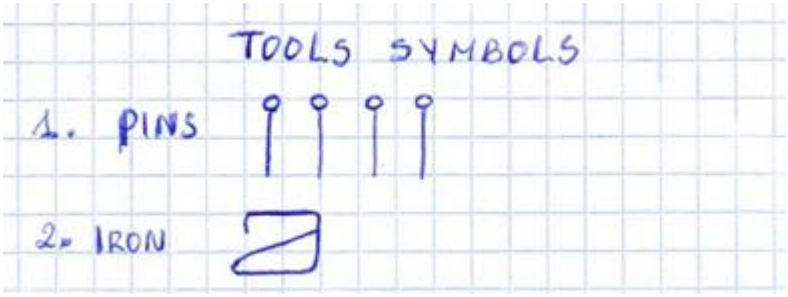
3. The Permanent Stack – If the need doesn't exist to be carrying your art materials all over the place, then a more permanent solution might be the best option for you.

- Content/Topic 3. Organization of drawing tools

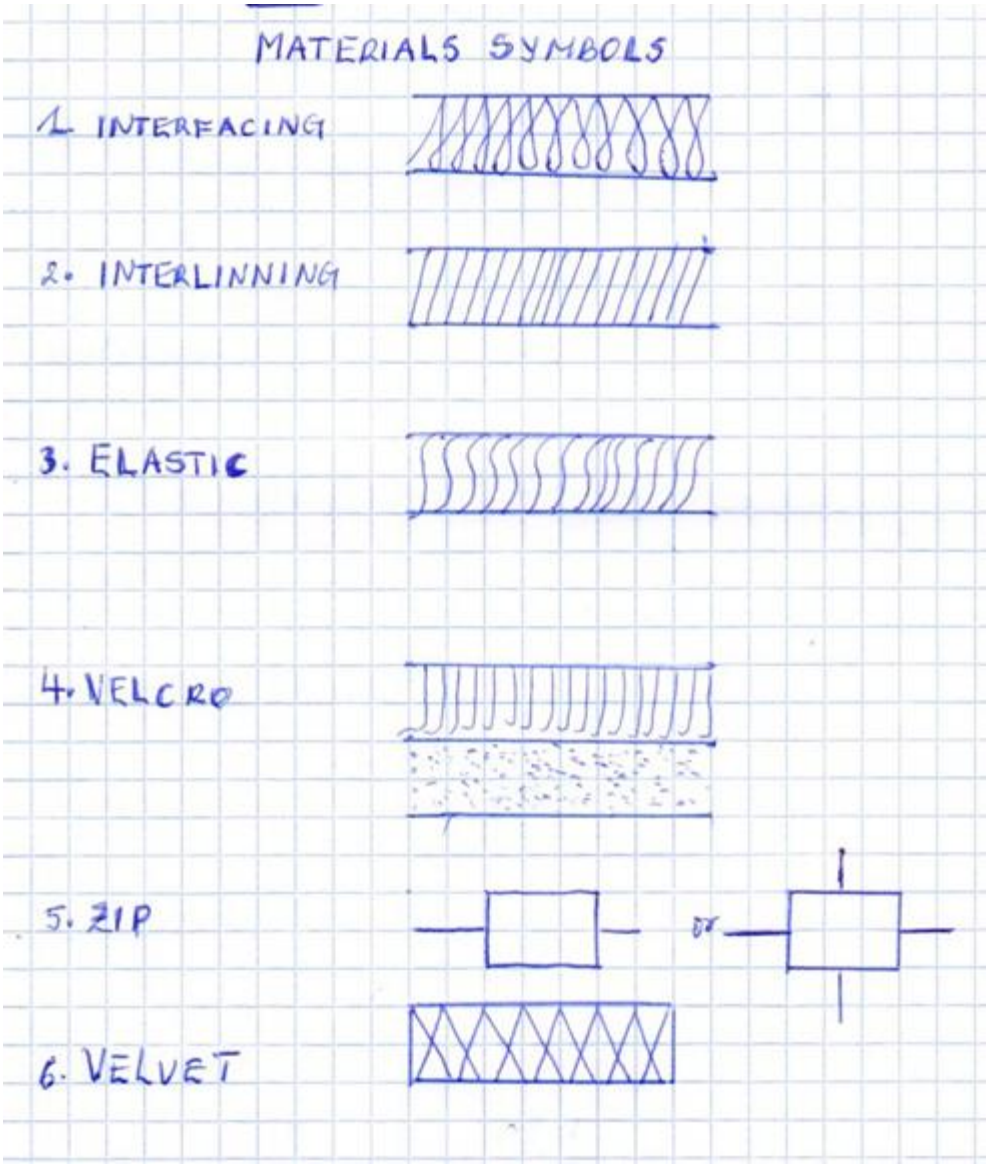


Learning Outcome 1.3: Identify tailoring drawing symbols

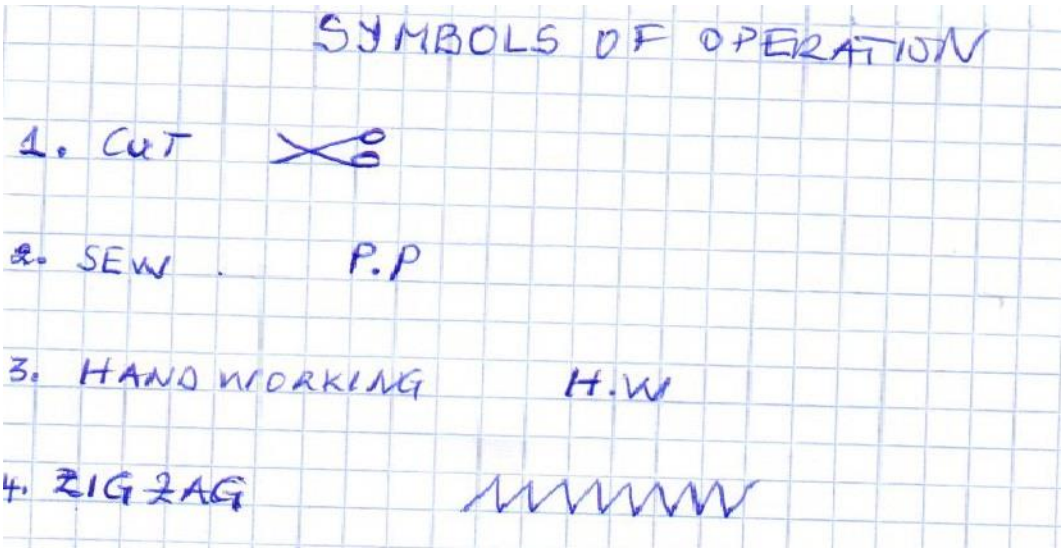
- Content/Topic 1. Different symbols of tailoring tools



- Content/Topic 2. Types of symbols used for different materials

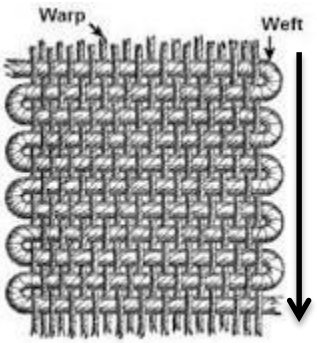


- Content/Topic 3. Different types of operation symbols

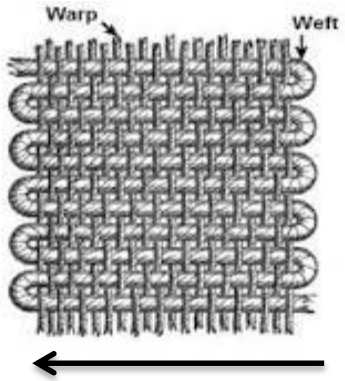


Invisible stitches

Warp threads



Weft threads



9 RIGHTSIDE R.S or

10 WRONGSIDE W.S. or

11. CHECKING

12. MAGAZINE

13. TRANSPORT

14. INVISIBLE

15. OVERLOCKING STICTHES

16. RETURN

17. Grain line

SECTION VIEWS

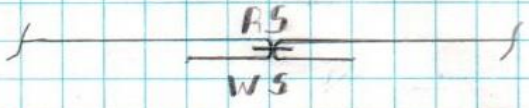
1. BELOW VIEW

2. TOP VIEW

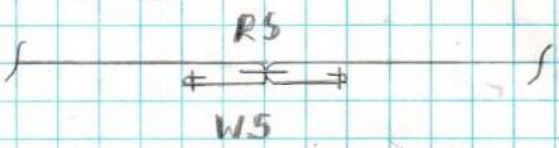
3. Left view

4. RIGHT VIEW

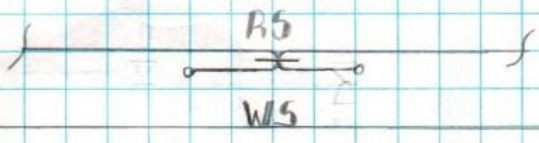
1. OPEN SEAM



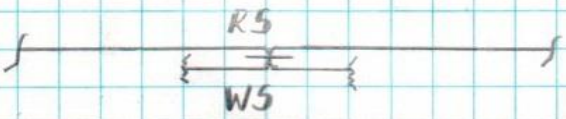
2 OPEN SEAM WITH MACHINE TRIM EDGES



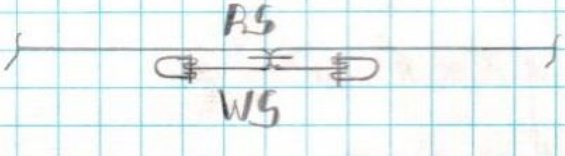
3. OPEN SEAM WITH OVERCAST MACHINED



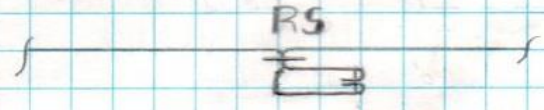
4 OPEN SEAM WITH ZIGZAG MACHINED

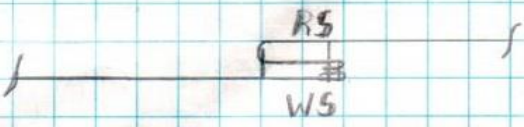


5 BINDING OPEN SEAM

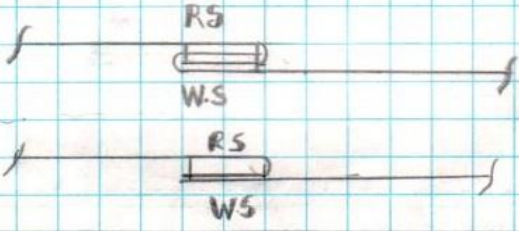


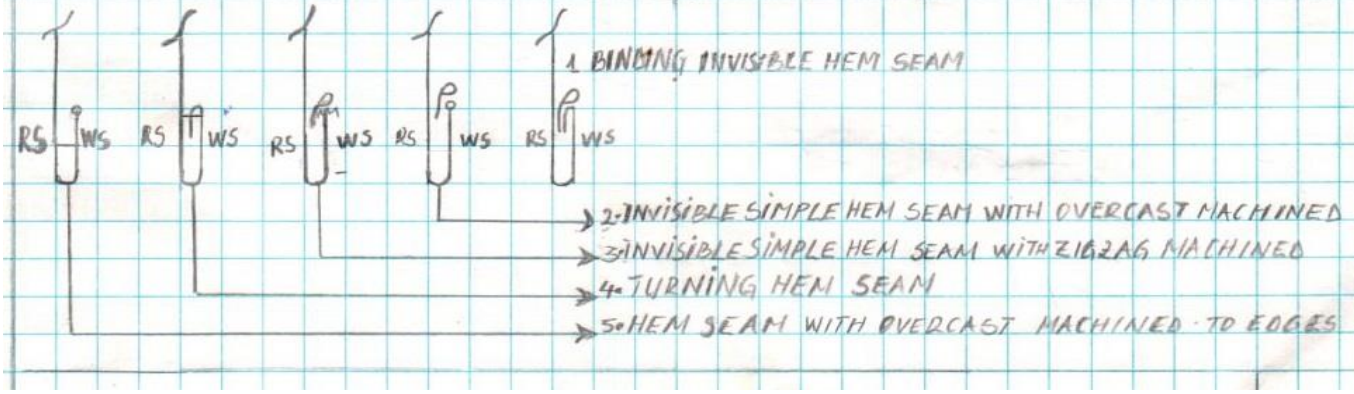
6 FRENCH SEAM

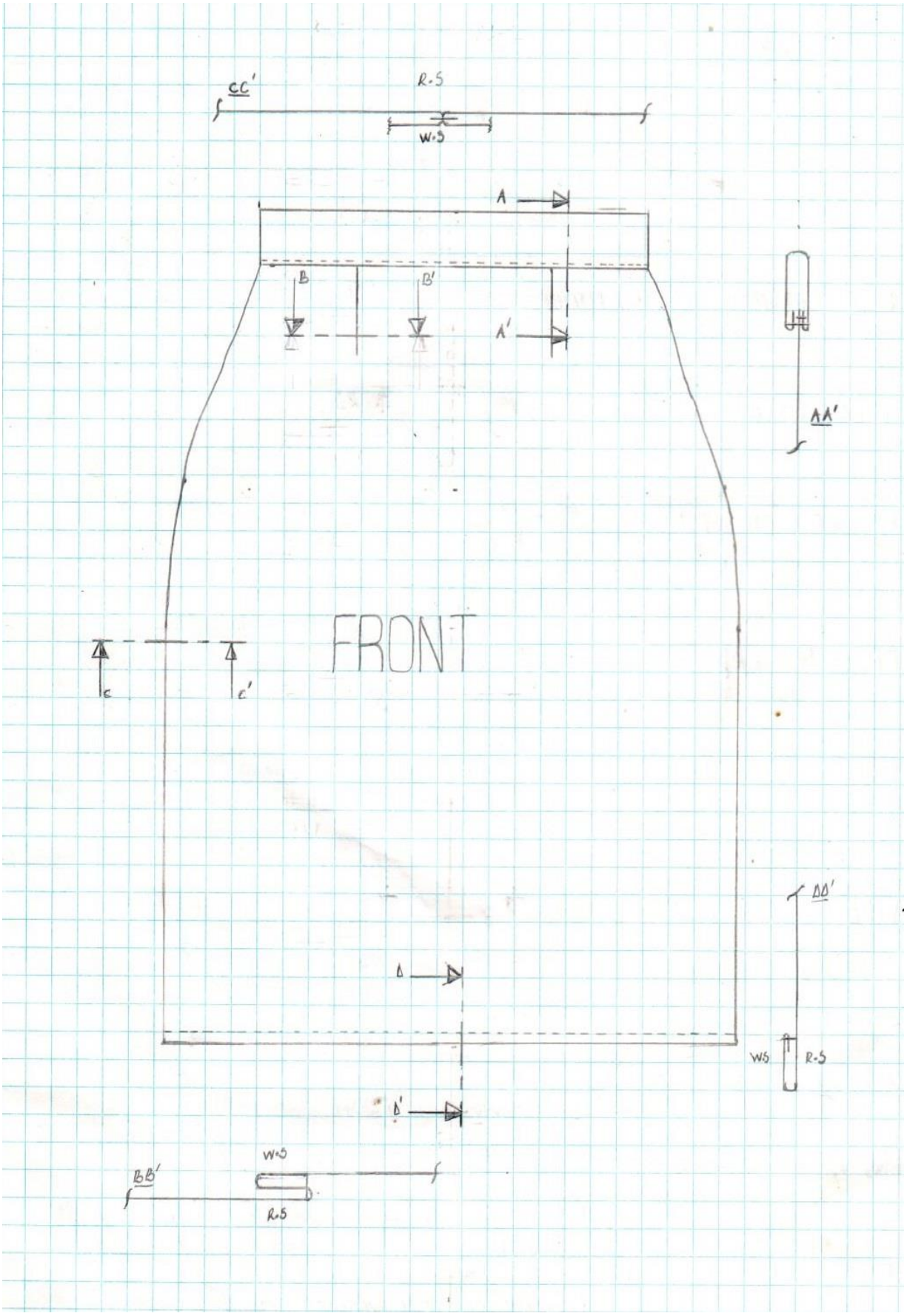




7 WELT SEAM



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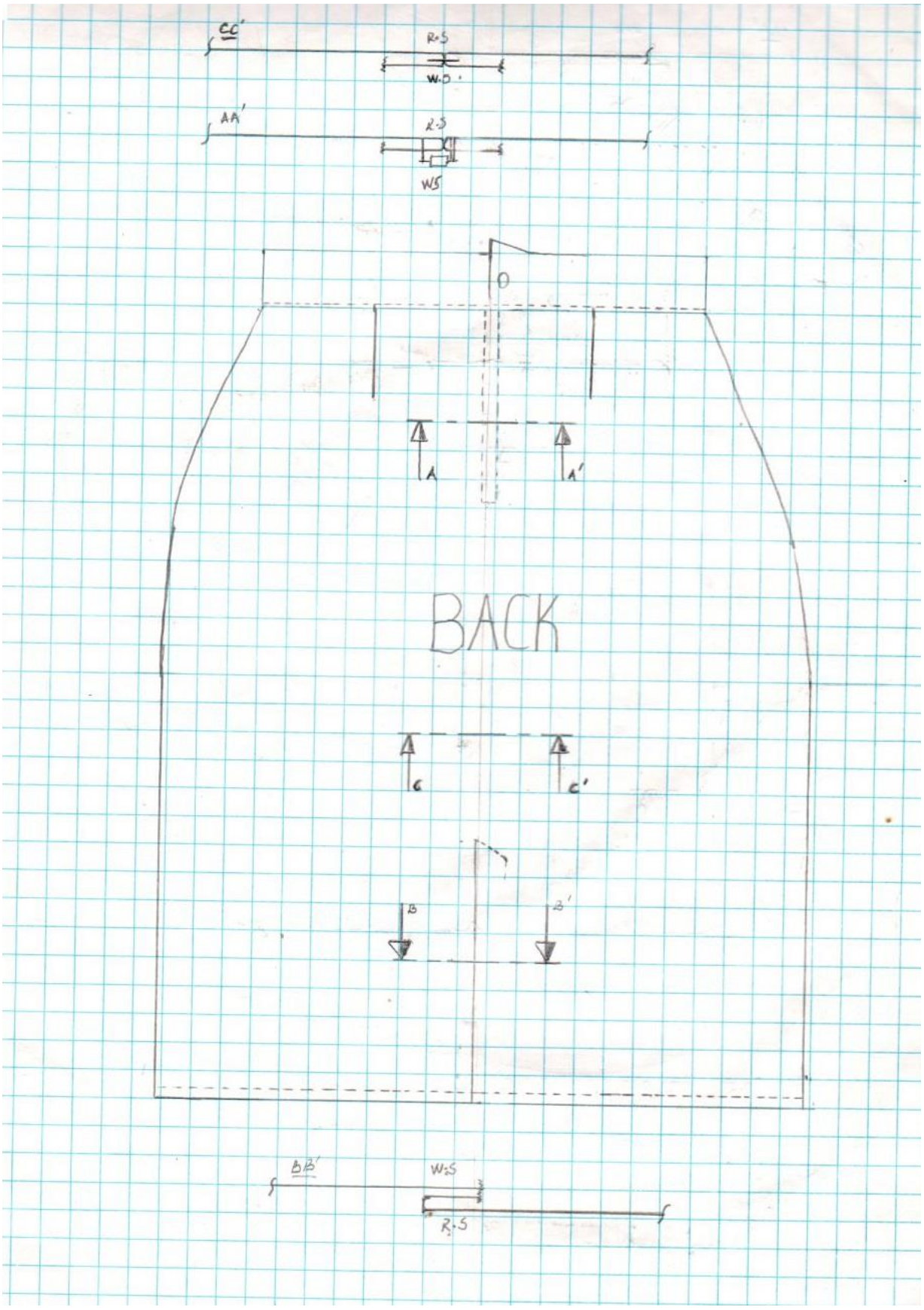
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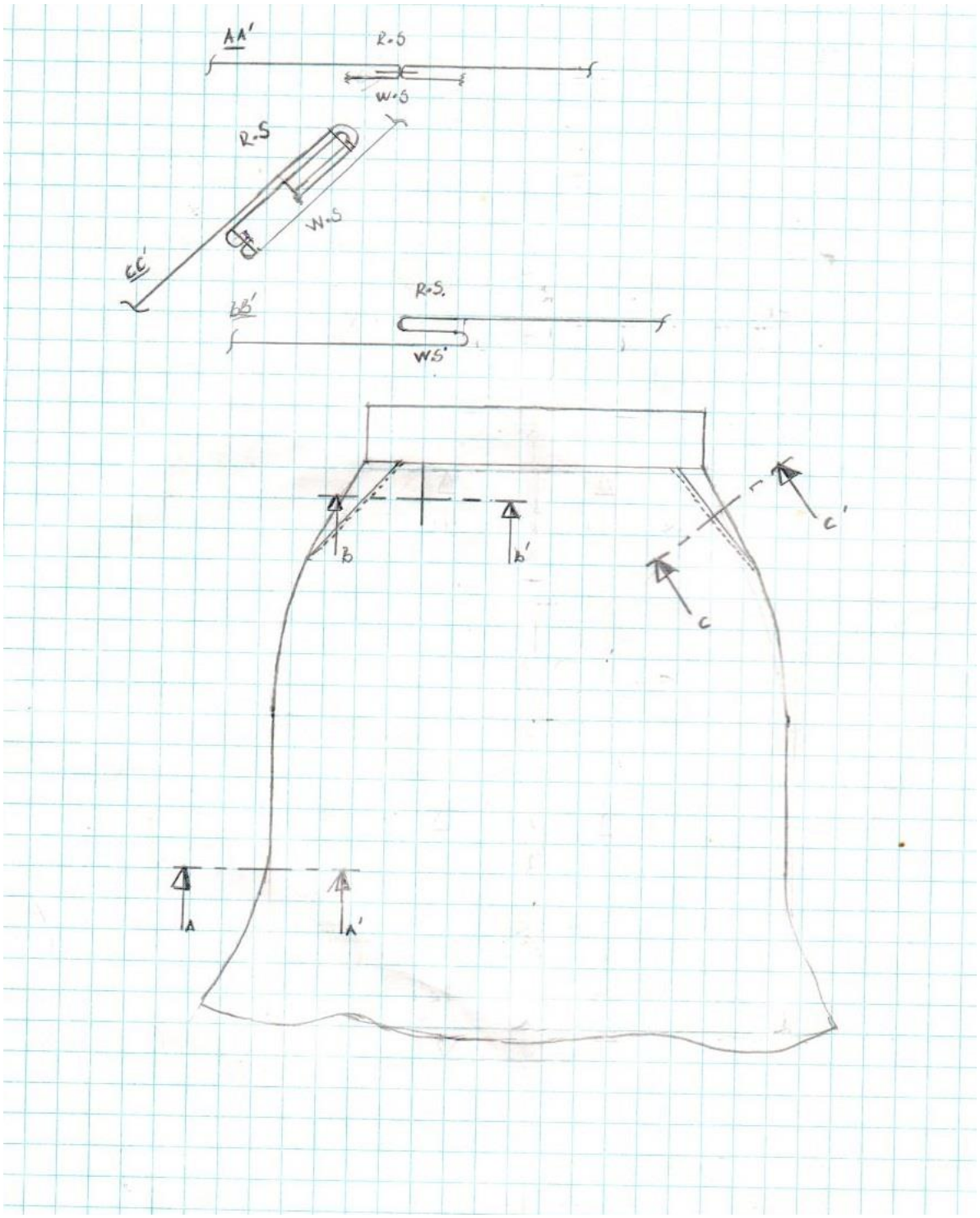
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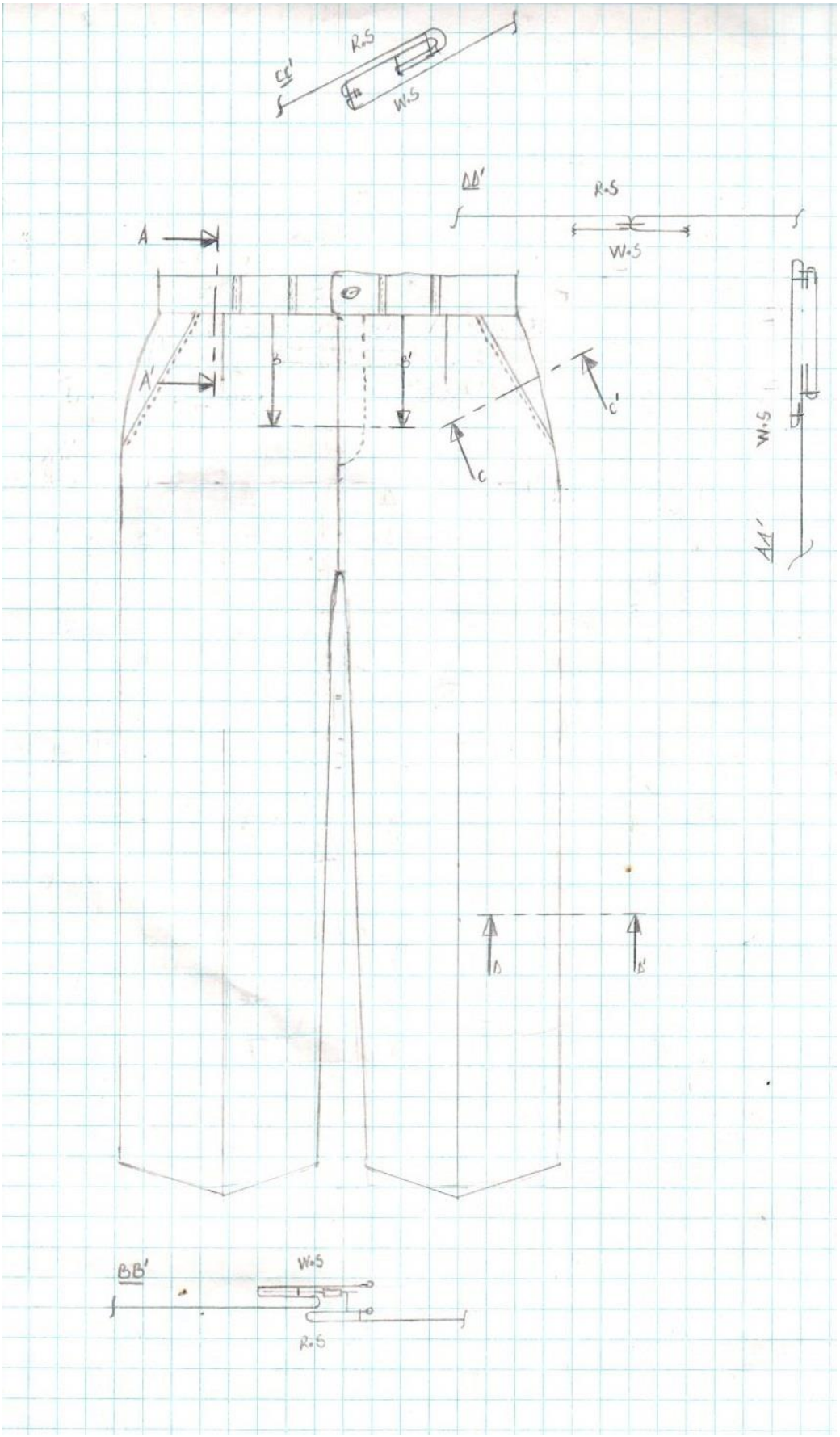
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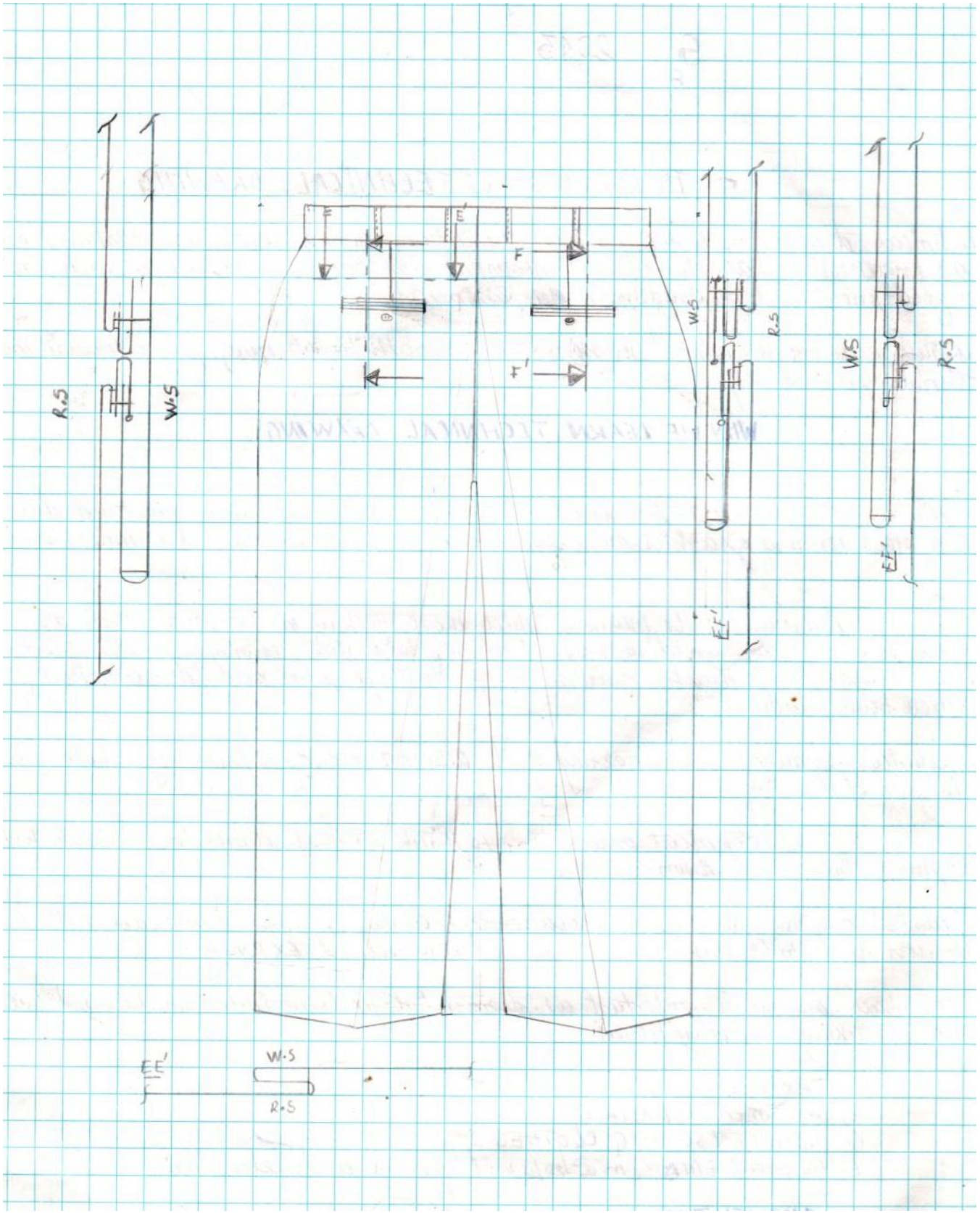
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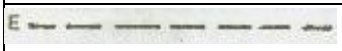
Learning unit 2 -Differentiate lines and lettering

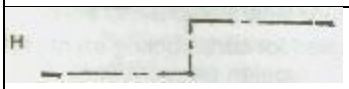
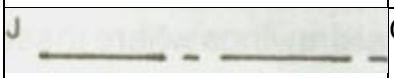
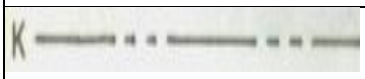
Learning Outcome 2.1-Categorize lines

- Content/topic 2 Types of lines

Lines of different types and thickness are used for graphical representation of objects.
The types of lines and their applications are shown in table below

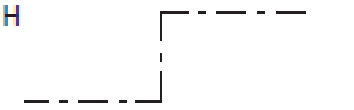
CONVENTIONS FOR VARIOUS LINES

LINE REPRESENTATION	DESCRIPTION	GENERAL APPLICATION
	Continuous thick or continuous wide line	A1 visible outline A2 visible edges
	Continuous thin straight or curved or continuous narrow line	B1 imaginary lines of intersection B2 dimension line B3 projection line B4 leaders and sectioning line B5 hatching B6 outlines of revolved sections in place B7 short centre line B8 construction line B9 extension lines B10 Diagonals indicating flat surfaces B11 Indication of repetitive features
	Continuous thin freehand	C1 limit of partial or interrupted views and sections, if the limit is not a chain thin C2 broken part
	Continuous thin (straight with zigzag)	D1 limits of partial or interrupted views:
	Dashed thick	E1 hidden outlines E2 hidden edges
	Dashed thin	f1 hidden out lines f2 hidden edges

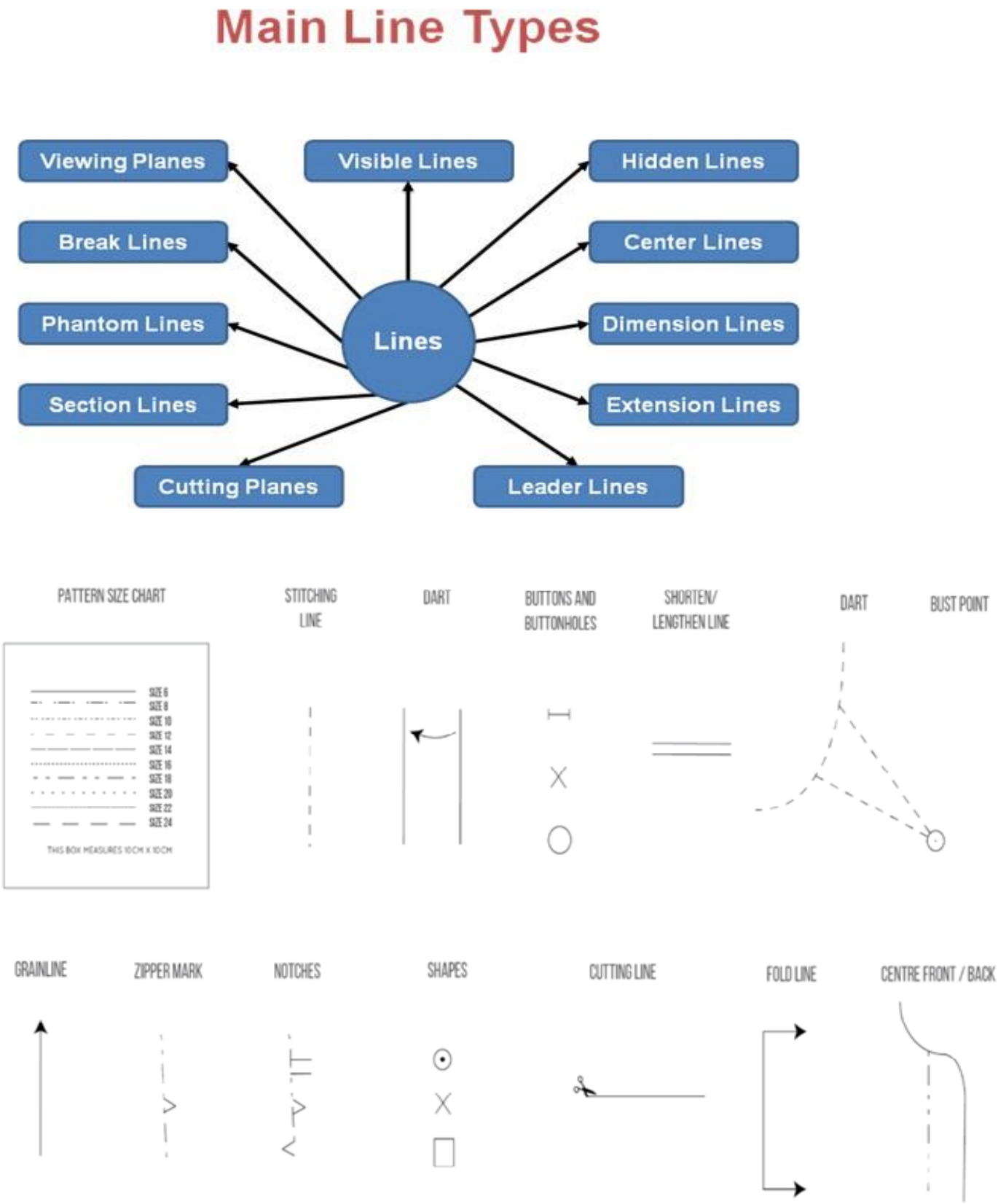
	Chain thin	G1 centre lines G2 line of symmetry G3 trajectories G4 Position line G5 Pitch circle for gears G6 Pitch circle for holes
	Chain thin, thick at the ends and change of direction	H1 cutting planes
	Chain thick	J1 indication of lines or surfaces to which a special requirement applied .
	Chain thin double – dashed	K1 outlines of adjacent parts K2 alternative and extreme positions of movable parts K3 centroidal lines K4 initial outlines prior to forming K5 parts situated in front of the cutting plane K6 Outline of finished parts K7Projected tolerance zones

Line styles and conventions		
Thick continuous		VISIBLE LINES used on each view; includes arcs/circles/curves/title block and border
Thick dashes		HIDDEN LINES used on each view. Dashes start and end with contact to a visible or hidden lines
Thin continuous		THIN CONTINOUS LINES used for dimensioning lines, projection lines, leaders, letterform used in title block.
Thin chain		CENTRE LINES, axis of solid forms, pitch lines (think roof line) Note: centre lines show symmetry

Table 1
Line styles and conventions

Line	*Description*	*General Applications*
A	Continuous thick	A1 Visible outlines
B	Continuous thin (straight or curved)	B1 Imaginary lines of intersection B2 Dimension lines B3 Projection lines B4 Leader lines B5 Hatching lines B6 Outlines of revolved sections in place B7 Short centre lines
C	Continuous thin, free-hand	C1 Limits of partial or interrupted views and sections, if the limit is not a chain thin
D 	Continuous thin (straight) with zigzags	D1 Line (see Fig. 2.5)
E	Dashed thick	E1 Hidden outlines
G	Chain thin	G1 Centre lines G2 Lines of symmetry G3 Trajectories
H 	Chain thin, thick at ends and changes of direction	H1 Cutting planes
J	Chain thick	J1 Indication of lines or surfaces to which a special requirement applies
K	Chain thin, double-dashed	K1 Outlines of adjacent parts K2 Alternative and extreme positions of movable parts K3 Centroidal lines

Lines : are the most common symbols on a pattern, highlighting the edges of each piece you need to cut from your fabric. However, different lines mean very different things.



Here are the most common sewing pattern symbols you will come across, download a copy of the

Size lines – almost all dressmaking patterns will have a cutting or size line. Use the accompanying chart from the designer to determine your size and cut along this line. Read our previous blog article about help with

centre Front / Centre Back lines – often illustrated with a dashed or dotted line, the centre front or centre back is usually marked to help you line up pattern pieces, for example overlapping the front bodice pieces of a shirt at the button stand.
Notches – these are usually triangles or dashes on the edge of a pattern piece. They allow you to match up different pattern pieces at the correct points. Some people cut outwards but other choose to snip inwards where these points are marked. Be careful not to cut too far into the fabric (just 3mm should do it), especially in case you need to make adjustments later on.

Grainlines – These are single or double ended arrows that run the length of the pattern piece. The grainline should be used to position the pattern piece parallel to the fabric selvedge. Measure from the top of the grainline across to the selvedge and the bottom of the Grainlines to the selvedge, these two numbers should match. If it is a single arrowed Grainlines, the arrow should point upwards in the same direction of the fabric print. If it is a double arrowed Grainlines, the pattern piece can be orientated in either direction, parallel to the selvedge.

Foldlines – a fold line may be marked with just the words or a boxed arrow and indicates that this edge of the pattern piece should be placed along the folded edge of the fabric (where right sides of the fabric are folded against each other with selvedges matching). There is no seam allowance along a fold line. This is typical for a bodice, skirt or facing piece.

Cutting line – this will usually be illustrated with a dotted or solid line with a scissors icon. It indicates where you should cut along fabric.

Adjustment lines – these are single or double lines running across pattern pieces that signify the best point to shortening of lengthen the pattern pieces depending on your body shape. Cut along these lines and these move apart or overlap the two pieces to get the desired length. These are often marked as 'shorten or lengthen here'.

Darts – these are usually shown as dotted or solid lines in a triangle/diamond shape. They indicate where you should stitch to create shape at the bust, waist and shoulders.

Buttonholes and Buttons – these can be illustrated in lots of way, from dashes to circles, dots or barred lines. One side of the bodice will be for buttonholes, the other side buttons.

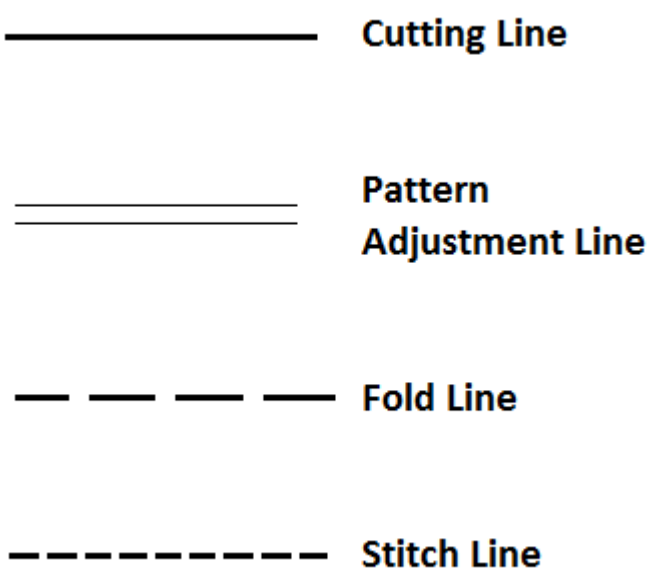
Zipper mark – often illustrated with a notch or line and arrow, it marks where a zipper should be inserted.

Stitching lines – these are usually dashed lines that indicate where you should topstitch, for example to attach pockets or a Trouser's fly front.

Shapes – a wide variety of shapes are used on patterns from circles to dots and crosses to indicate important points on the pattern. These will help you to match pattern pieces together at the correct point and stitch

accurately. These are often included for design features such as in seam pockets, bust points or to show you where to start and stop stitching.

Dart lines – either marked with lines or notches and arrows, darts are marked to show where and in what direction to fold the fabric.

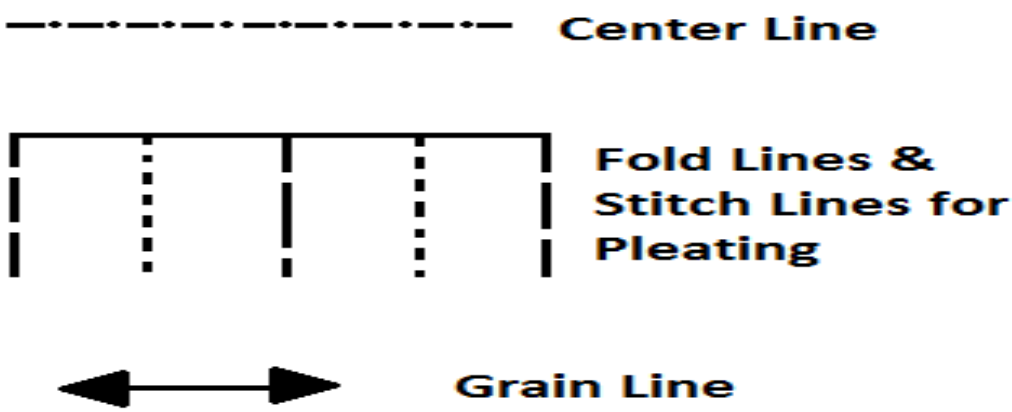


Cutting Lines: These lines indicate where to cut the fabric to match the shapes on the pattern. They are solid lines and easy to identify. For patterns offering multiple sizes, you may see several cutting lines, each with the size printed on or near the line to help ensure you always cut the correct one for your size.

Pattern Adjustment Lines: Another type of solid line you may are pattern adjustment lines. These allow you to make a garment longer or shorter based on your needs. These run across a piece and usually appear as two parallel lines. The space between the lines depends on the degree of lengthening or shortening required.

Fold Lines: When cutting a symmetrical piece, patterns often recommend folding the fabric in half and cutting. When unfolded, the fabric forms the desired shape, takes less cutting time, and guarantees perfect symmetry. A folded line looks like a cutting line with breaks along it. You align the fold line with the folded edge of the fabric, leaving no extra space.

Stitch Lines: These lines are far less common in contemporary patterns, but they have a use which we will see in the next symbol. Stitch lines are lines made of dashes. You can tell the difference between a fold line and a stitch line by the length of line segments. Fold lines use longer dashes while stitch lines use shorter ones.



Fold and Stitch lines: One of the only times you will see both fold and stitch lines used together on a pattern occurs with pleated garments. This directs you how to repeatedly fold the fabric and how far along the fold you need to stitch.

Center Front and Center Back Lines: These lines help during the fitting process of garment production, before sewing the pieces together. Once the fabric pieces, with the pattern still attached, are pinned together, you need to drape the garment on a form or a live model to ensure it fits correctly. These lines help ensure that the center of the garment properly aligns with the center of the body. You can identify these lines because they look like Morse code, using dashed with a dot in between them.

Grainlines: These lines are extremely important to creating a properly fitted, well-constructed garment, but to explain them, we first need to understand some basics of fabric weaving. If you look closely at any piece of clothing you are currently wearing, you will see the cloth is woven from two sets of parallel threads. In one direction, running parallel to each other, you have the **warp** threads which are stronger than those going the other direction. The threads running perpendicular to the warp thread, while parallel to them, are the **weft** threads which are weaker. Warp threads stand out more when looking closely at a piece of fabric so you always want them running the same direction when the pieces are sewn together. This is where Grainlines help. These lines, with an arrow point on each end, should align with the warp threads and run in the same direction.

Non-line Symbols

Lines are not the only symbols you will see on a pattern. Let's look at some of other markings you need to know.

Notches

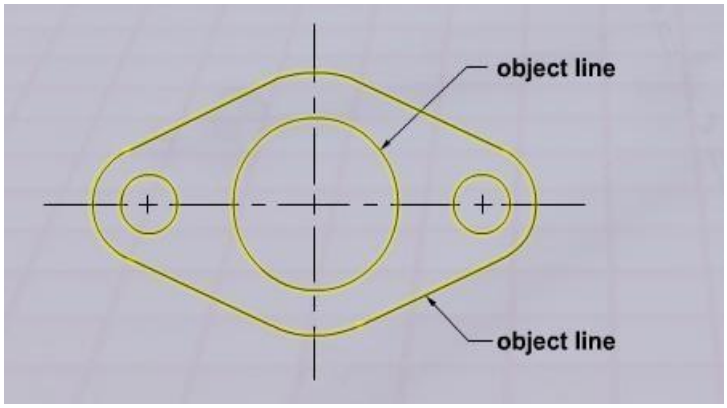
Barred Lines

Small x

APPLICATION EXAMPLE OF THE LINES

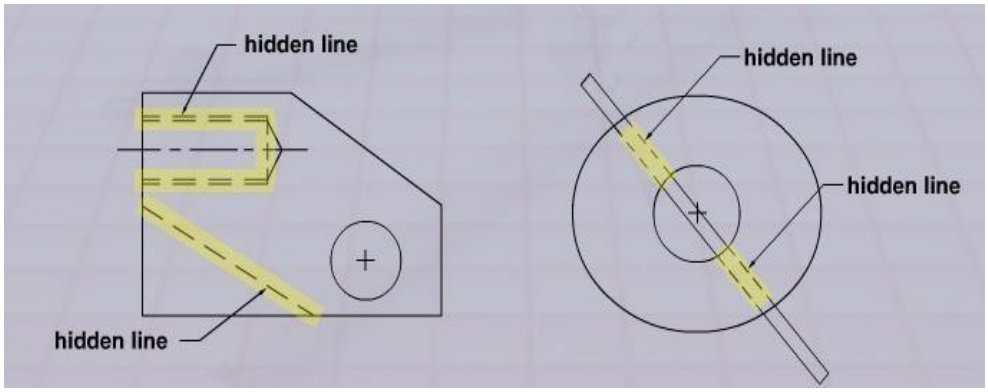
Visible/Object Lines

Dark, heavy lines.
Used to represent the outline or contour of the object being drawn.
Define features you can see in a particular view.



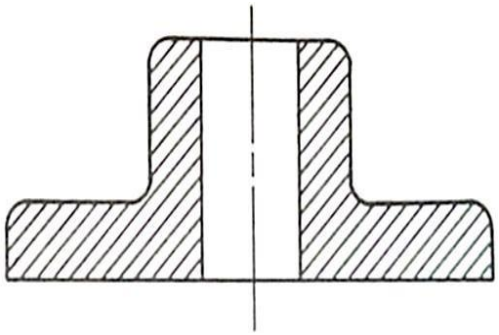
Hidden Lines

Light, narrow, short, dashed lines.
Shows the outline of a feature that can not be seen in a particular view.
Used to help clarify a feature, but can be omitted if they clutter a drawing.



Section Lines

Thin line usually drawn at a 45 degree angle.

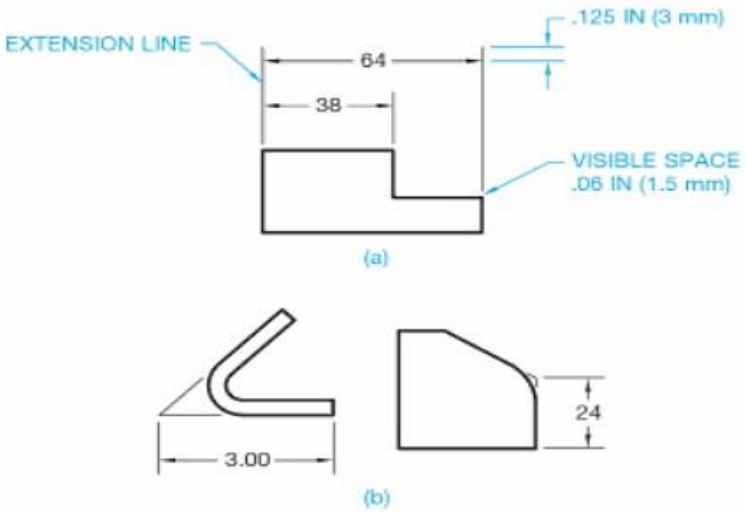


Indicates the material that has

been cut through in a sectional view
Indicate length.

Extension Lines

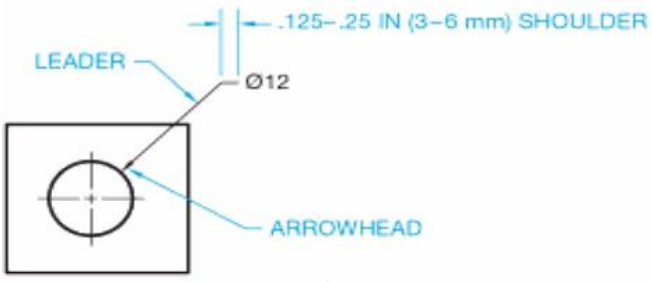
Thin lines used to establish the extent of a dimension.
Can also be used to show extension of a surface to a theoretical intersection as shown in (b).



Begin 1.5mm from the object and extend to 3mm beyond the last dimension. They should not cross dimension lines.

Leader Lines

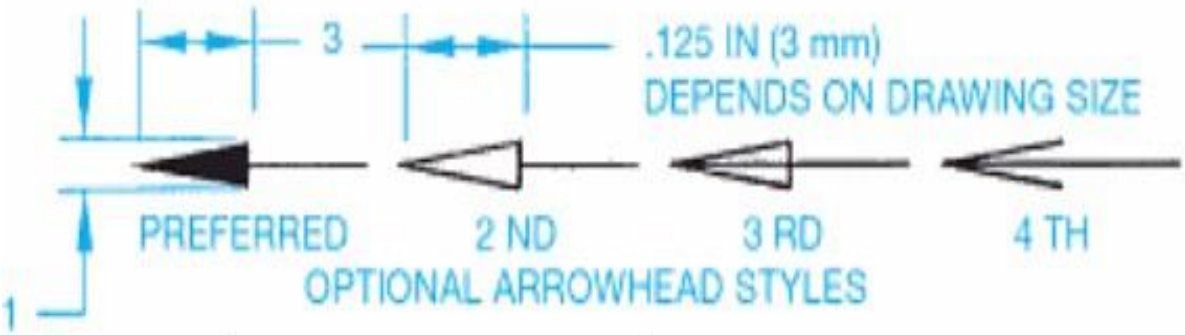
Thin lines used to connect a specific note to a feature.
Also used to direct dimensions, symbols, item number and part numbers on a drawing.
Commonly drawn at ***45, 30 and 60*** degrees.
Has a ***short shoulder*** (3-6mm) at one end beginning at the center of the vertical height of text, and a ***standard dimension arrowhead*** at the other end touching the feature.
Leader lines should not cross each other.
Leader lines should not be excessively long.
Leader lines should not be vertical or horizontal.

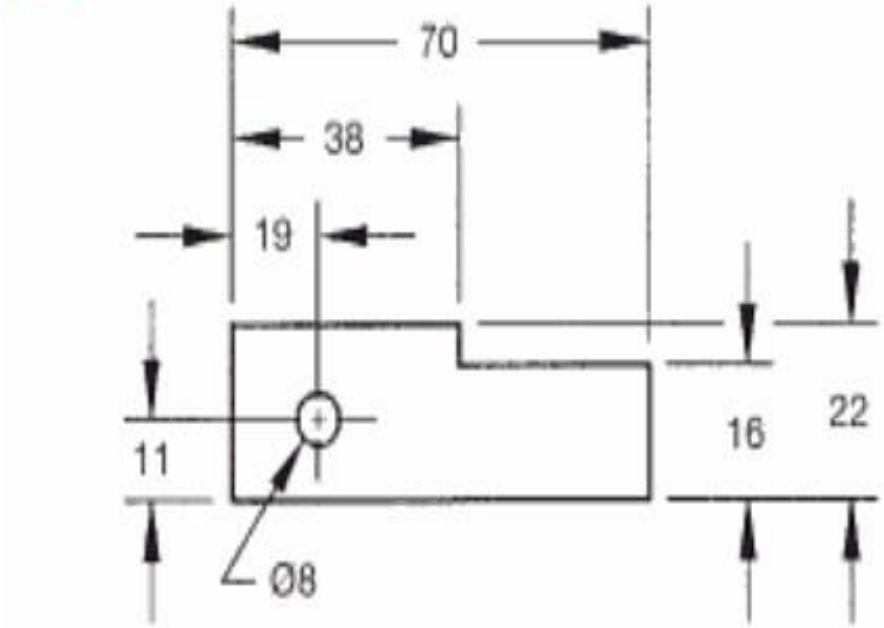


Leader lines

Arrowheads

Used to terminate dimension lines and leader lines and on cutting-plane lines and viewing plane lines.
They should be three times as long as they are wide.
They should be the same size throughout the drawing.
The filled arrowhead is generally preferred because of its clarity.





- Content/topic 3. Conventional presentation of lines

Should not be parallel to dimension lines, extension lines or section lines.

Learning Outcome 2.2 -Apply types of lines

- Content/Topic 1. Application of lines

Continuous thin

Continuous thin straight or curved or
Continuous narrow line

1. imaginary lines of intersection
2. dimension line
3. projection line
4. leaders and sectioning line
5. hatching
6. outlines of revolved sections in place
7. short centre line
8. construction line
9. extension lines
10. Diagonals indicating flat surfaces
11. Indication of repetitive features

Continuous thin straight or curved or
Continuous narrow line

1. imaginary lines of intersection
2. dimension line
3. projection line
4. leaders and sectioning line
5. hatching
6. outlines of revolved sections in place
7. short centre line
8. construction line
9. extension lines
10. Diagonals indicating flat surfaces
11. Indication of repetitive features

Continuous thin freehand

1. limit of partial or interrupted views and sections if the limit is not a chain thin
2. broken part

Continuous thin (straight with zigzag)

D1 limits of partial or interrupted views: Suitable for CAD drawings provided the line is not an axis

Medium thick line

- Content/Topic 1 Technical application types of lines

Line types and their application

There are technical drawings of different lines, whose application for underwriting certain elements is foreseen. A line can be a straight or a curve, they must have a specific starting point and an endpoint, and may be with or without interruption through his. The rules for lines in technical drawings are in the ISO 128-20 described.

Here is a list with different line types and their application:

1. Full line, narrow

- Dimension line
- Maßhilfslinie
- Light Edge
- Note and reference lines
- Hatch
- Short funds lines
- Thread reason
- Maßlinienbegrenzung
- Diagonally crosses the flat surfaces characterize
- Bending lines (with tubes and machined parts)
- Umrahmungsen (from Prüfmaßen/Form- and position tolerances and details)

2. Freehand line, narrow

- Drawing of views and limitations interrupted cuts (drawn freehand)

3. Criss-cross line, narrow

- Drawing of limitations interrupted views and slices (with automatic character Signed)

4. Vollinie, broad

- silhouette visible
- visible edge
- Thread Gust
- Limit the usable length of thread
- Form division lines

5. Streak line, narrow

- covert edges
  - covert outlines

6. Streak line width

- Identification of surface treatments

7. Streak point line, narrow

- Midline
- Symmetry Line
- Part circle (with holes)
- Part circle (with teeth

8. Streak point line, wide

- Cutting levels
- Identification of division lines in the form of cuts
- Identification of limited areas, e.g. Treatment

9. Two-stroke point line:

- Focus lines
- Outlines of adjacent components
- End positions of movable parts

Learning Outcome 2.3 Classify letter styles

LETTERING

Definition: The art of writing the alphabets A, B, C .....Z and numbers such as 1, 2, 3 .....9, 0 etc., is known as lettering.
It is an important part of drawing and is used to write letters, dimensions, notes and other necessary information required to complete execution of machine or structure, etc. Mainly, there are three types of lettering most commonly used in engineering drawing. Gothic Lettering, Roman Lettering and Free hand Lettering.

- Content /Topic 1: Classification of letter style

The lettering, in general, is classified in three categories:

1. Gothic Lettering
2. Roman Lettering.
3. Free hand Lettering.

1. GOTHIC LETTERING

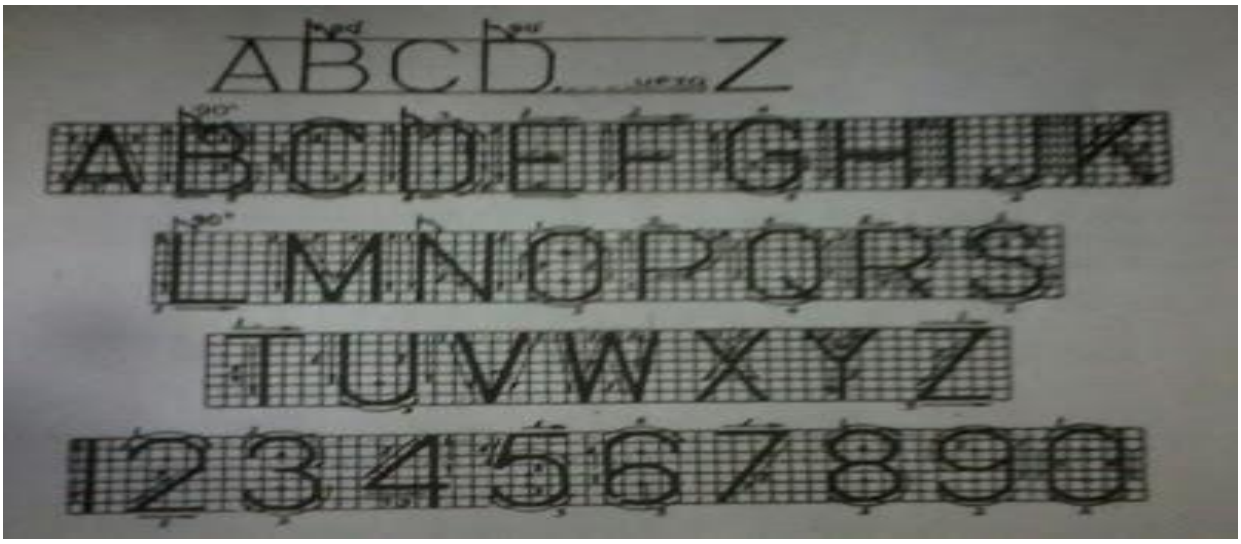
The letter in which all the alphabets are of uniform width or thickness is known as **gothic lettering.**

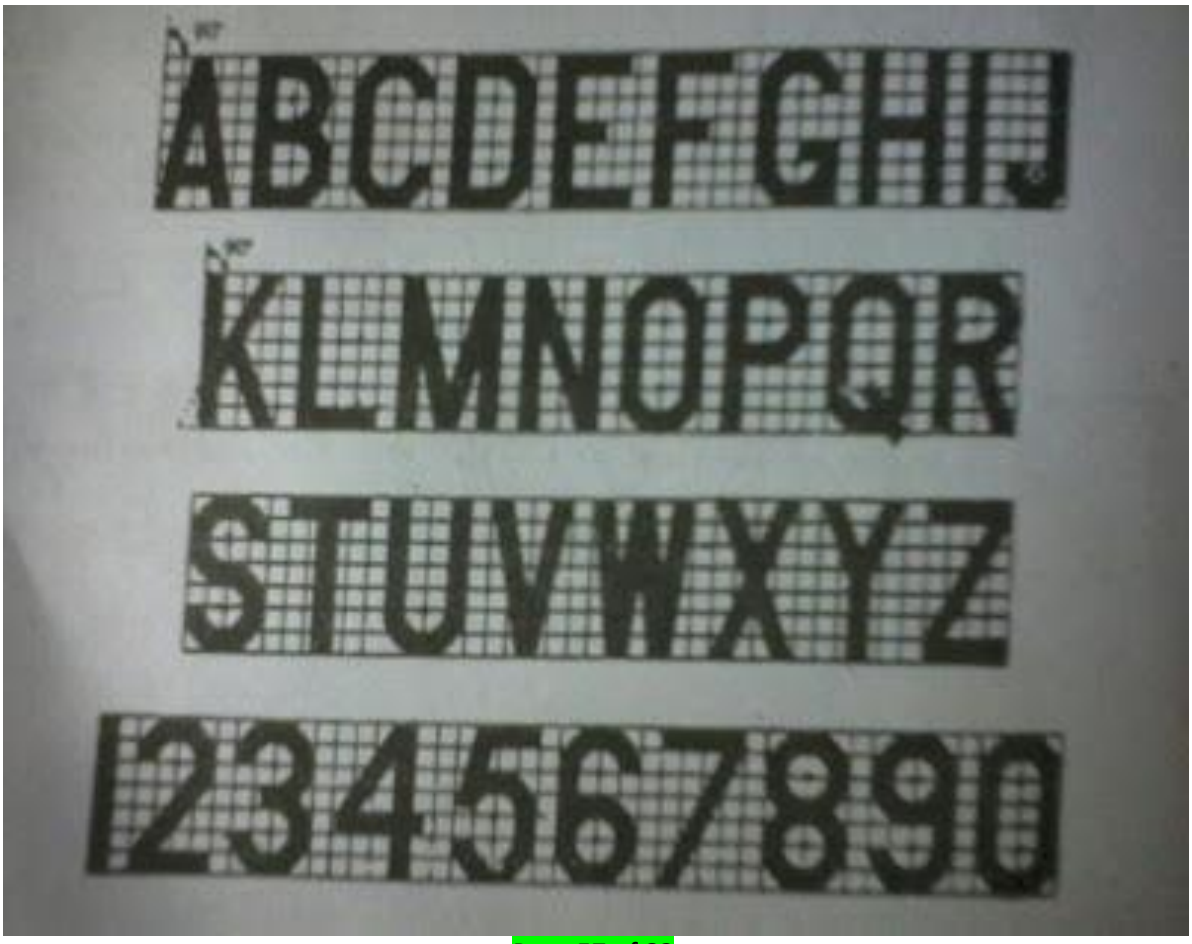
1. Vertical Gothic Lettering
2. Italic or Inclined Gothic Lettering.

Single Stroke Vertical Gothic Lettering

These are vertical letter having thickness of each line of alphabet or numerals etc. same as the single stroke of a pencil.

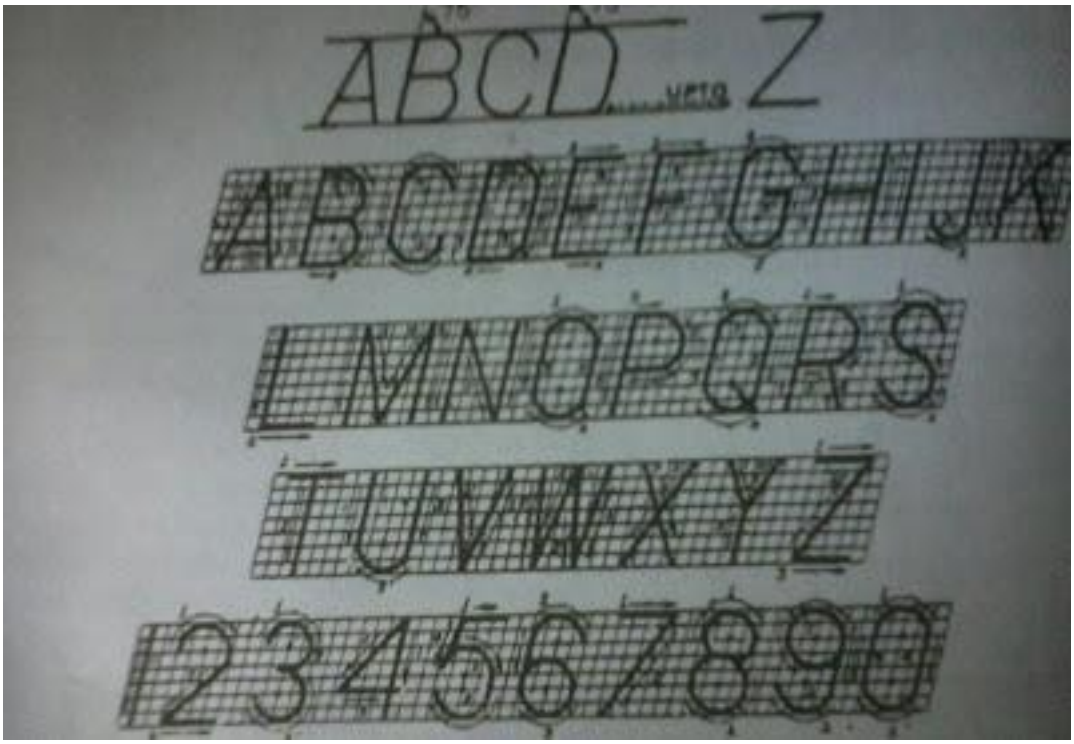
Since Stroke means that the letter is written with one or more stems or curves and each made with single stroke.





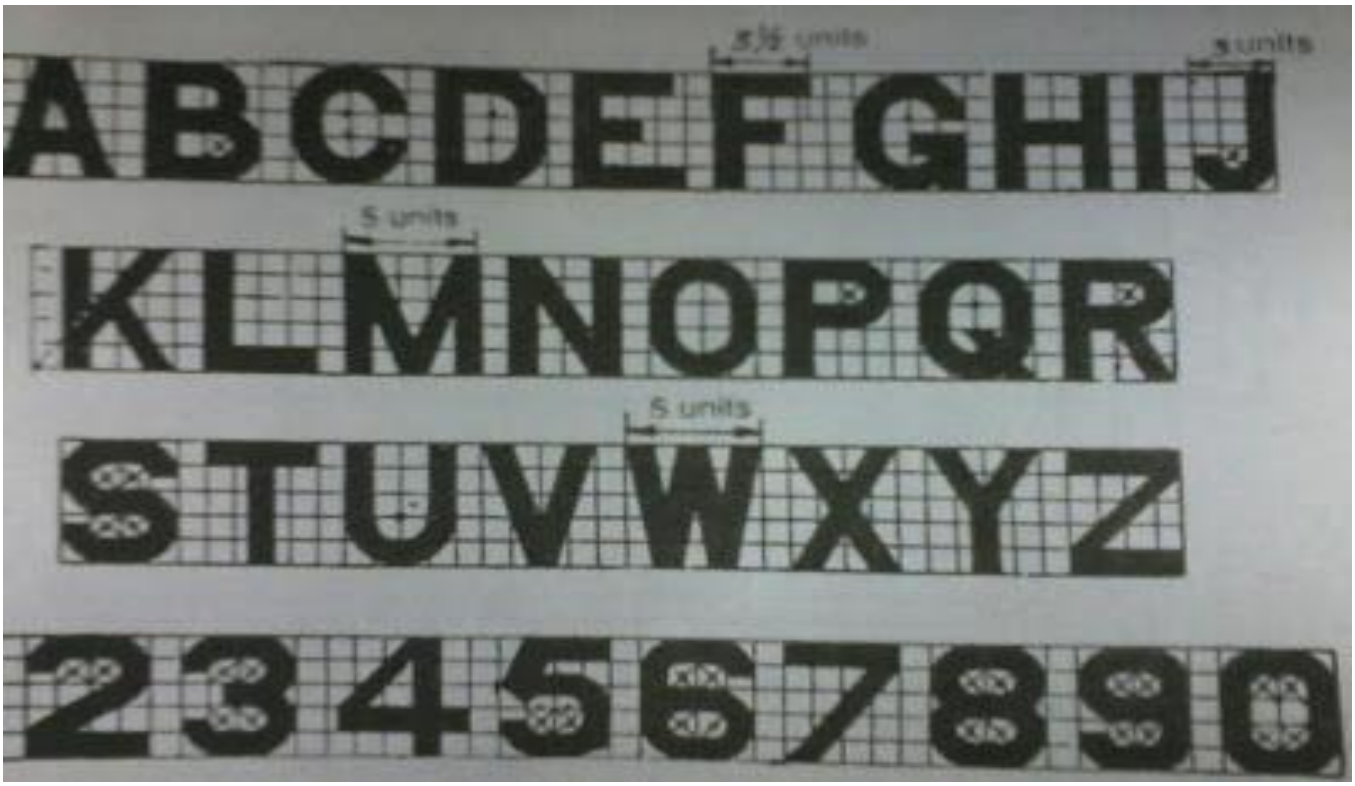
Single Stroke Inclined Gothic Lettering

These are single stroke letter inclined at **75'** to the **Horizontal.**



Double Stroke Vertical Gothic Lettering

Vertical letter drawn by double Stroke of pencil with uniform thickness between these strokes are called **Double Stroke Vertical Gothic Lettering.**

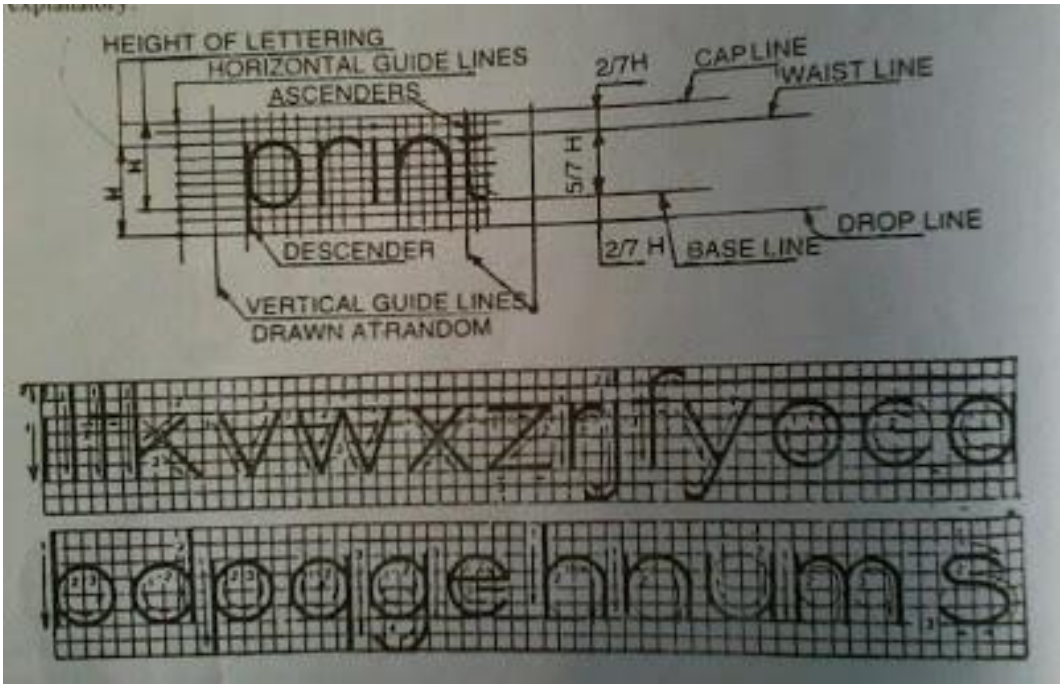


Double Stroke Inclined Gothic Lettering

Double stroke gothic when inclined at an angle of **75'** is called **Double Stroke Inclined Gothic Lettering**.

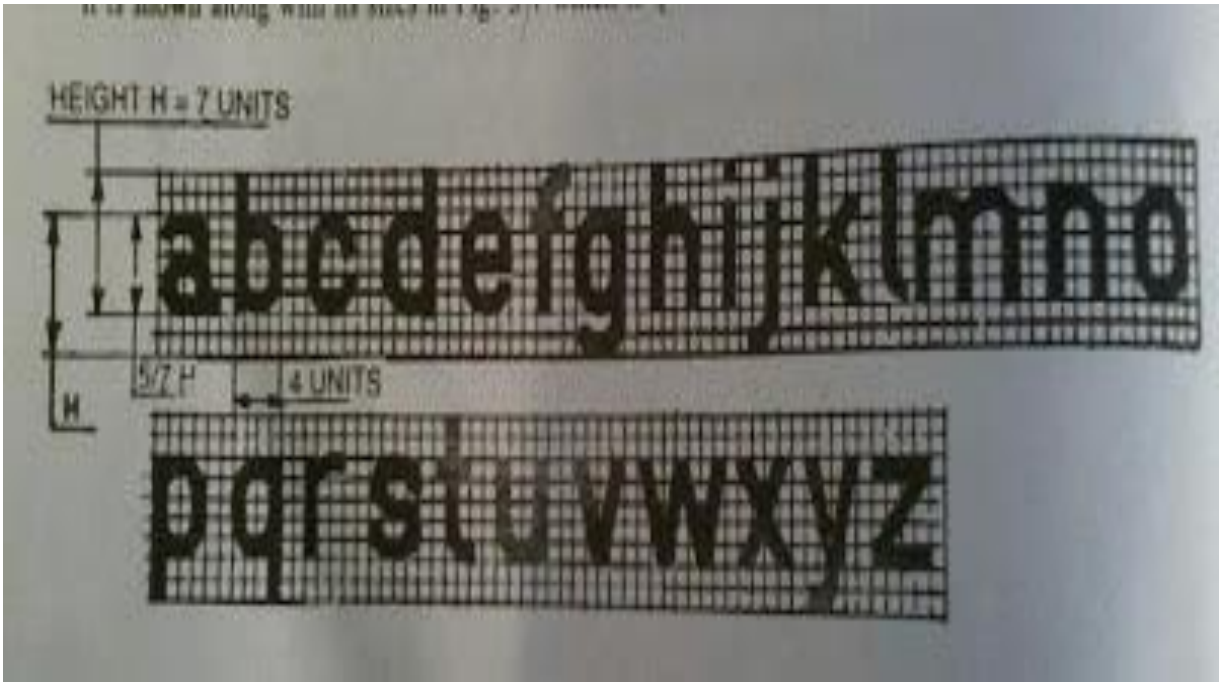
Lower Case Vertical Single Stroke Gothic Lettering

Lower case vertical gothic lettering is shown along with its sizes. Which is quite self explanatory.



Lower Case Vertical Double Stroke Gothic Lettering

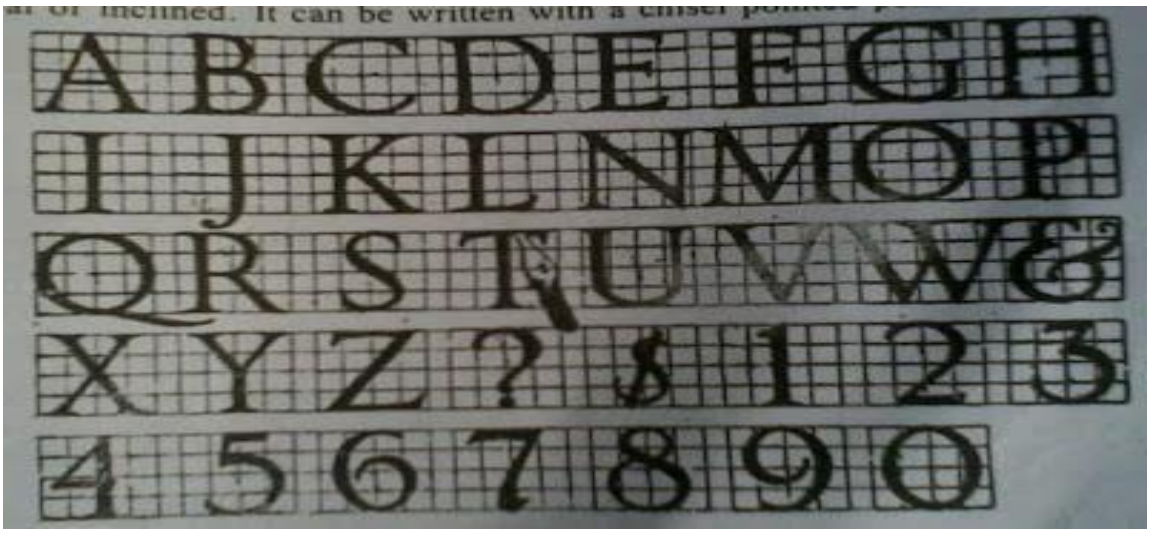
It is shown along with its size which is quite self-explanatory.



3. ROMAN LETTERING

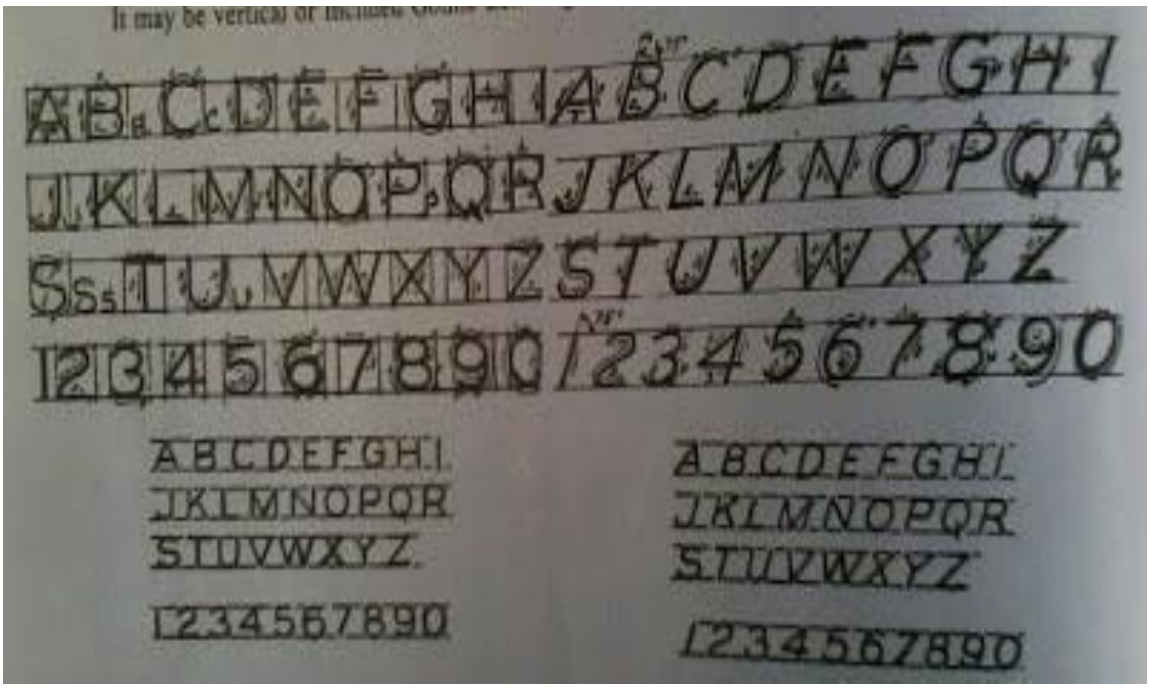
The lettering in which all the letters are formed by thick and thin elements is called **Roman Lettering**.

It may be vertical or inclined or inclined. It can be written with a chisel pointed Pencil or D-3 type Speed Ball Pen.



4. FREEHAND LETTERING

The art of writing alphabets without the use of instruments is called **freehand lettering**. It may be vertical or Inclined Gothic Lettering.



- **Content/Topic 2. Technical of lettering**

Proportion and form of the letter and the order of the strokes.

Height Of Lettering

The height "h" of the capital letter is taken as the base of dimensioning.
The main requirements of lettering on engineering drawing are legibility, uniformity, ease and rapidity in execution.
Both upright and inclined letter are suitable for general use. All letters should be capital, except where lower case letters are accepted internationally for abbreviations.
The recommended size of lettering is as under:-

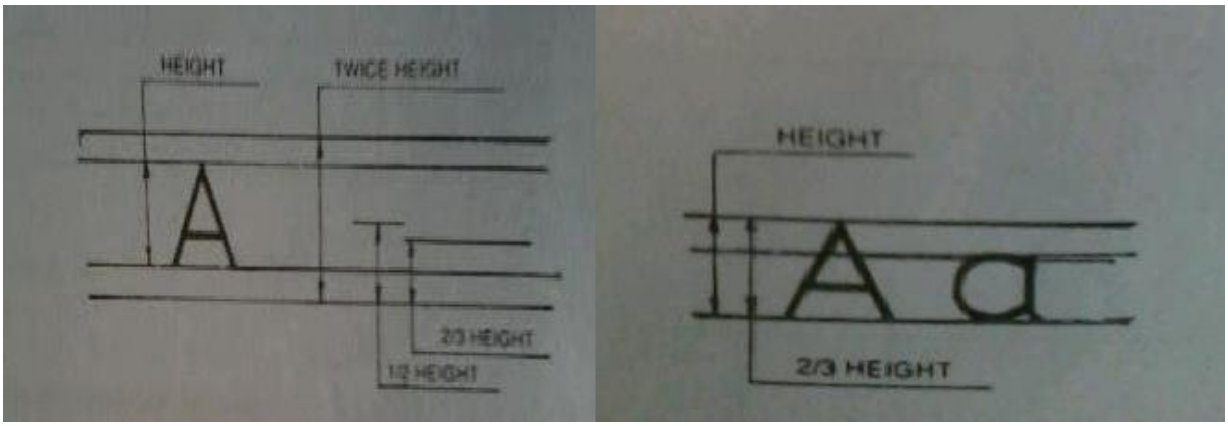
ITEM	SIZE h, mm
Drawing number in Title Block and letters denoting Cutting Plane Section	10, 12
Title of Drawing	6, 8
Sub-titles and Headings	3, 4, 5, 6,
Notes, such as Legends, Schedules, Material list, Dimensioning	3, 4, 5
Alteration, Enteries and Tolerances	2, 3

The spacing between of the letters and words

Tracing of guides lines Writing of letter style

Guide Lines

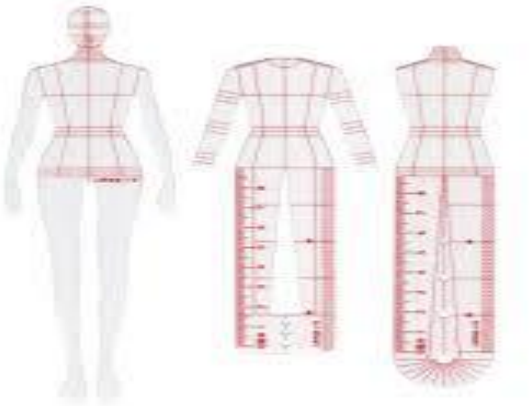
The light thin lines drawn to obtain uniform and correct height of letters are called **Guide Lines**. Guide line should be drawn very light and thin, so that, they need not be erased after the lettering is finished. To erase guide lines after finishing the lettering is not easily possible.
Guide line for capital and lower case lettering.



Learning Unit 3- Make dimension on drawing

Learning Outcome 3.1- Set drawing on drawing sheet

Definition Dimensioning is the process of specifying part' s information by using of lines, number, symbols and notes



- Content/Topic 1. Setting of margin on drawing sheet

Every drawing (architectural, structural, mechanical etc) has a title block and the drawing area. The width of the title block is 10 cm independently of the paper size. The rest of the drawing area.

The title block includes:

Project information

Drawing information

Designers information

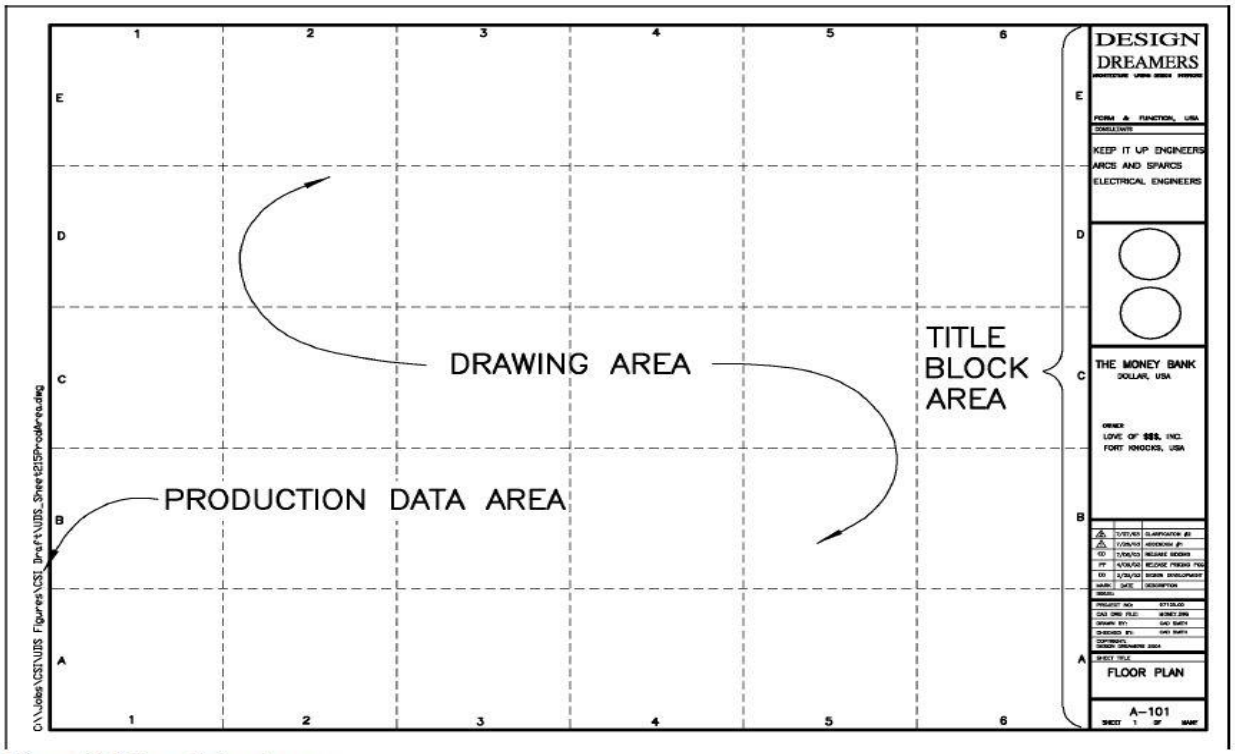


Figure 02.1 Overall sheet layout.

Drawing Borders and Margins

All drawings require a boarder. The standard line thickness of the boarder is 0.6 mm. The top, right and bottom margin should be 10 mm and the left margin should be 20 mm. This applies for all sheet sizes (A0, A1, A2, A3, A4). Notice that the left marigns in larger to allow space for binding a drawing set..

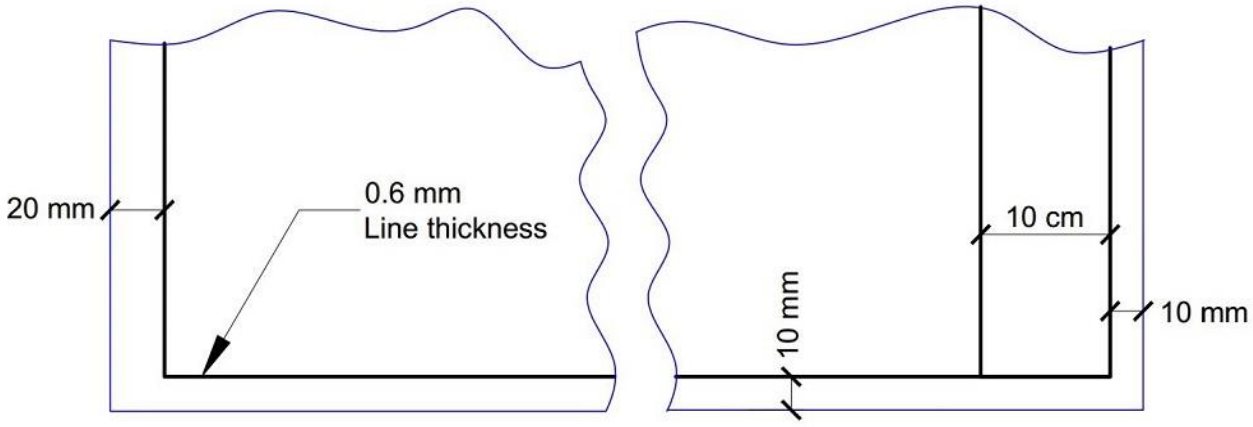
Boarder lineweight: 0.60 mm

Top margin: 10 mm

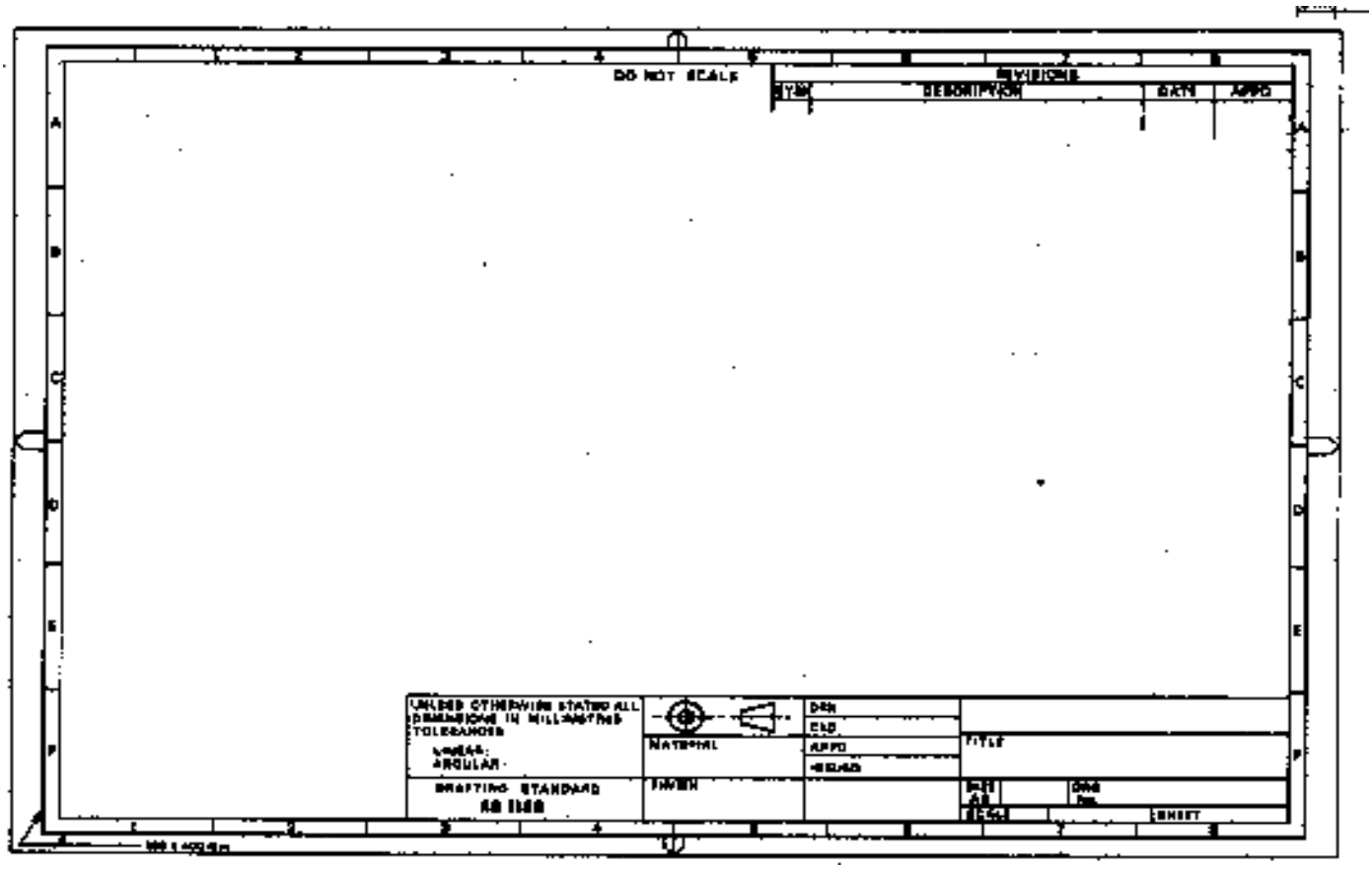
Right margin: 10 mm

Bottom margin: 10 mm

Left margin: 20 mm



- Content/Topic 2. Using technical position of drawing on drawing sheet

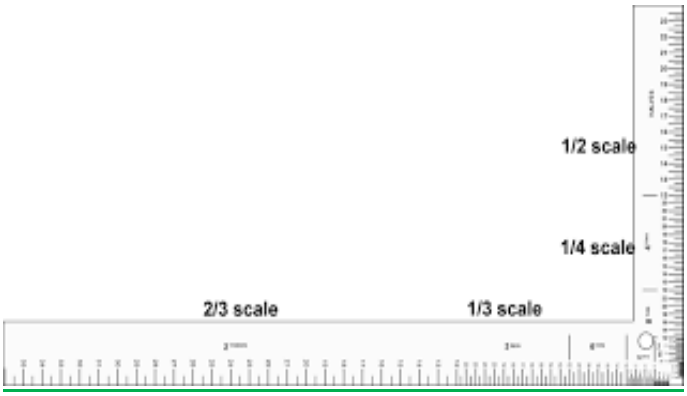


Learning outcome 3.2- Select Scale

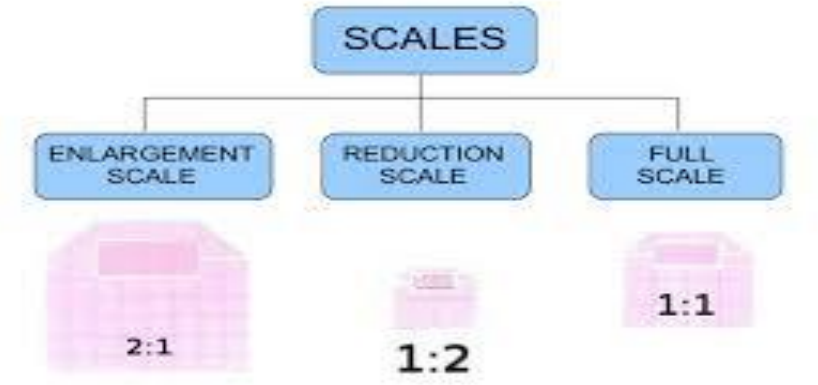
- Content/Topic 1. Definition of scale

Definition: scale is a ratio of size in a map, model, drawing, or plan or is is increasingly being used as shorthand for '**scale** up' (“to grow or expand in a proportional and usually profitable way”)

.



- Content/Topic 2. Different types of scale



Enlarge scale

2:1

Full size scale

1:1

Reduced scale

1:2

- Content/Topic 3. Calculation of scale

$$\text{Scale} = 1 \text{ cm} : 5 \text{ km}$$
$$\therefore \text{ Scale factor} = 5$$

$$\text{Actual distance} = 14 \text{ km}$$

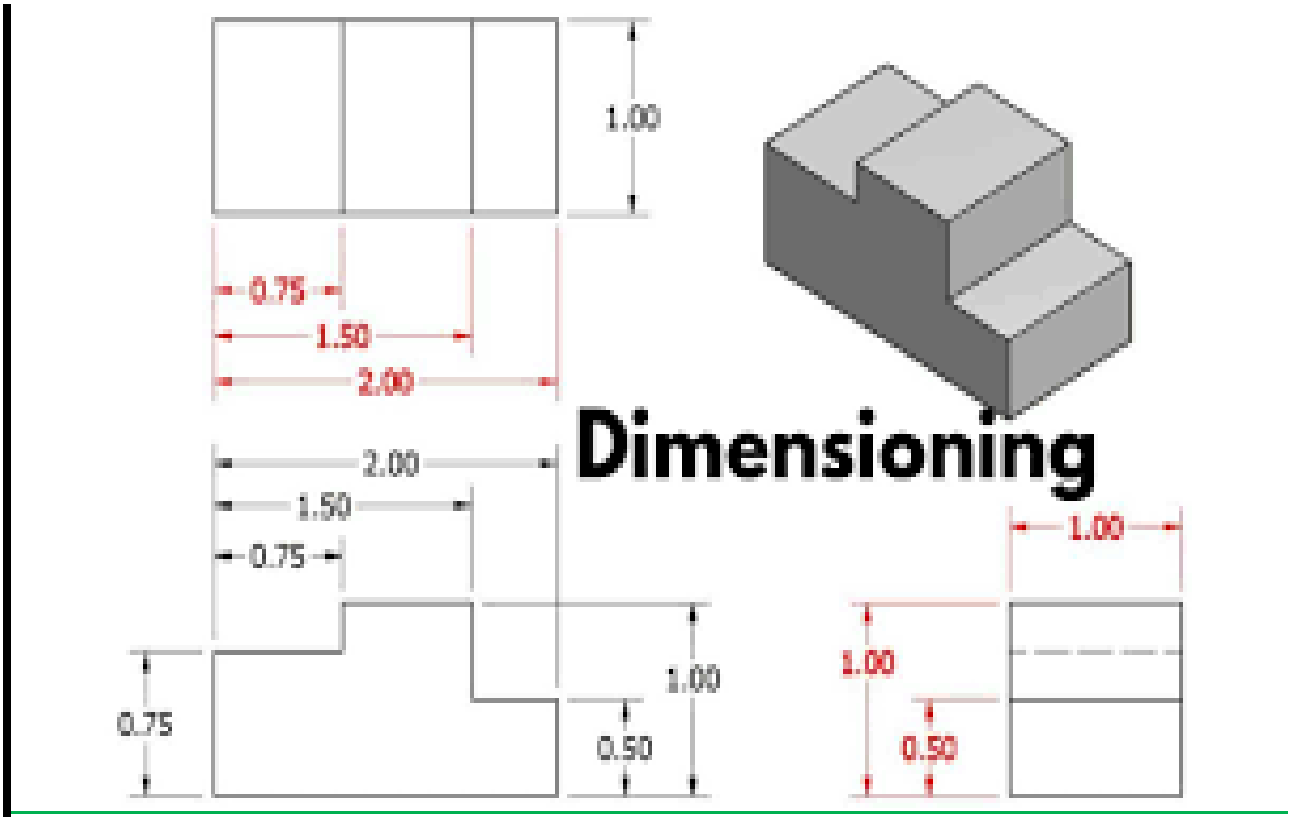
$$\text{Map distance} = \frac{\text{Actual distance}}{\text{Scale factor}}$$
$$= \frac{14}{5}$$
$$= 2.8$$

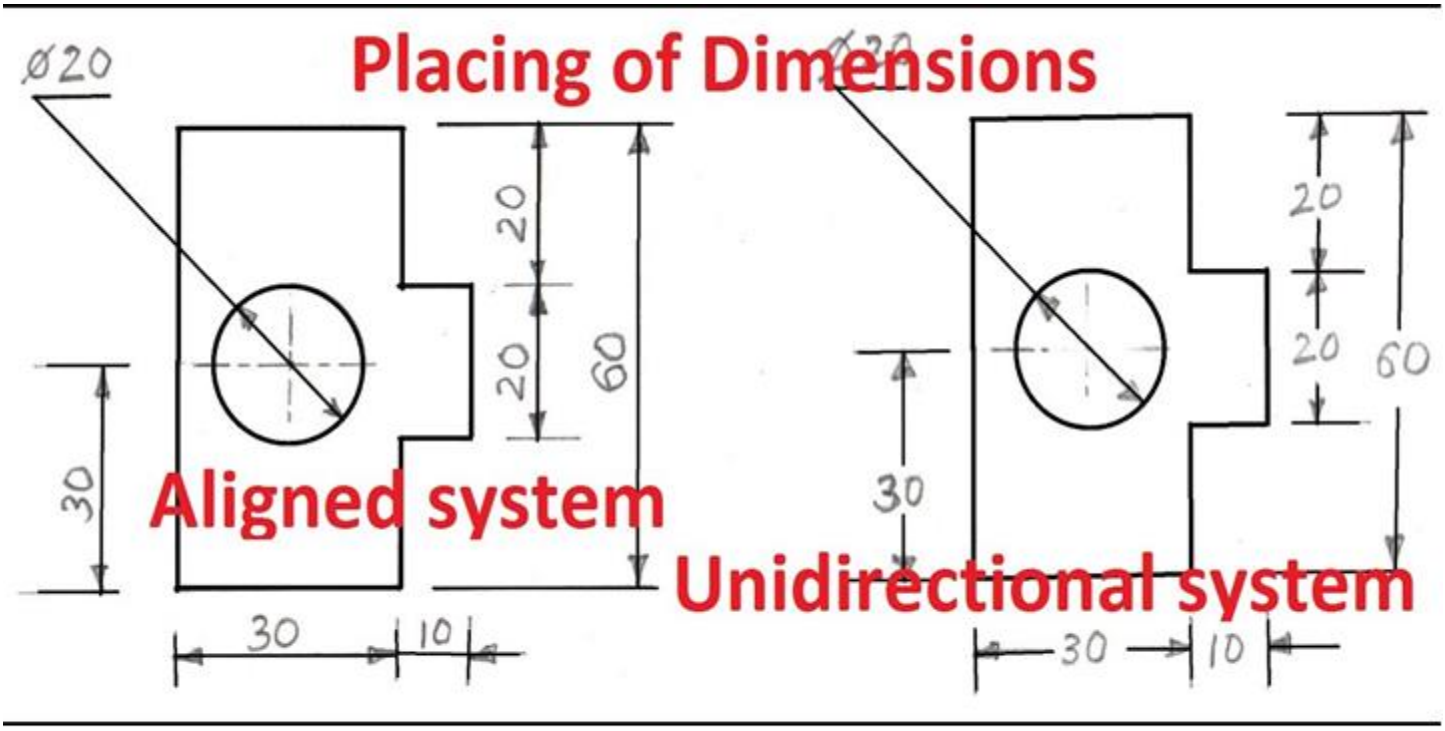
LEARNING OUTCOME 3.3-APPLY DIMENSIONING ON DRAWING

- Content/Topic 1. Introduction of dimensioning

Dimensioning is the process of measuring either the area or the volume that an object occupies.

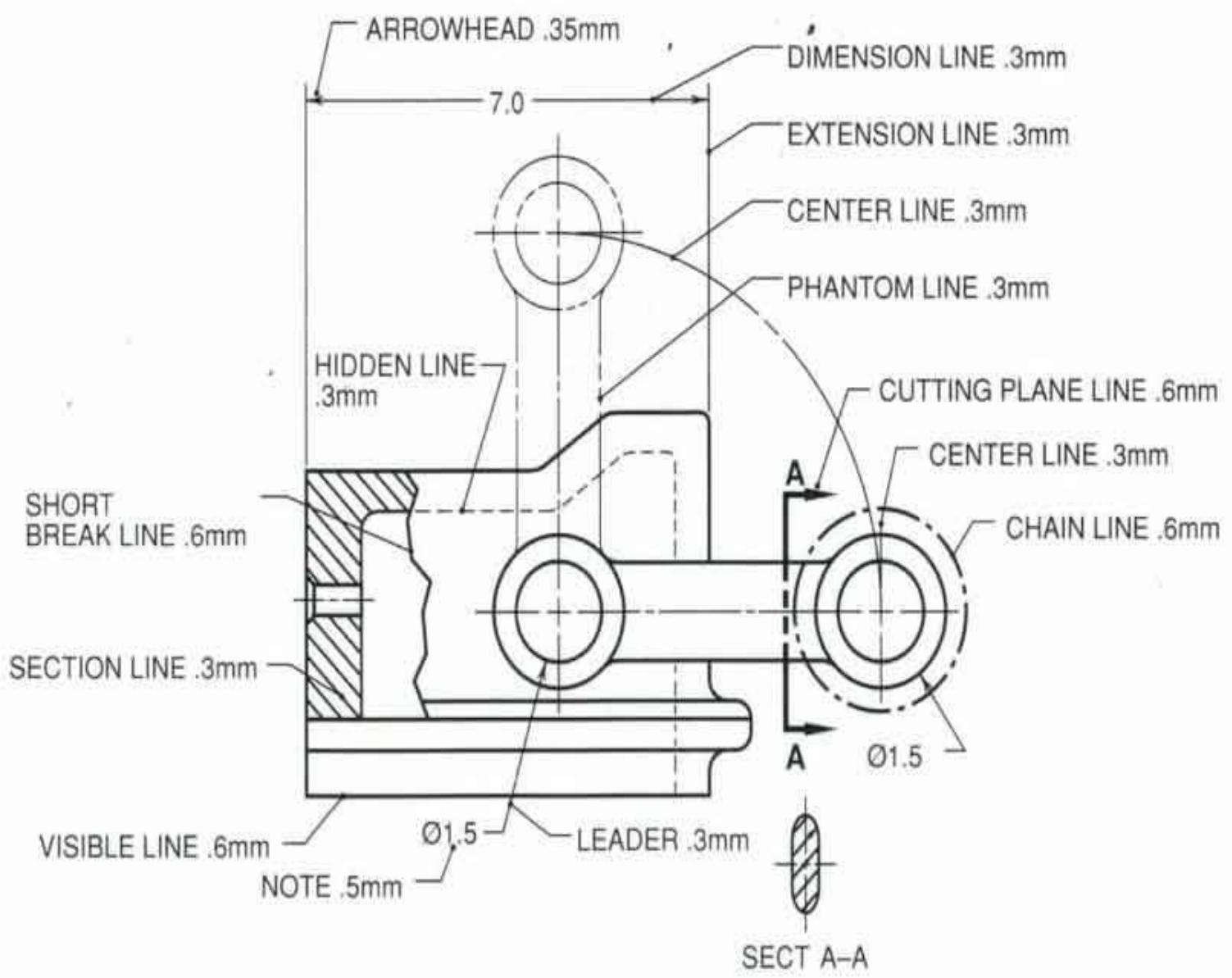
Drawing dimensions are added to a **drawing** to further document the model, without changing or controlling features or part size. You add **drawing dimensions** as annotations to **drawing** views or geometry in **drawing** sketches. **Drawing dimensions** are expressed as numeric constants





- Content/Topic 2. Different elements of dimensioning

ELEMENTS OF DIMENSIONING



The element of dimensioning includes the projection line, leader line, termination of dimension line, symbols and dimension itself. These are illustrated in above figure.

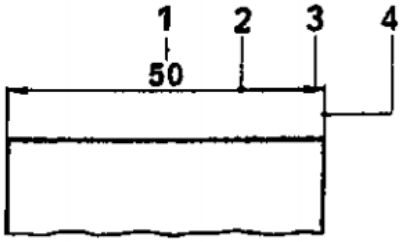
For dimensioning a drawing, four basic elements are used:

1. Dimension figure
2. Dimension line
3. Arrow head

Extension line

Dimension line

Dimension line is a thin continuous line used to indicate the measurement, terminated at the end by



arrowhead (→) or oblique stroke (*)

Always draw parallel to the edge of the surface and dimensions are to be indicated. The distance between the outline of the object and the first dimension line is 10mm and second dimension line is 8mm.

The dimension line

indicates the dimension directly between the body edges where the true shape appears oroutside of the object parallel to the dimensionBody edges and centre lines must not be used as dimension lines!

The distance of the dimension line from the body edge should be at least 8 mm, the distance between dimension lines should be at least 6 mm

Dimension lines must not cross each other.

Extension lines

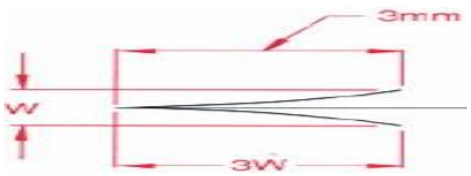
Extension line is also a thin continuous line extending beyond the outline of the object. It should extend about 3mm beyond the dimension line. We start from the body edges at right angle to the dimension line **–** with a few exceptions,

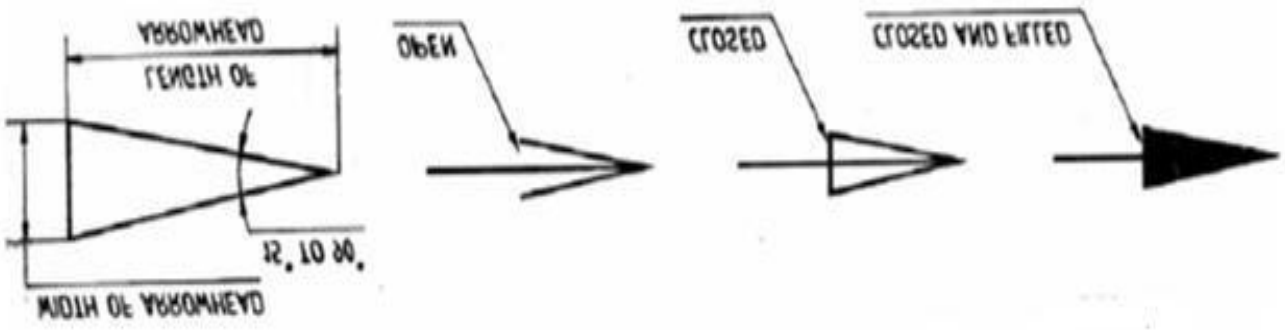
e.g. Circular measure, and extend the line **1 mm** to **2 mm** beyond the dimension line.

Extension lines should be drawn so they will not cross one another.

Arrowheads

Arrow heads are drawn from each dimension line. This size of an arrow head should be uniform on any drawing. To have the proper proportions, the length of an arrow head must be approximately three times its width

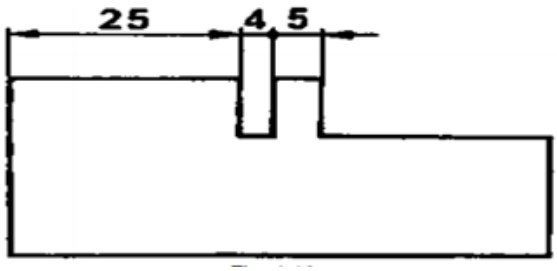




A leader or a pointer

It is a light, continuous line (terminated by an arrow head) that extends from note of the figure to show where it applies. It is terminated by an arrowhead. It should be made with straight edge and should not be curved or made freehand.

Units of dimensioning



Dimension should as far as possible be expressed in one unity only. The recommended unit is millimeter. Drawing is prepared to scales based on division of 10, such as 1 to 2 or 1: 2, 1 to 5 or 1:5, 1 to 10 or 1: 10.

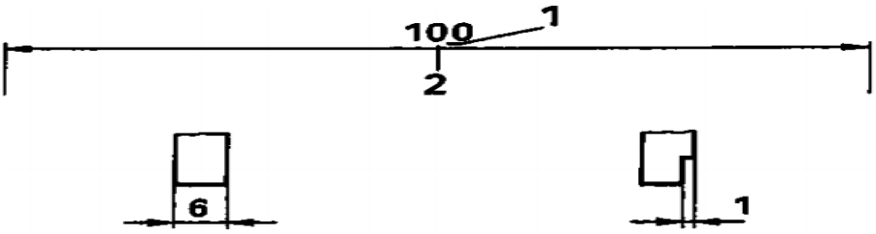
Dimension Figures

The dimension figures have to be shown on drawings in the specified style lettering so clearly that they can be interpreted in only one way.

These figures have a uniform size of at least 3 mm in height and must not be separated by lines or crossed by them. The dimension figure is always located at a short distance above the dimension line.

Usually it is placed in the centre of the dimension line. If, in case of very small dimensions, room is very limited, the dimension figure is located laterally above the arrowhead.

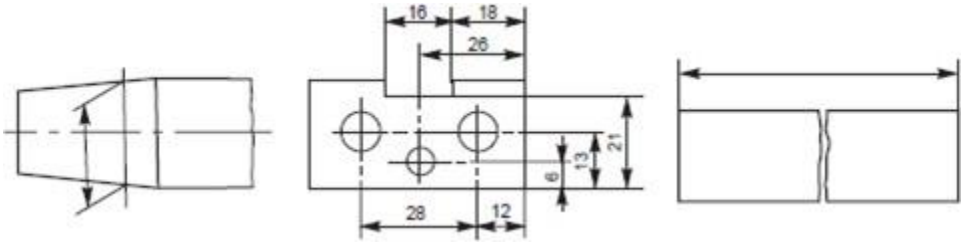
Methods of execution



The elements of dimensioning include the projection line, dimension line, leader line, dimension line termination, the origin indication and the dimension itself. The various elements of dimensioning are shown in Figures

The following are some of principles to be adopted during execution of dimensioning

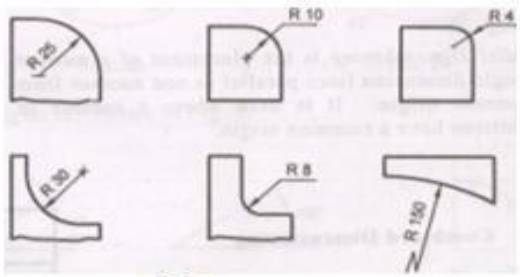
- ✓ Projection and dimension lines should be drawn as thin continuous lines.
- ✓ Projection lines should extend slightly beyond the respective dimension lines.
- ✓ Projection lines should be drawn perpendicular to the feature being dimensioned.
- ✓ Where necessary, they may be drawn obliquely, but parallel to each other. However, they must be in contact with the feature.
- ✓ Projection lines and dimension lines should not cross each other, unless it is unavoidable.
- ✓ A dimension line should be shown unbroken, even where the feature to which it refers, is shown broken.
- ✓ A centre line or the outline of a part should not be used as a dimension line, but may be used in place of projection line.



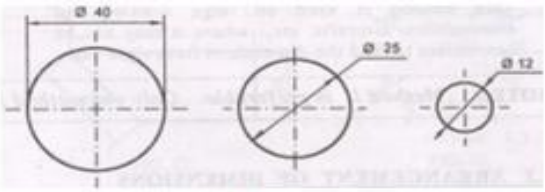
SHAPE IDENTIFICATION

To enable better interpretation of the drawing, shape identification symbols are written before the dimension figures as shown in above figure

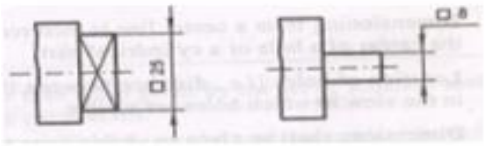
- From figure (a) to indicate the radius an arrowhead and symbol R are used
- To indicate the dimension for circular symbol Φ is used as shown in fig (b)
- To indicate square cross section, symbol □ is used along with cross section lines as shown in figure c
- The spherical features are indicated either by giving radius the symbol SR as shown in figure (d) or by diameter SΦ as shown in figure (e)



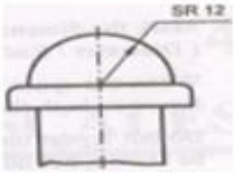
(a)



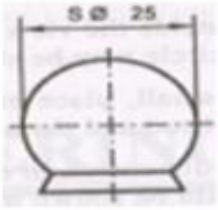
(b)



(c)



(d)



(e)

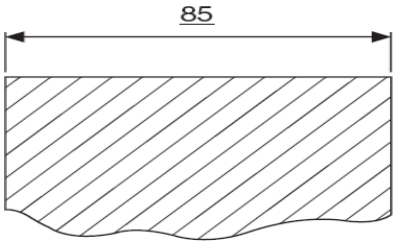
Arrangement of Dimensions

The arrangement of dimensions on a drawing must indicate clearly the design purpose.

- Show each dimension only once!
- Do not show dimensions at hidden edges of the object!
- Enter external dimensions in any case.

The following are the ways of arranging the dimensions

Dimensioning of features not drawn to scale



1. Chain dimensioning and auxiliary dimensioning

- **Chain dimensions**

Chains of single dimensions should be used only where the possible accumulation of tolerances does not endanger the functional requirement of the part (Fig. 2.43).

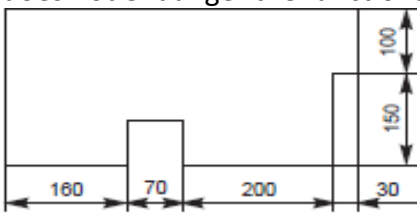


Fig. 2.43 Chain dimensioning

2. Parallel dimensions

In parallel dimensioning, a number of dimension lines, parallel to one another and spaced-out are used. This method is used where a number of dimensions have a common datum feature (Fig. 2.44 *a*).

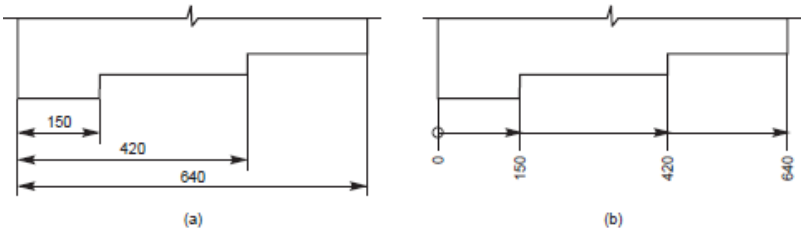


Fig. 2.44 Parallel dimensioning

Combined dimensions

These are the result of simultaneous use of chain and parallel dimensions

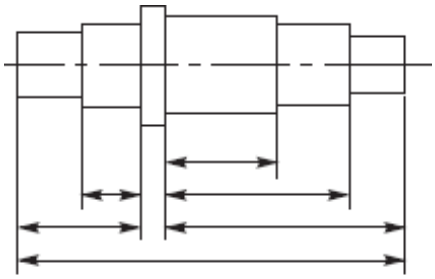
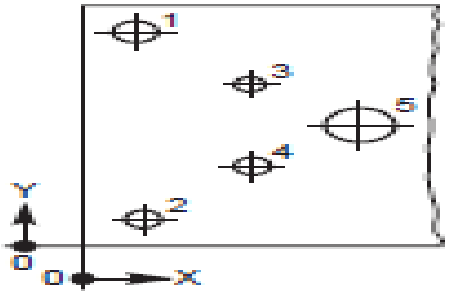


Fig. 2.45 Combined dimensioning

Co-ordinate dimensions

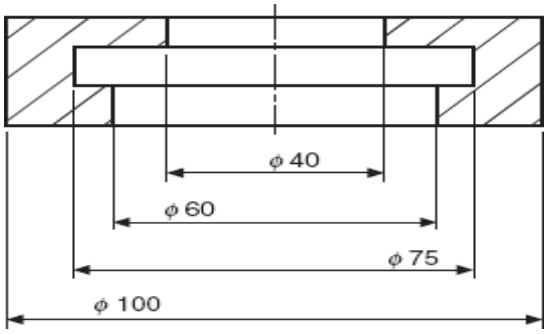
The sizes of the holes and their co-ordinates may be indicated directly on the drawing; or they may be conveniently presented in a tabular form, as shown in Fig. 2.46.



	X	Y	ϕ
1	20	160	15.5
2	20	20	13.5
3	60	120	11
4	60	60	13.5
5	100	90	26
6			
7			
8			
9			
10			

Fig. 2.46 Co-ordinate dimensinong

Staggered dimensions



Special of Dimensioning

i. Diameters

Diameters should be dimensioned on the most appropriate view to ensure clarity**. Any diameter dimension of a cylindrical shape is provided with a**

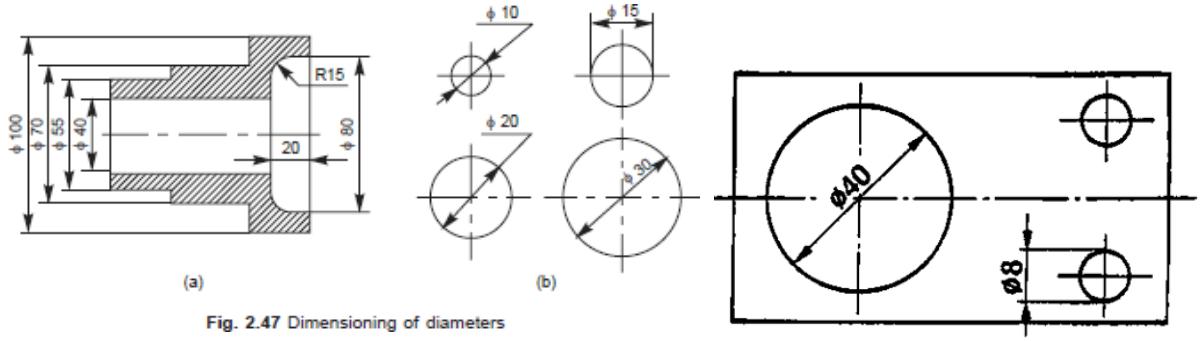
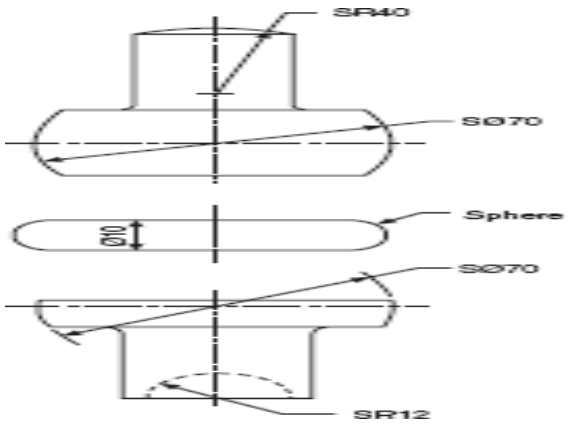


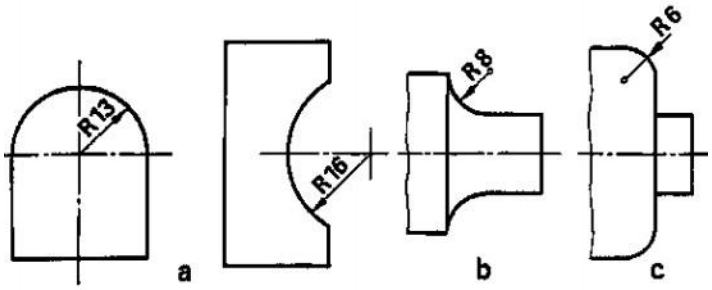
Fig. 2.47 Dimensioning of diameters

diameter symbol in front of the dimension.

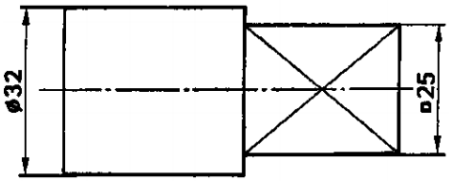
Dimensioning spherical radii and diameters



Dimensioning radii

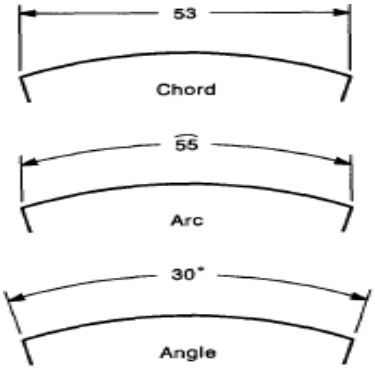


Square Sign and Diagonal Cross square sign indicates a square shape.



Dimensioning chord, arc and angle Chords, Arcs, Angles and Radii

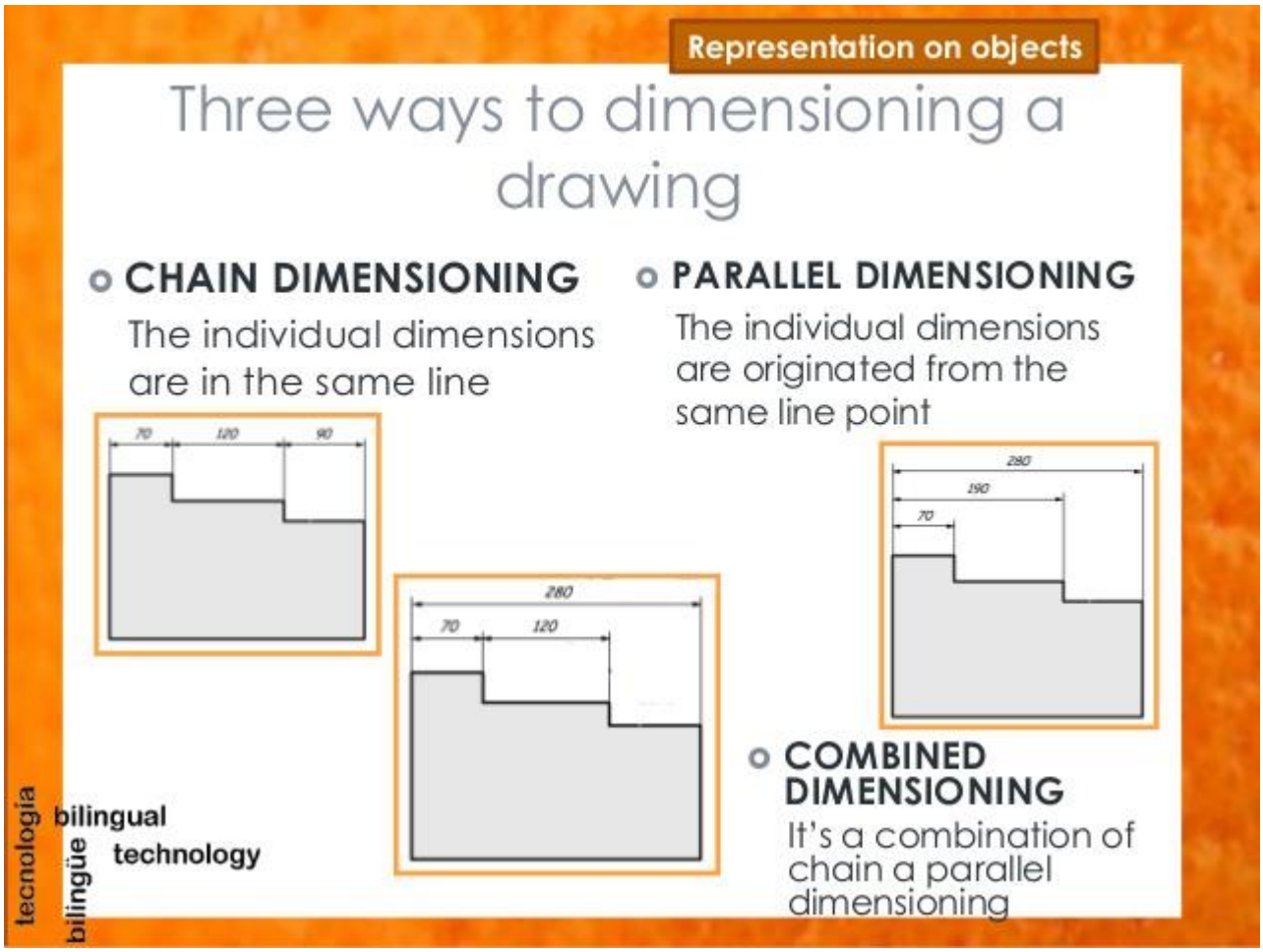
The dimensioning of chords, arcs and angles should be as shown in Fig. 2.48. Where the centre of an arc falls outside the limits of the space available, the dimension line of the radius should be broken or interrupted according to whether or not it is necessary to locate the centre (Fig. 2.35).
Where the size of the radius can be derived from other dimensions, it may be indicated by a radius arrow and the symbol R, without an indication of the value (Fig. 2.49).



Chamfers and counter sunks

Chamfers may be dimensioned as shown in Fig. 2.51 and counter sunks, as shown in Fig.

- Content/Topic 3. Steps of dimensioning drawing



1. Each dimension should be given clearly so it can be interpreted in only one way.

2. Dimensions should not be duplicated or the same information given in two different ways (dual dimensioning excluded).

3. Dimensions should be given between points or surfaces that have a functional relation to each other or that control the location of mating parts.

4. Dimensions should be given so it will not be necessary for the machinist to calculate, scale, or assume any dimension.

5. The machinist should not be expected to assume a feature is centered (as a hole on a plate), so always provide a location dimension from the appropriate datums.

6. Dimensions should be attached to the view where the shape is best shown and the features dimensioned are shown true shape.

7. Dimensioning to hidden lines should be avoided wherever possible. Use auxiliary cross sectional views instead.

8. Dimensions should not be placed on a view unless clarity is promoted and long extension lines are avoided.
9. Longer dimensions should be placed outside all intermediate dimensions so that dimension lines will not cross extension lines.

10.In machine drawing, all unit marks should be omitted, except when necessary for clarity; for example, 1" REAMER or 1mm DRILL.

11.Detail dimensions should "line up" in chain fashion.

12.Dimension lines should be spaced uniformly throughout the drawing. They should be at least 3/8" from the object outline and 1/4” apart.

13.No line of the drawing should be used as a dimension line or coincide with one.

14.Dimension lines should not cross, if avoidable. Dimension lines and extension lines should not cross, if avoidable. Extension lines may cross each other. When extension lines cross extension lines or visible lines, no break in either should be made.

15.A center line may be extended and used as an extension line, in which case it is still drawn like a center line.

16.Leaders for notes should be straight, not curved, and point to the center of circular views of holes wherever possible. Leaders should slope at 45°, 30° or 60° with horizontal but may be made at any convenient angle except vertical or horizontal.

17.Leaders should extend from the beginning or from the end of a note, the horizontal "shoulder" extending from mid height of the lettering.

18.Dimension figures should be approximately centered between the arrowheads, except that in a "stack" of dimensions, the figures should be "staggered."

19.Dimension figures should be about 1/8” high for whole numbers and 1/4” high for fractions.

20.Dimension figures should never be crowded or in any way made difficult to read.

21.Dimension figures for angles should generally be lettered horizontally.

22.Notes should always be lettered horizontally on the sheet.

23.Notes should be brief and clear, and the wording should be standard in form.

24.Finish marks should be placed on the edge views of all finished surfaces.

25.Finish marks should be omitted on holes or other features where a note specifies a machining operation.
26.A cylinder is dimensioned by giving both its diameter and length in the rectangular view, except when notes are used for holes. A diagonal diameter in the circular view may be used in cases where clarity is gained thereby.

27.Holes to be bored, drilled, reamed, and so on are size-dimensioned by notes in which the leaders preferably point toward the center of the circular views of the holes. Indications of manufacturing processes may be omitted from notes.

28.Drill sizes are preferably expressed in decimals.

29.Circles (holes) are dimensioned by the DIAMETER, arcs (fillets) by the RADIUS.

30.A diameter dimension value should always be preceded by the symbol Ø.

31.A radius dimension should always be preceded by the letter R. The radial dimension line should have only one arrowhead, and it should pass through or point through the arc center and touch the arc.

32.When there are several rough, non-critical features obviously the same size (fillets, rounds, ribs, etc.), it is necessary to give only typical (abbreviation TYP) dimensions or to use a note.

33.Decimal dimensions should be used for all machining dimensions. Decimal dimensions less than 1.0 should be preceded with a leading zero (i.e. 0.375).

34.Never show hidden lines in isometric drawing views, but always show tangent lines.

35.Never shade orthographic or isometric drawing views.

36.Always show hidden lines in orthographic views.

37.Suppress fastener threads to unclutter assembly drawings.

38.Whenever possible place dimensions outside objects rather than inside their outlines.

39.Place dimensions pertinent to part geometry in the detail drawing and dimensions pertinent to positioning the part with respect to others in the assembly drawing.

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