Tishk International University
Engineering Faculty
Petroleum and Mining Engineering Department

Engineering Drawing

Lecture 4: Lettering and Dimensioning

First Grade- Fall Semester 2020-2021

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Content:

- Lettering
- Lettering Technique
- Lettering Procedure
- Dimensioning
  - Dimensioning Components:

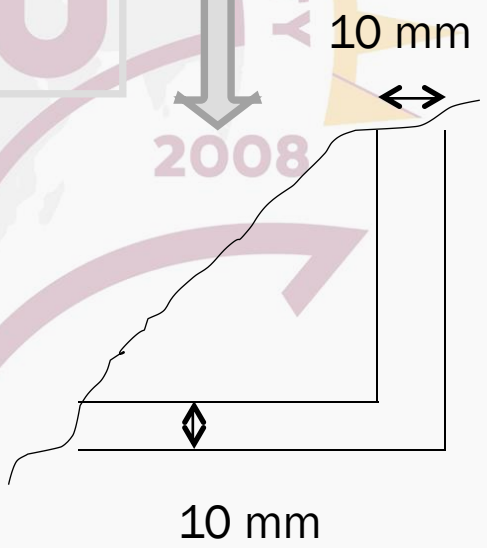
✓ Extension lines

✓ Dimension lines

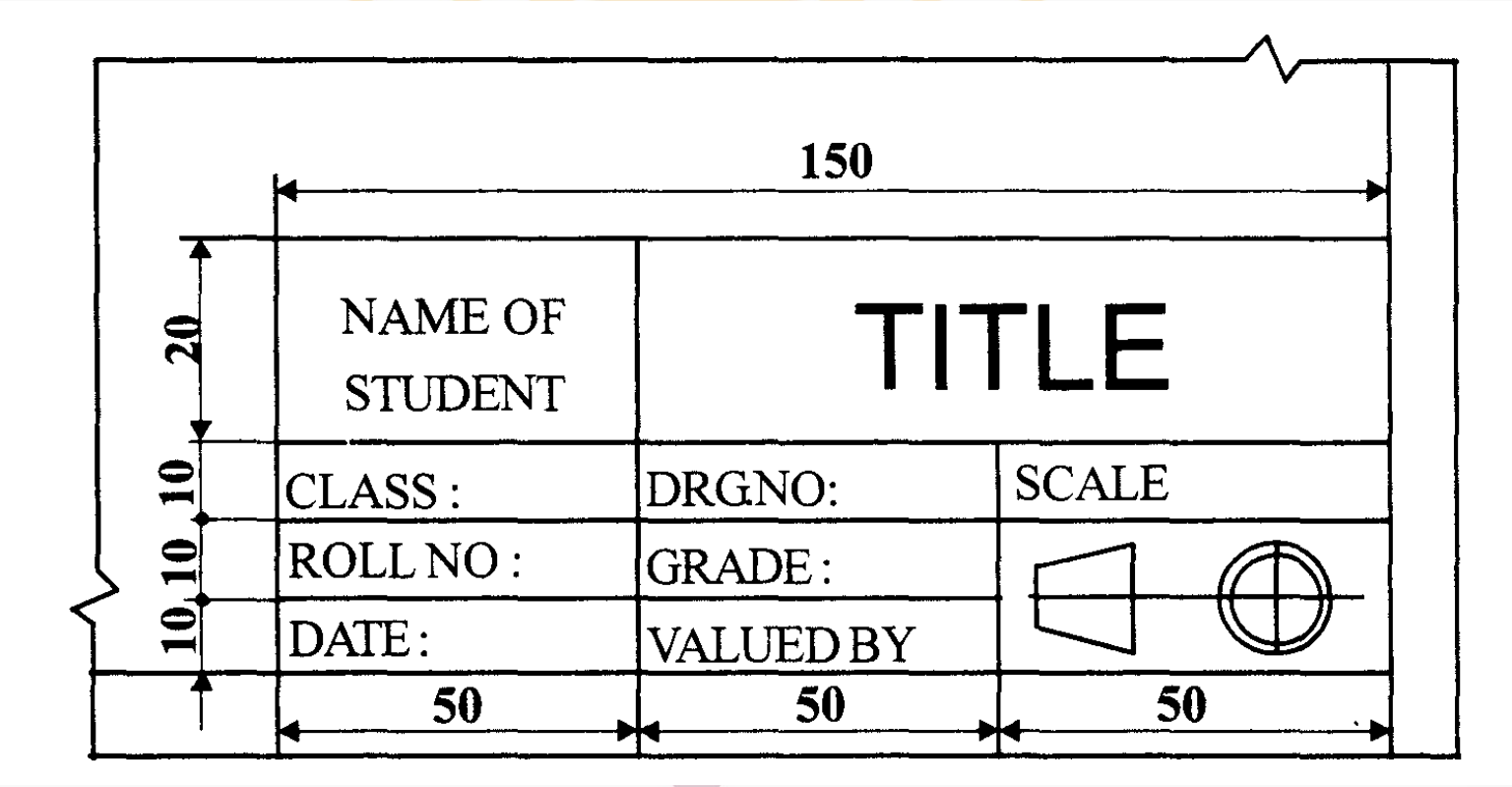
(with arrowheads)

✓ Leader lines

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



Title Block:


150
20
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NAME OF STUDENT
TITLE
CLASS :
DRGNO:
SCALE
ROLL NO :
GRADE :
DATE :
VALUED BY
50
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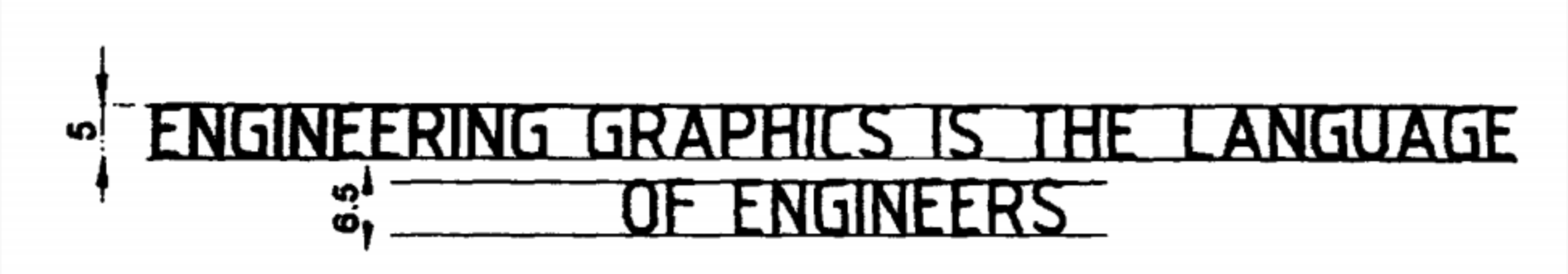
Lettering:

- Lettering is defined as writing of titles, sub-titles, dimensions, etc., on a drawing.



Lettering Technique:

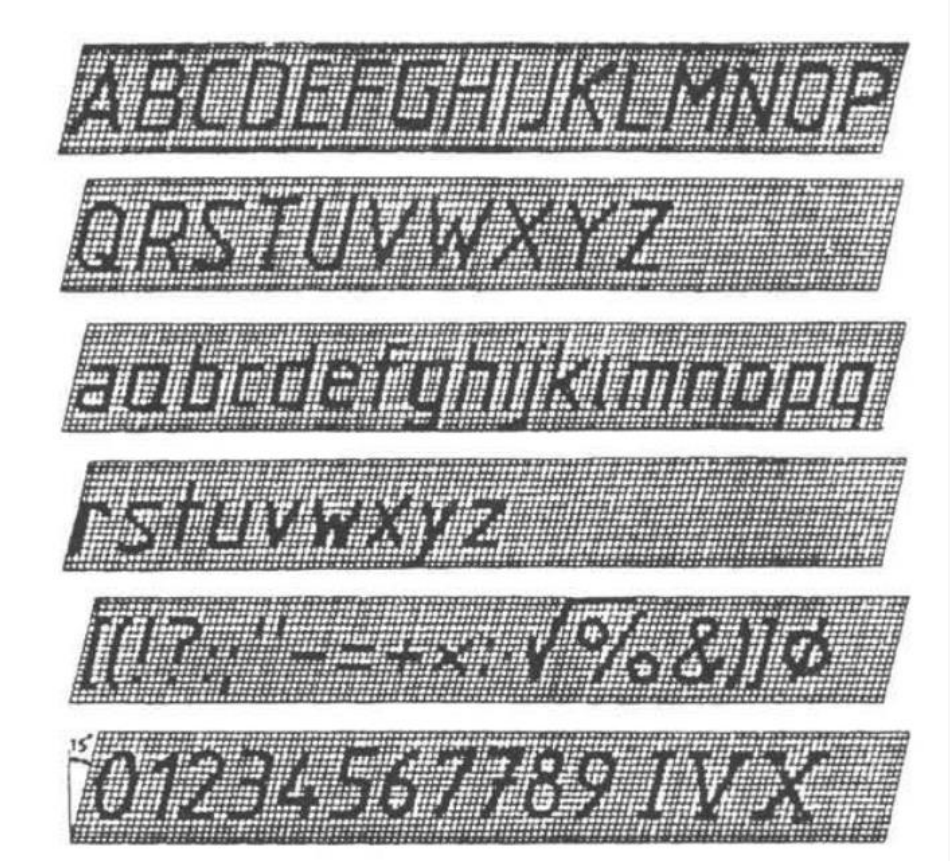
- Essential features of lettering- legibility, uniformity, ease, rapidity, and suitability for microfilming/ photocopying/ any other photographic processes.
- No ornamental/ decorative and embellishing/ enlarging style of letter.
- Plain letters and numerals which are clearly distinguishable from each other in order to avoid any confusion even in case of slight mutilations.
- The reproductions require the distance between two adjacent lines or the space between letters to be at least equal to twice the line thickness.
- The line thickness for lower case and capital letters shall be the same in order to facilitate lettering.

Lettering Technique:

- The lettering may be inclined at 15° to the right or may be vertical.

Vertical Lettering

Inclined Lettering

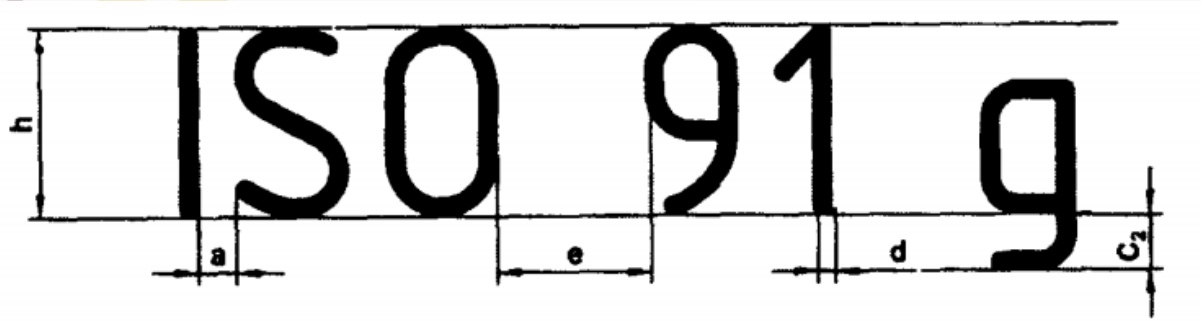


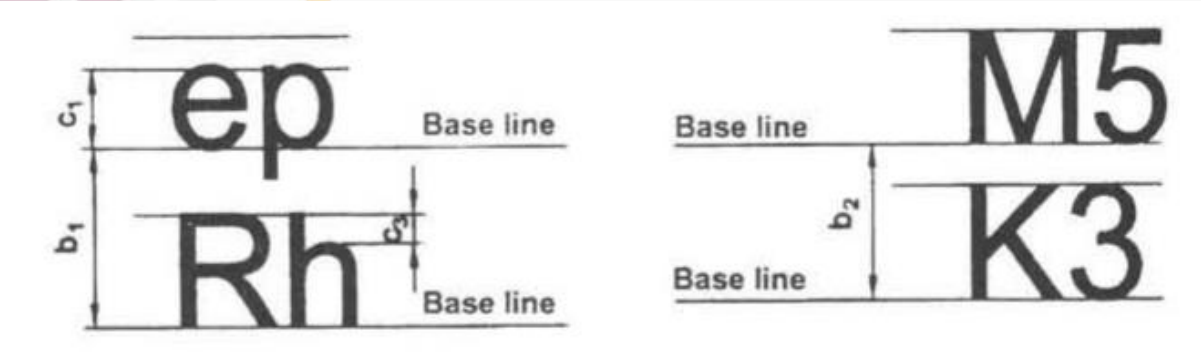
Lettering Types:

- Lettering A: height of the capital letter is divided into 14 equal parts
- Lettering B: height of the capital letter is divided into 10 equal parts.
- Your lettering must have the same height, style, and size.
- Lettering is an art that you must practice to obtain proficiency and continue practicing to maintain proficiency.

Lettering:

- BIS denotes the characteristics of lettering as :
- h (height of capital letters),
- ci (height of lower-case letters),
- c2 (tail of lower-case letters),
- c3 (stem of lower-case letters),
- a (spacing between characters),
- bl & b2 (spacing between baselines),
- e (spacing between words) and
- d (line thickness),





Size of Letters:

- Size of Letters is measured by the height h of the CAPITAL letters as well as numerals.
- Standard heights for CAPITAL letters and numerals recommended by BIS are given below :

1.8, 2.5, 3.5, 5, 6, 10, 14 and 20 mm

Note: Size of the letters may be selected based upon the size of drawing.

Procedure for Lettering:

- Guide lines: In order to obtain correct and uniform height of letters and numerals, guide lines are drawn, using

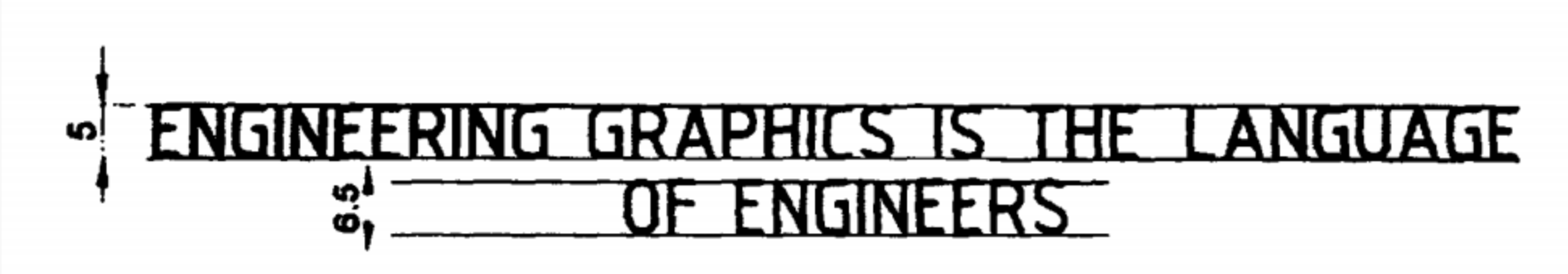
2H pencil with light pressure. HB grade conical end pencil is used for lettering.

1. Thin horizontal guide lines are drawn first at a distance ' h' apart.

2. Lettering Technique: Horizontal lines of the letters are drawn from left to right. Vertical, inclined and curved lines are drawn from top to bottom.

3. After lettering has been completed, the guidelines are not erased.

Lettering:



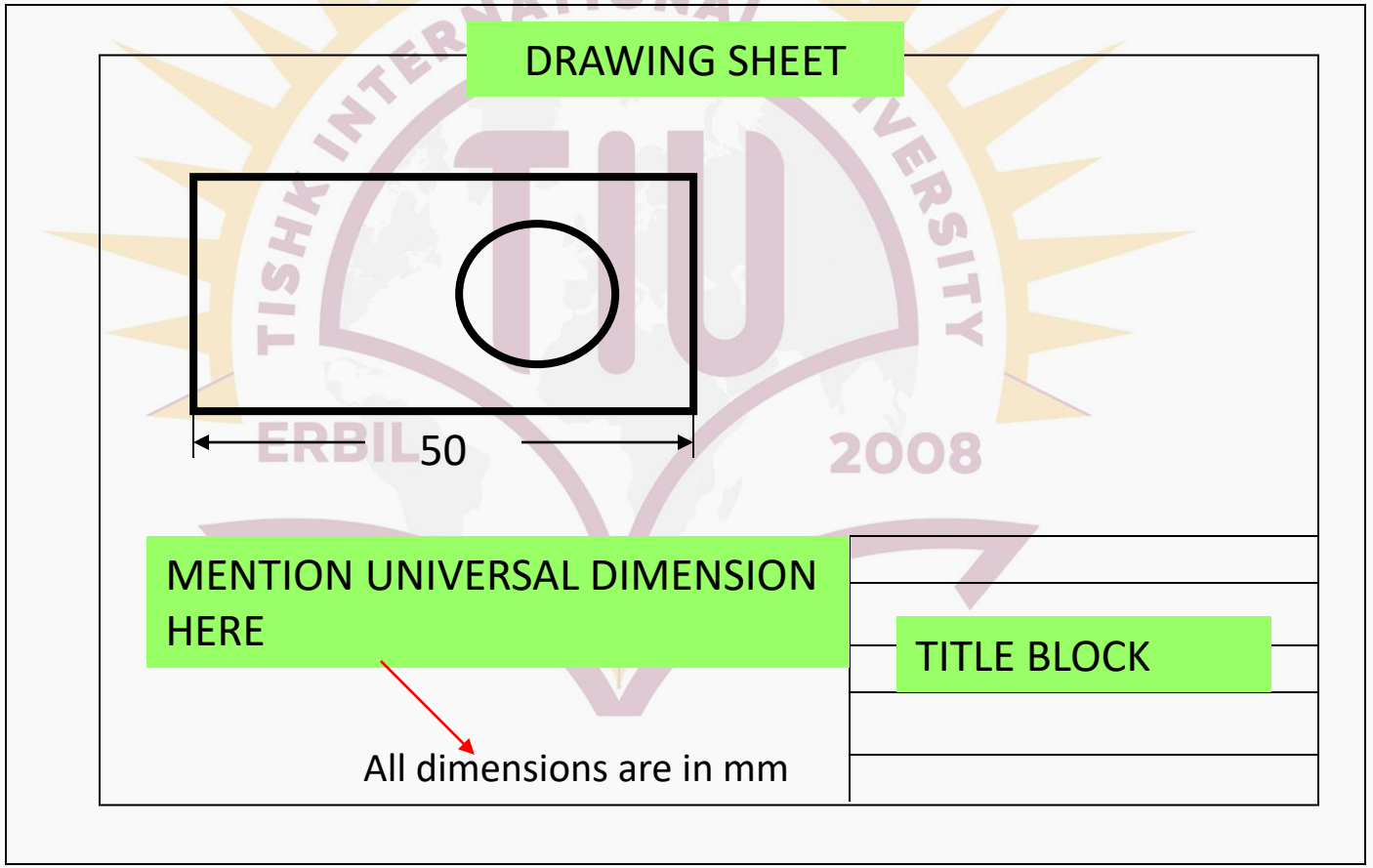
Dimensioning:

- BIS (Board of Indian Standards) defines dimension as *a numerical value expressed in appropriate units of measurement and indicated graphically on technical drawings with lines, symbols and notes.*
- Units of Measurement: The most commonly used unit for length is the millimeter. Angles are shown in degrees.
- Symbols are incorporated to indicate specific geometry wherever necessary.
- Notes are provided to give specification of a particular feature or to give specific information necessary during the manufacturing of the object.

Example on Drawing Sheet:

No dimension unit to be mentioned on the drawing

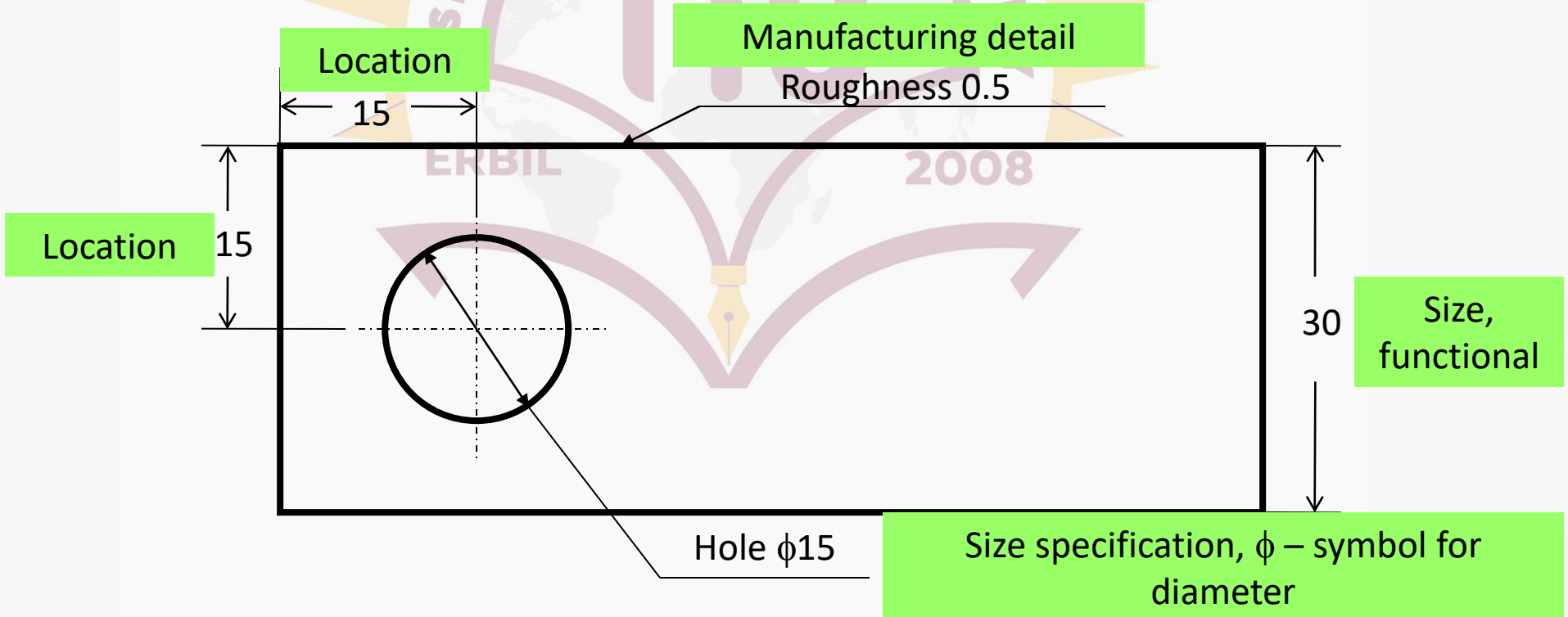
At the bottom sheet mention “All dimensions in ……”



Dimensioning:

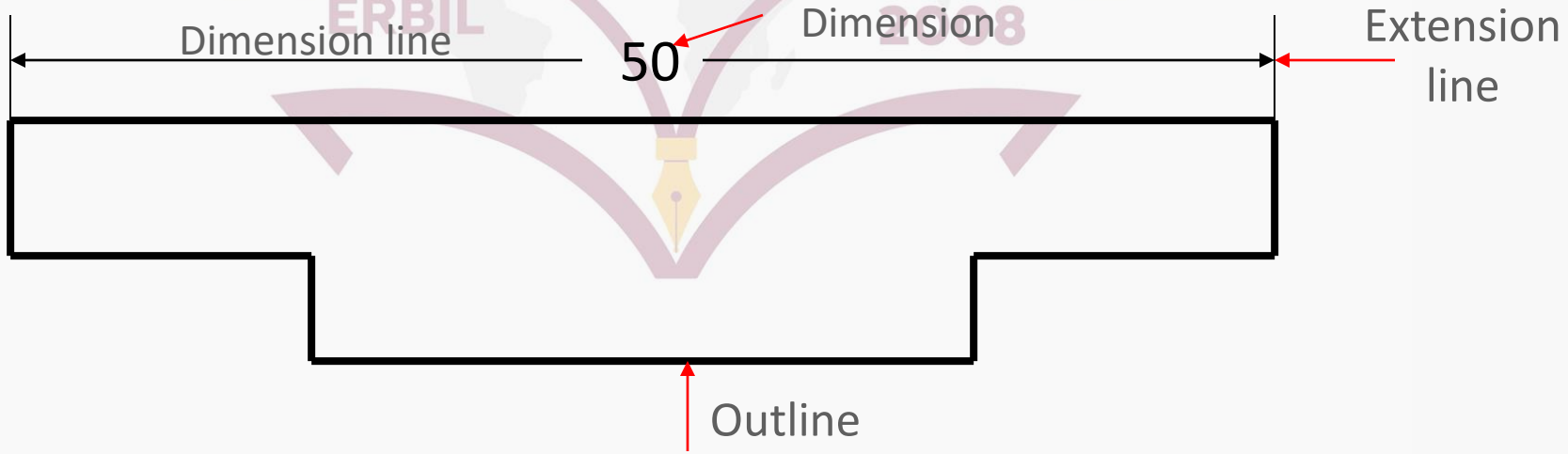
Providing information on a drawing about

- Distances (size or functional dimensions)
- Sizes and positions (location or datum dimensions) of holes, grooves and other features.
- Details relating to manufacture etc.



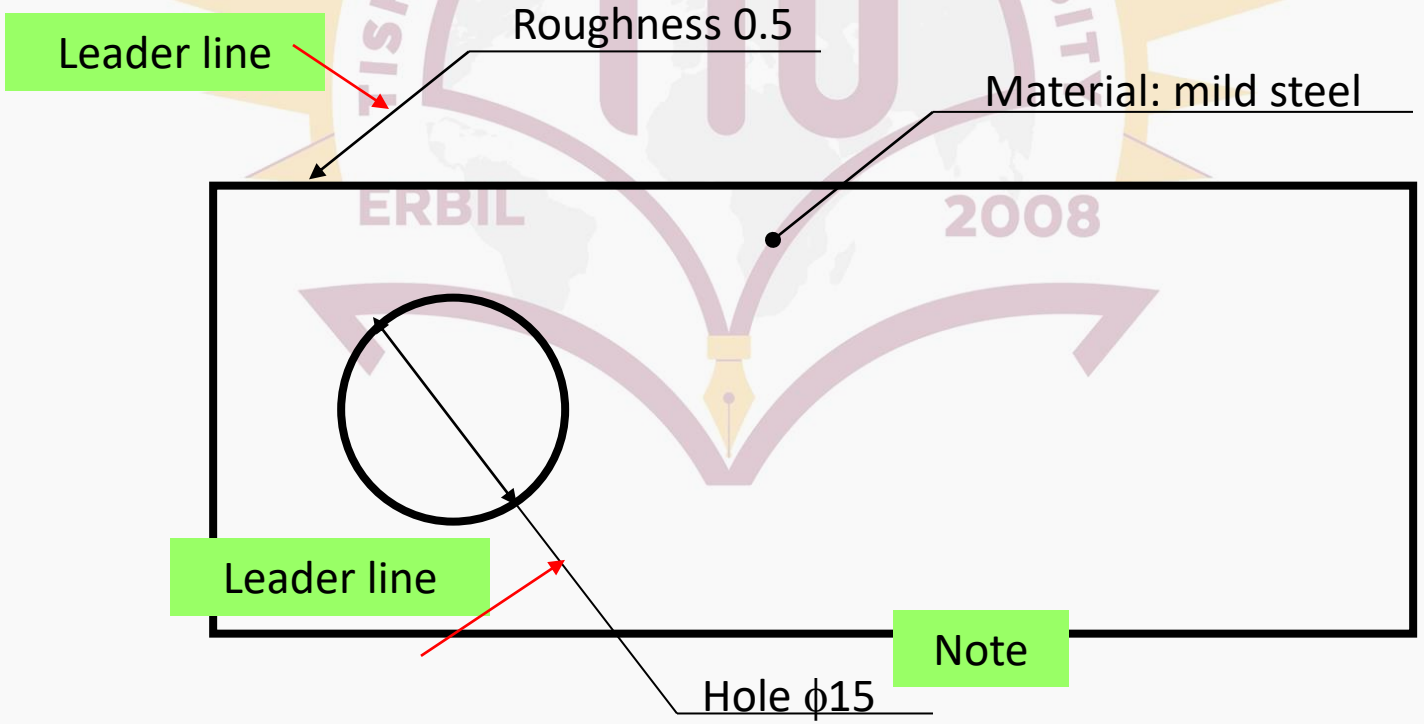
Different lines in dimensioning:

- Outline - Forms the shape of the object in a view (drawn dark and continuous)
- Extension line – An extension of an outline or centerline (drawn light and continuous, used to indicate the entity being dimensioned)
- Dimension line – Thin continuous line terminated by arrowheads touching the outlines, extension lines or center lines (used to specify end points of a dimension)



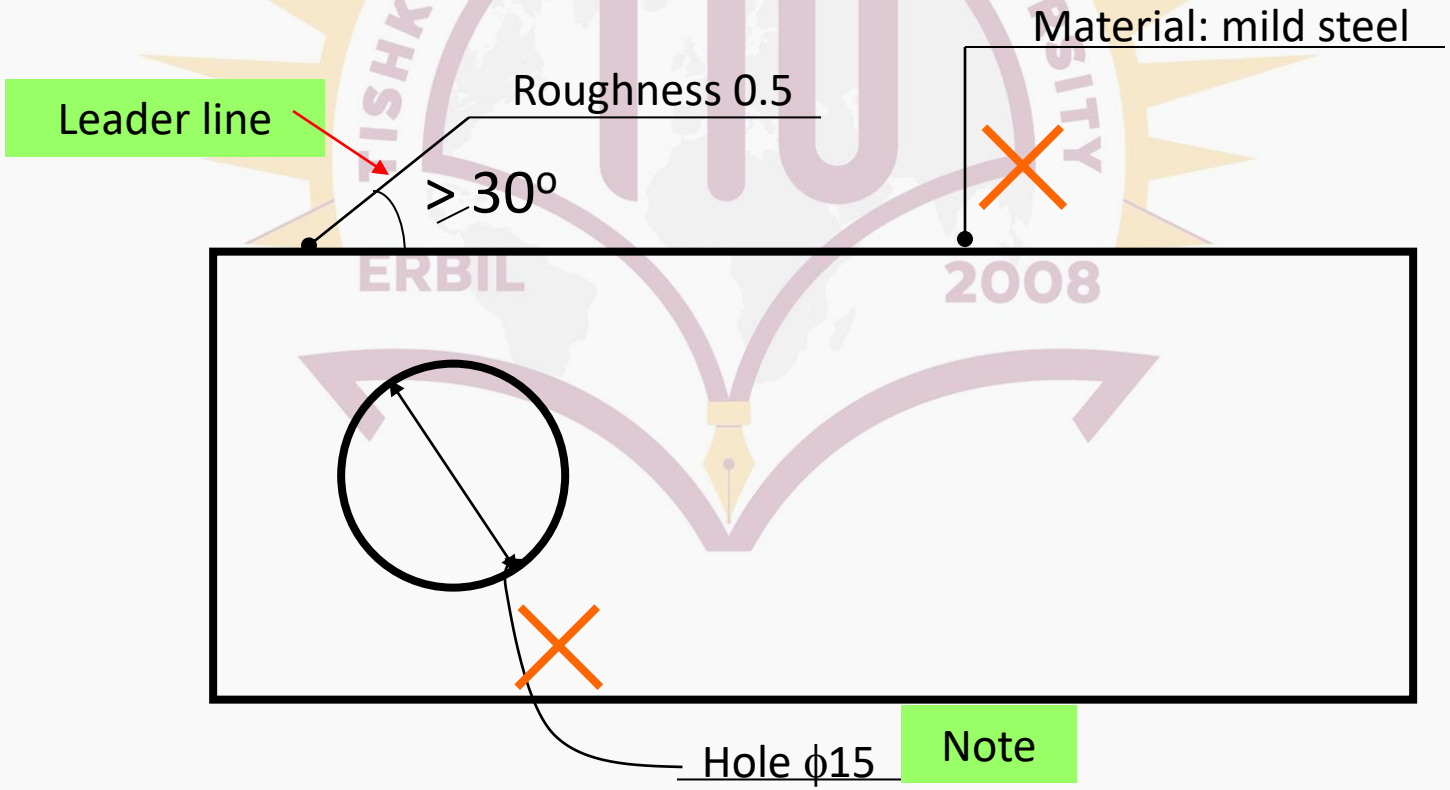
Leader lines and notes:

- Leader (or pointer) line – Thin continuous line connecting a note or dimension figure with the feature to which it applies. One end of the leader terminates in an arrowhead or dot.
- The arrowhead touches the outline while the dot is placed within the object or on the outline
- The other end of a leader is terminated in a horizontal line underlining the note



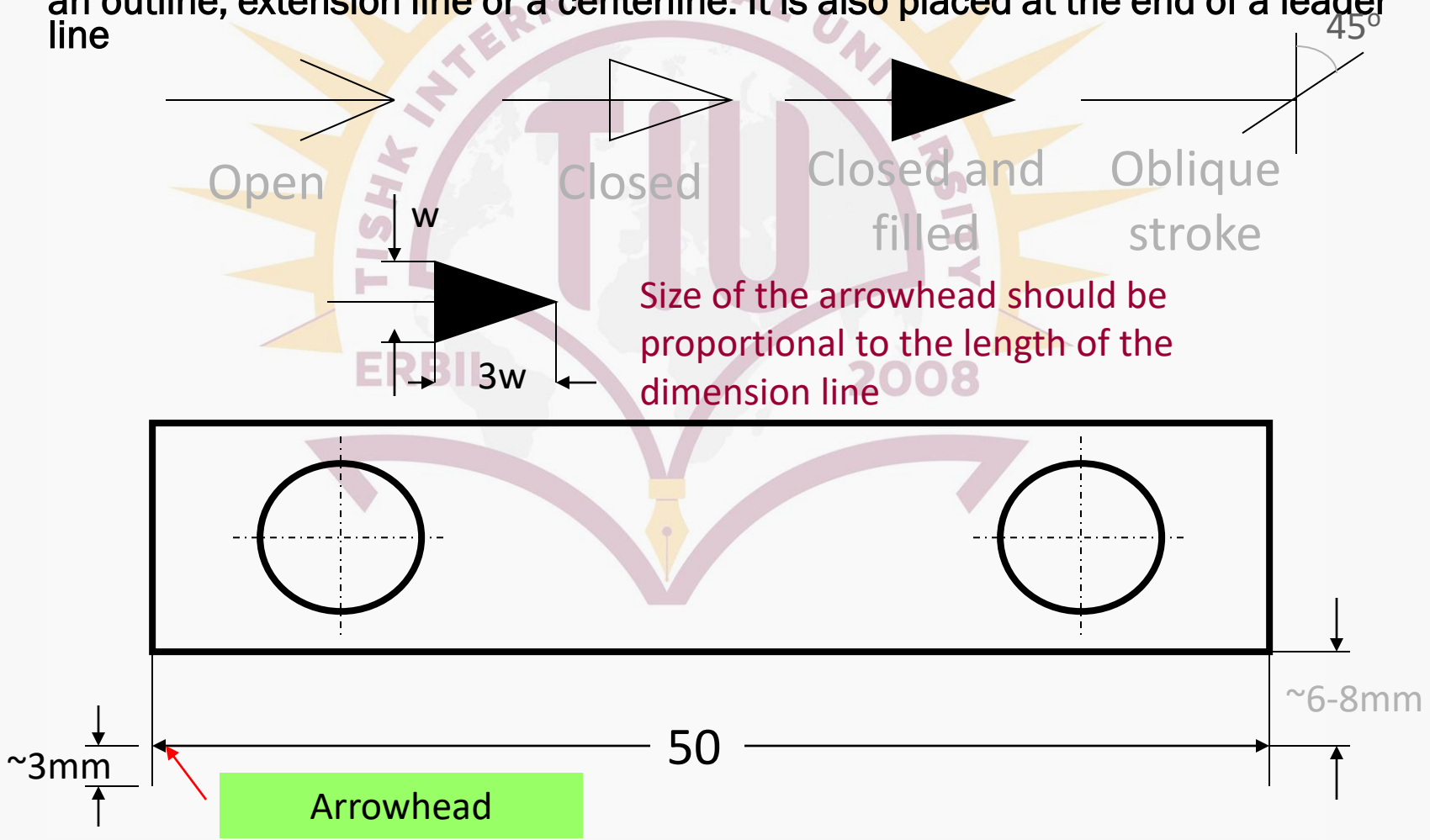
Rules for leader lines:

- A leader line is never drawn horizontal, vertical or curved
- It is drawn at an angle not less than 30° to the line that it touches
- When pointing to a circle or arc, it is drawn radially



Arrowheads and dimension line positioning:

- A dimension line is placed at least 6-8 mm away from an outline and from each other
- An extension line extends ~3mm beyond a dimension line
- Arrowhead – Placed at each end of a dimension line, its pointed end touches an outline, extension line or a centerline. It is also placed at the end of a leader line



Systems of Dimensioning:

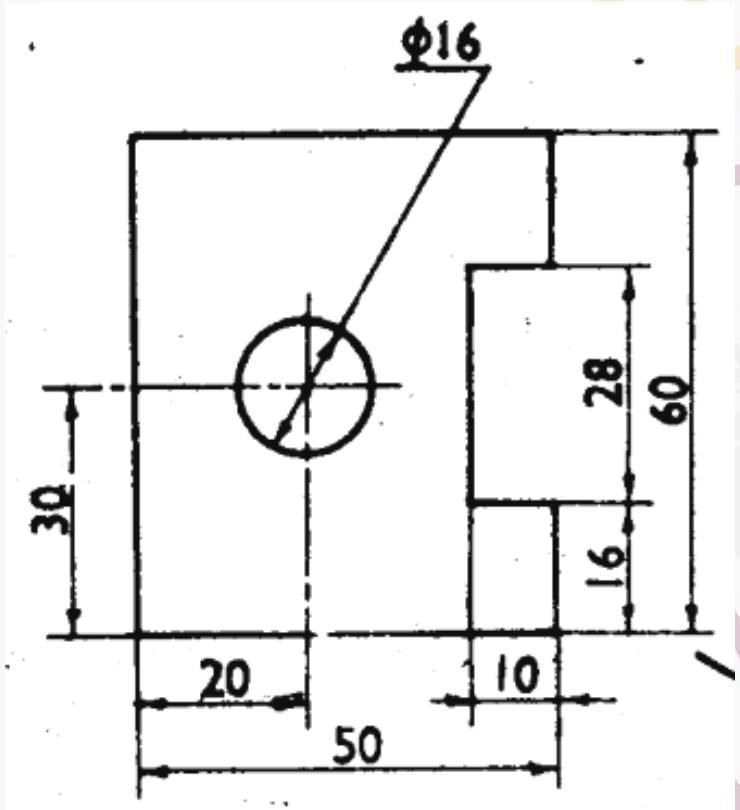
Aligned System

In the aligned system, dimensions are aligned with the entity being measured. They are placed perpendicular to the dimension line such that they may be read from the bottom or right-hand side of the drawing sheet. Dimensions are placed at the middle and on top of the dimension lines.

Unidirectional System

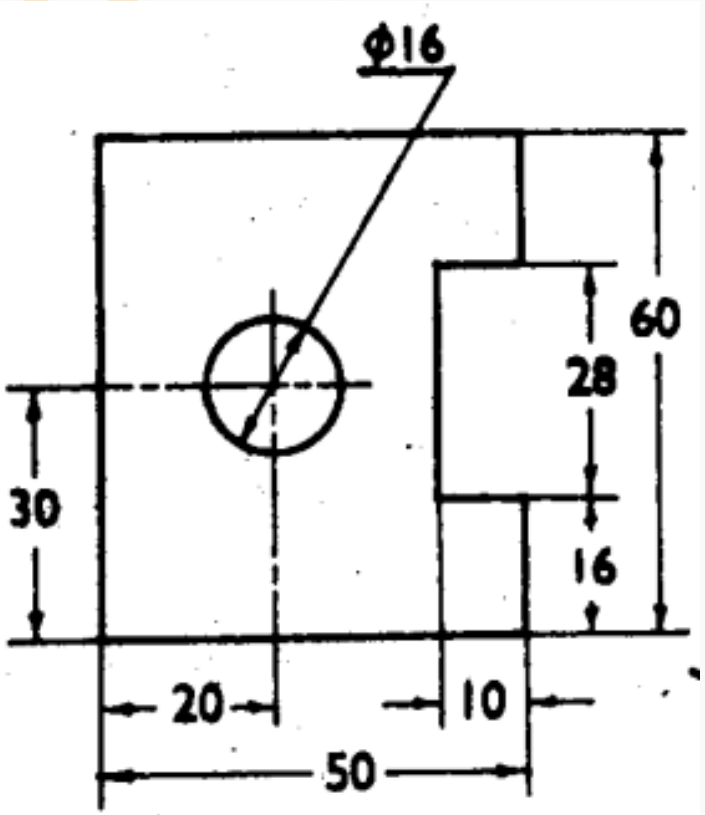
In the unidirectional system, dimensions are placed in such a way that they can be read from the bottom edge of the drawing sheet. Dimensions are inserted by breaking the dimension lines at the middle.

Dimensioning systems



Aligned system

(readable from bottom and right edge of sheet)



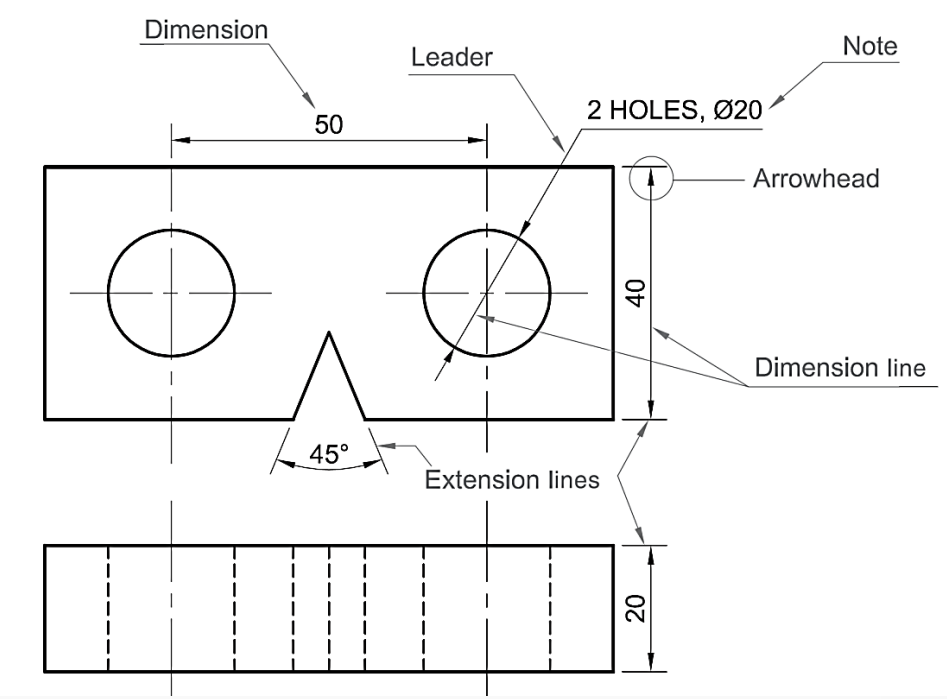
Unidirectional system

(visible from bottom edge)

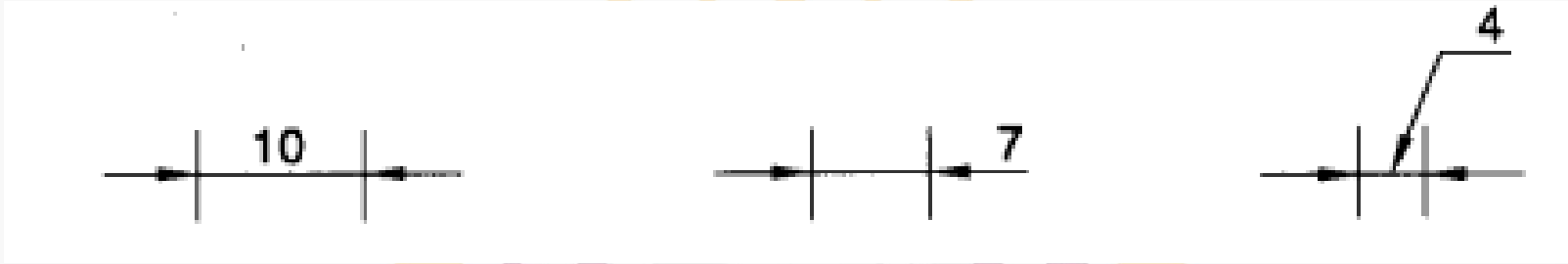
Dimensioning elements:

A line on the drawing whose length is to be shown is called an *object line*. The object line is essentially an outline representing the feature(s) of the object. While showing an angle, the two lines forming the angle will be the object lines.

Dimensioning is often done by a set of elements, which includes extension lines, dimension lines, leader lines, arrowheads and dimensions. These are shown in the figure below.



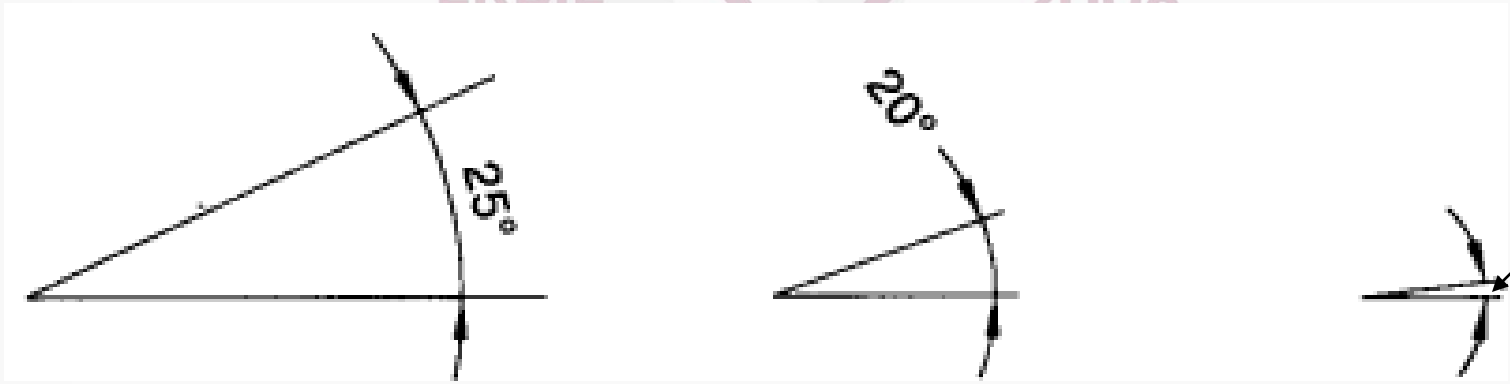
Placing of dimension:



Within extension lines

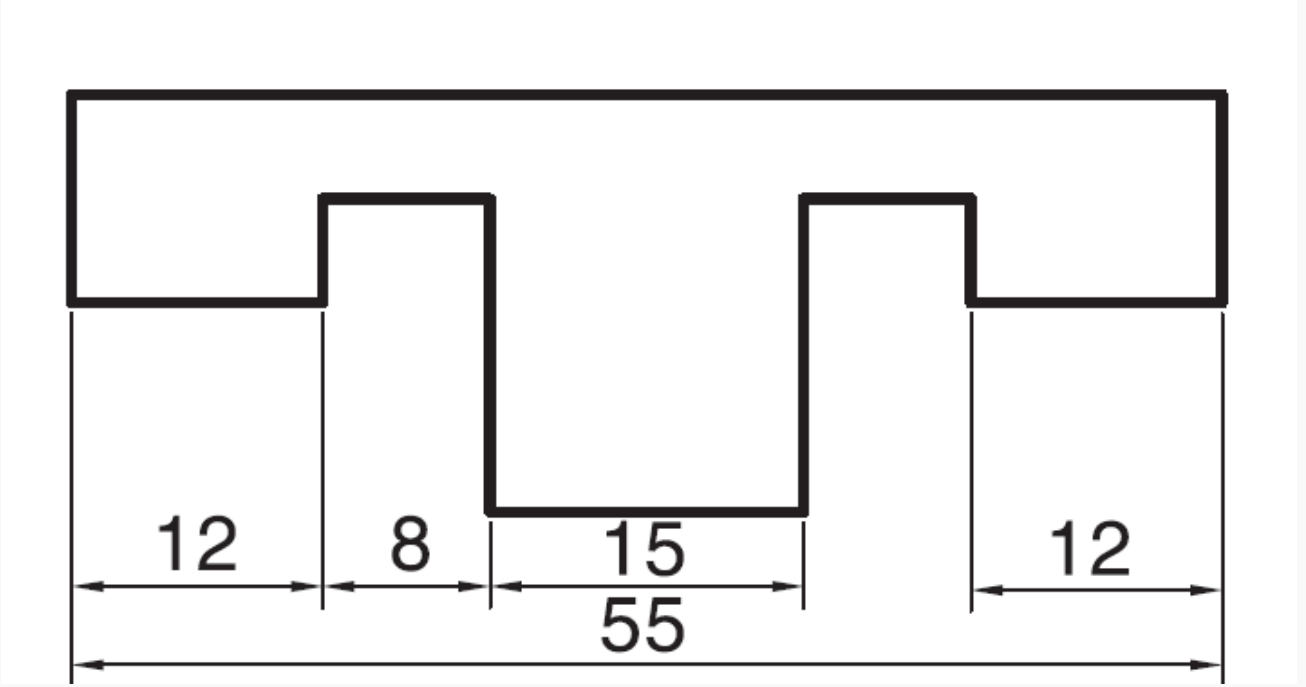
Outside extension lines

With leader



Chain (continuous) dimensioning

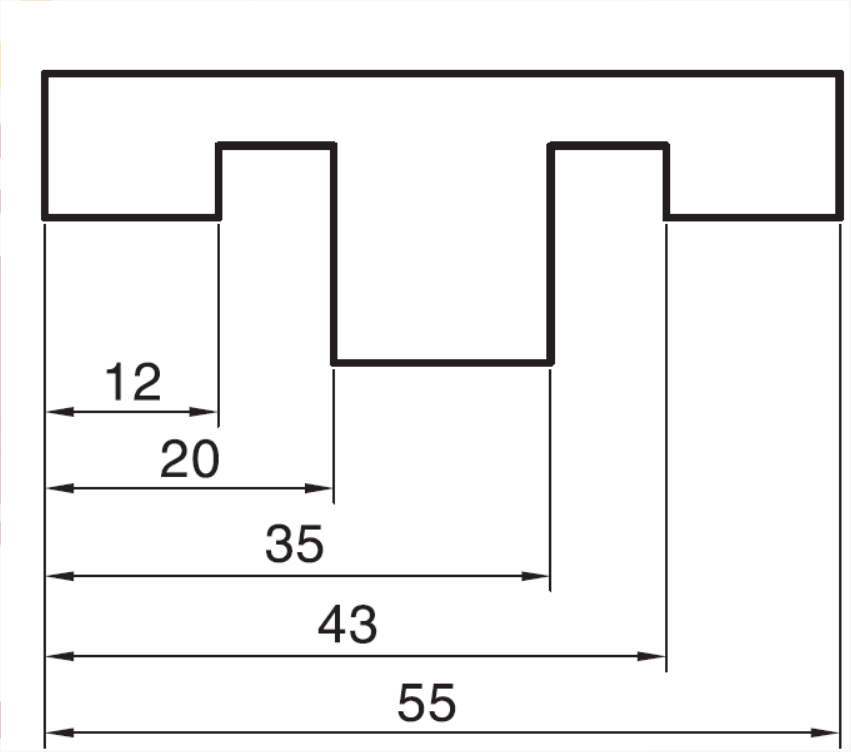
All the dimensions are aligned in such a way that an arrowhead of one dimension touches tip-to-tip the arrowhead of the adjacent dimension. The overall dimension is placed outside the other smaller dimensions



Parallel (progressive) dimensioning:

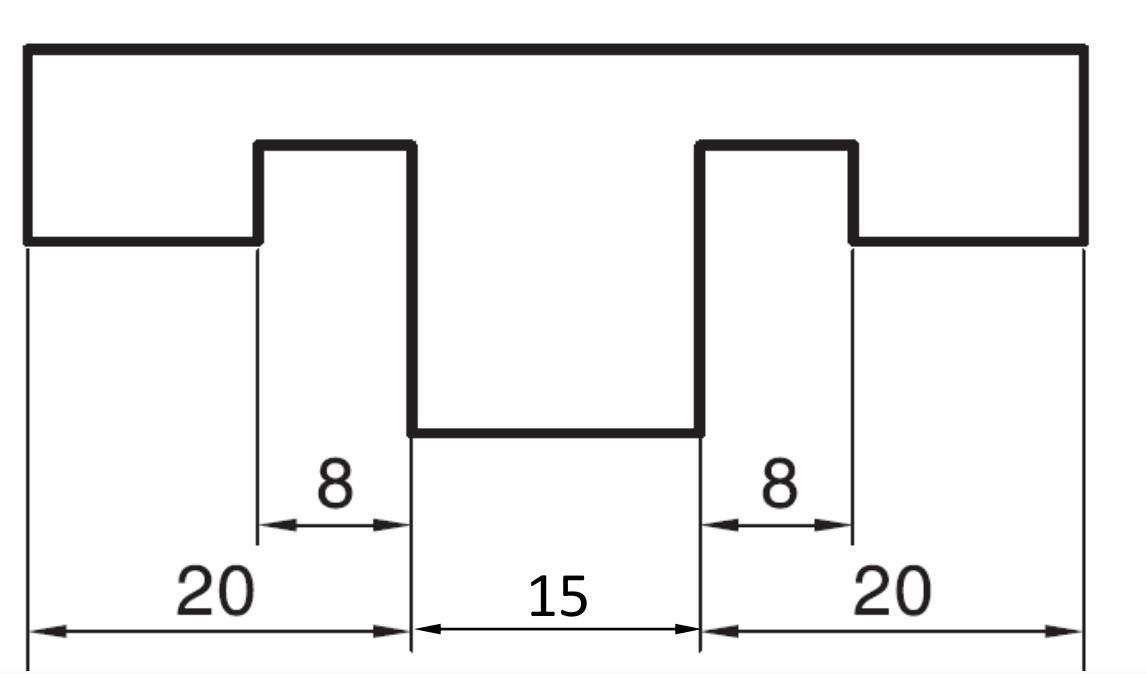
All the dimensions are shown from a common reference line. Obviously, all these dimensions share a common extension line. This method is adopted when dimensions have to be established from a particular datum surface.

Smaller dimensions should always be placed nearer the view. The next smaller dimension should be placed next and so on.



Combined dimensioning:

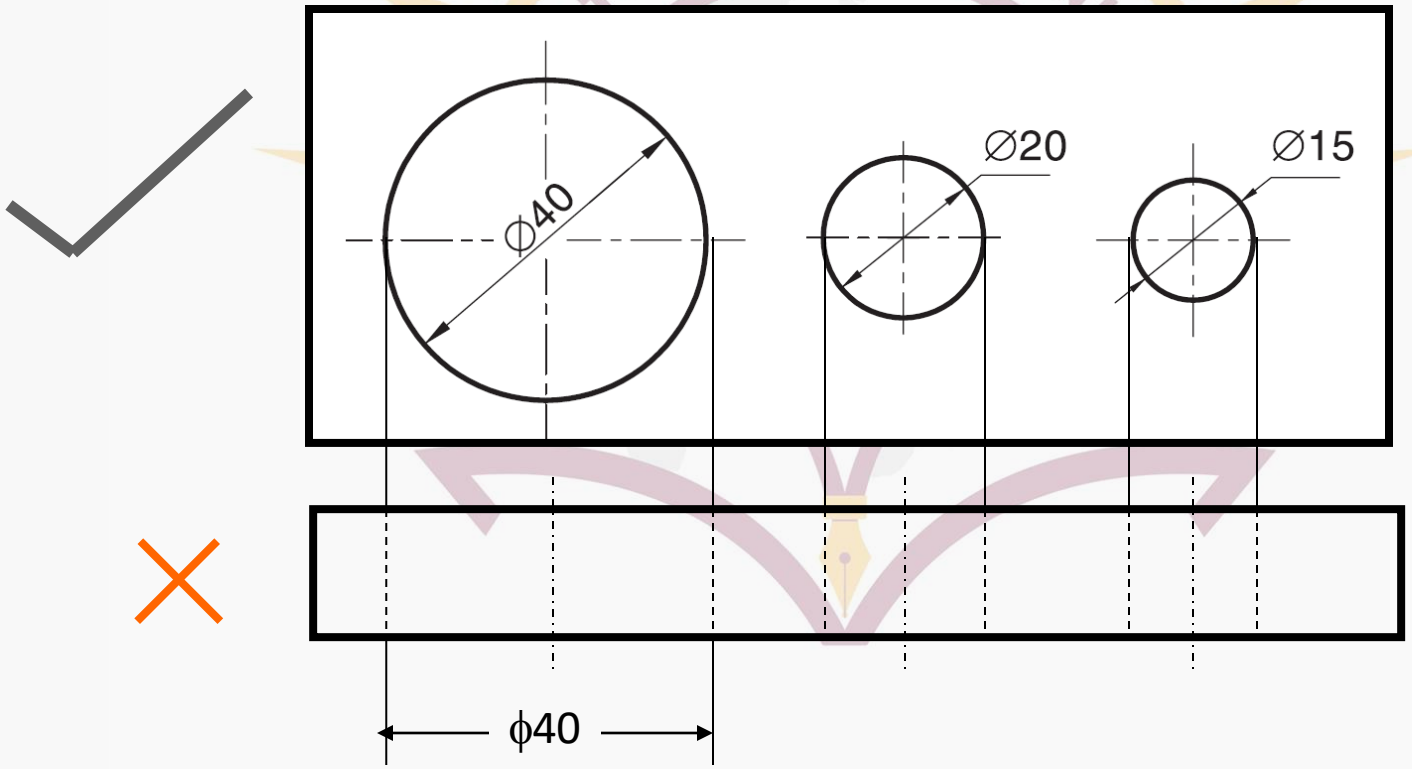
When both the methods, i.e., chain dimensioning and parallel dimensioning are used on the same drawing, the method of dimensioning is called combined dimensioning



Circular holes:

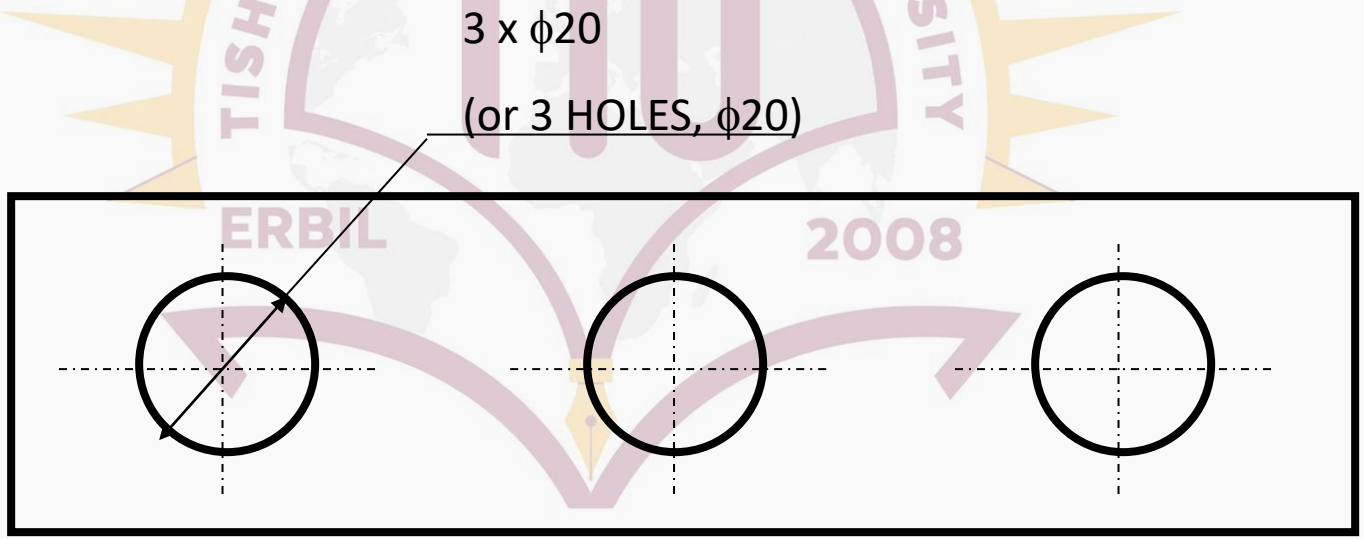
A hole is usually dimensioned by giving its diameter instead of radius. The dimension indicating a diameter should always be preceded by the symbol ø

They should be dimensioned in the view in which they appear as circles



Number of holes with same size:

- When more than one hole of the same size forms a pattern, it is not necessary to dimension each one.
- One hole is dimensioned and a note specifies the total number of holes with that dimension.

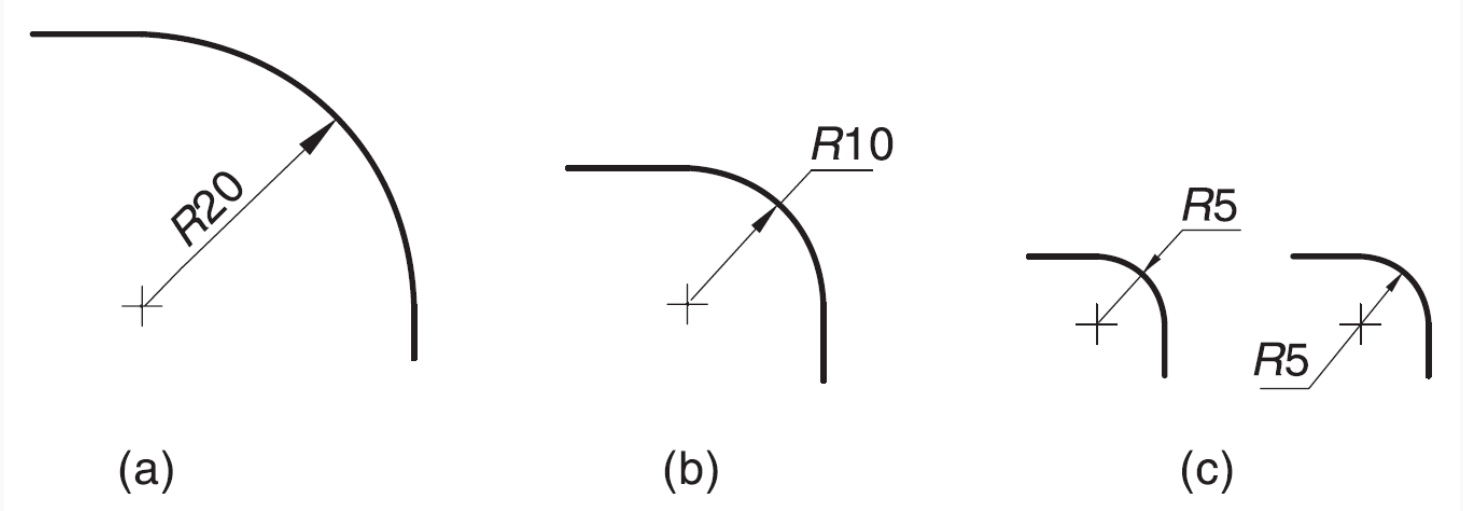


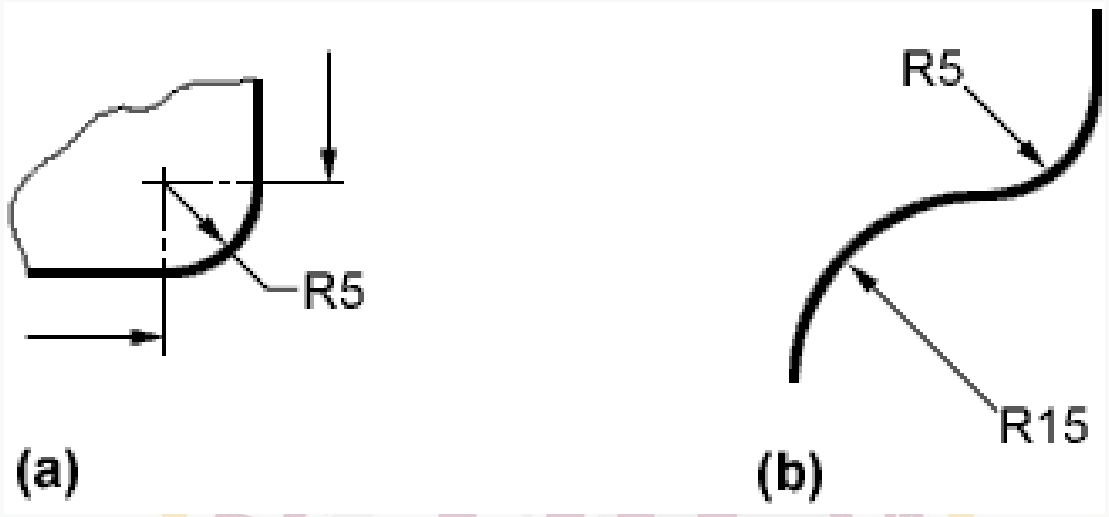
Dimensioning arcs:

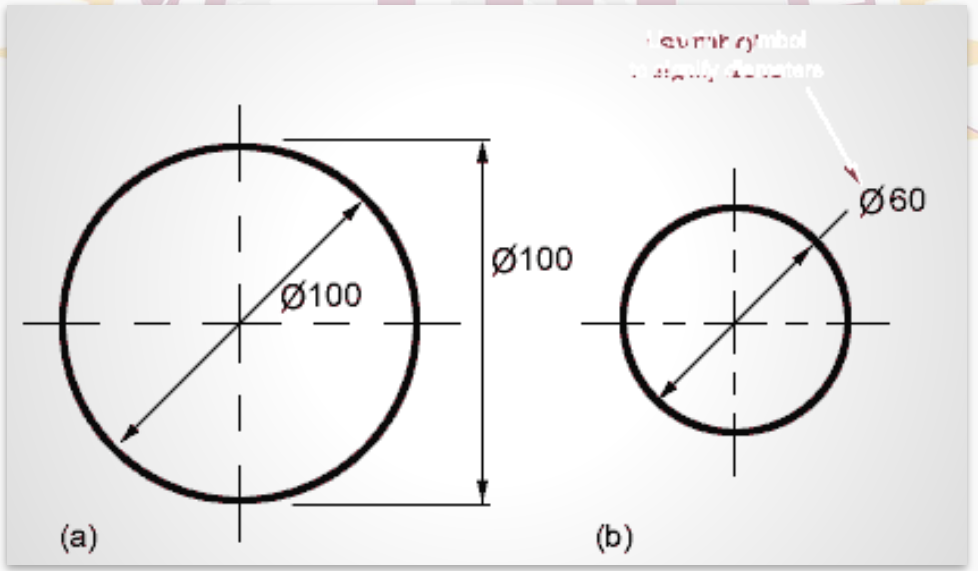
An arc is usually dimensioned by giving its radius. The dimension indicating radius should be preceded by symbol *R*

The R can be placed after the dimension also

The position of center of arc is denoted by a +



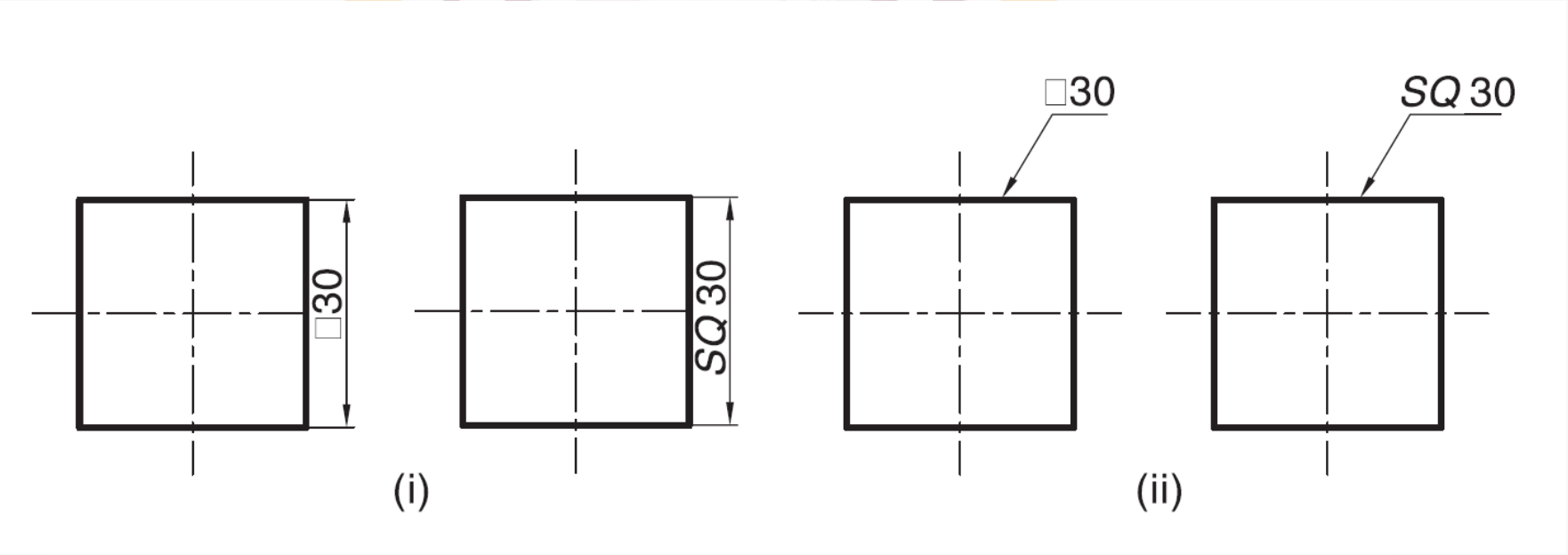

R5
(a)
R5
R15
(b)


Ø100
Ø100
(a)
Ø60
(b)

Dimensioning of squares:

Square features (e.g., a rod of square cross-section) are dimensioned using symbol

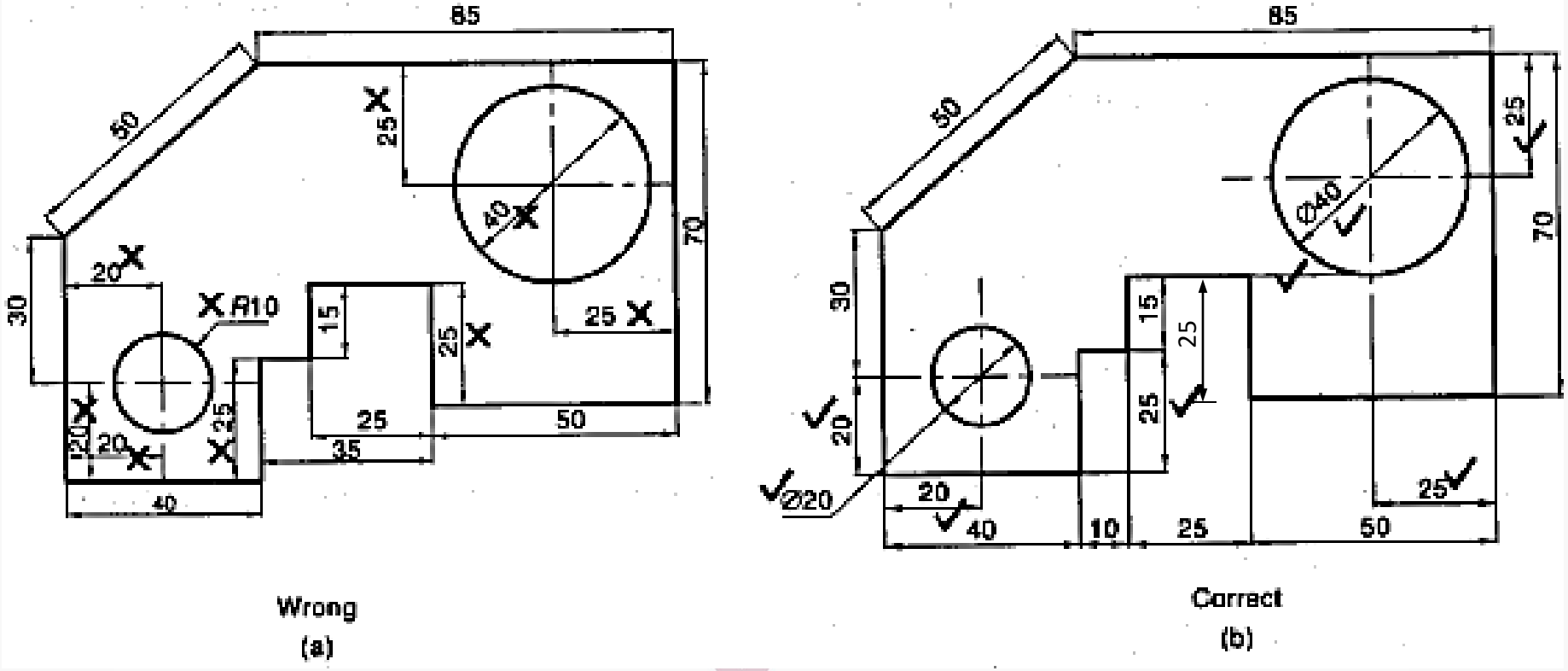
or *SQ* as shown in (i) or (ii)



General rules of dimensioning:

1. Between any two extension lines, there must be one and only one dimension line bearing one dimension. One of the extension lines may be common to another dimension as in parallel dimensioning.
2. As far as possible, all the dimensions should be placed outside the views. Inside dimensions are preferred only if they are clearer and more easily readable.
3. All the dimensions on a drawing must be shown using either Aligned System or Unidirectional System. The two systems should not be mixed on the same drawing.
4. The same unit of length should be used for all the dimensions on a drawing. The unit should not be written after each dimension, but a note mentioning the unit should be placed below the drawing.
5. Dimension lines should not cross each other. Dimension lines should also not cross any other lines of the object.
6. All dimensions must be given.
7. Each dimension should be given only once. No dimension should be redundant.

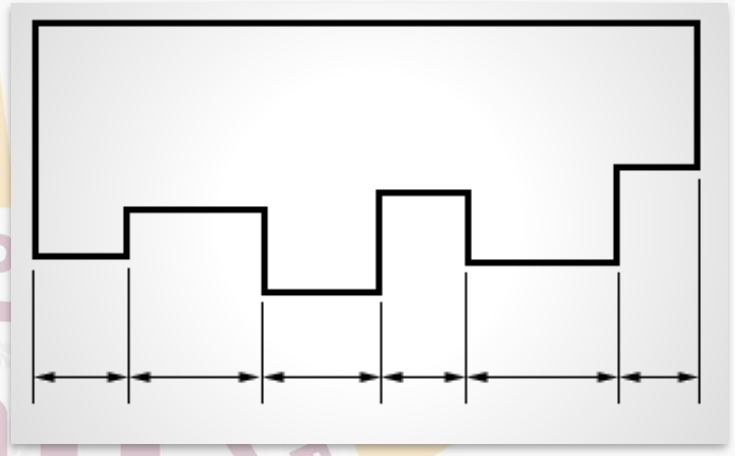
Dimensioning, correct vs. wrong:



Symbols and abbreviations used in Eng. drawing:

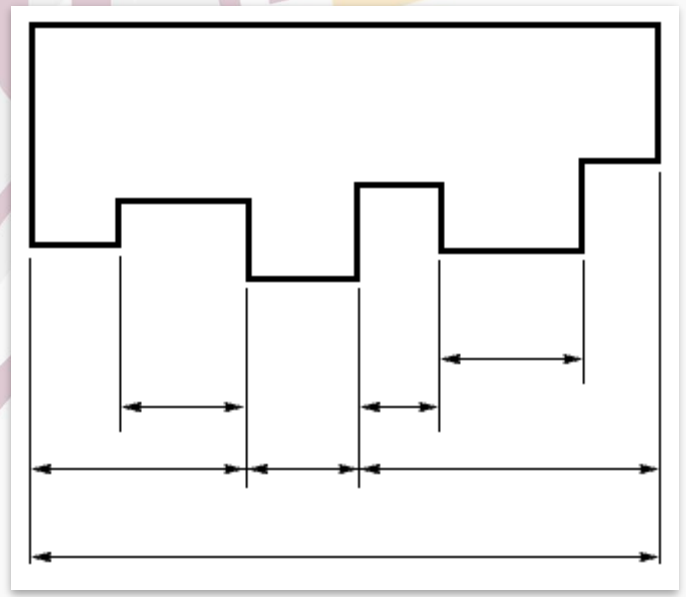
Symbol/Abbreviation	*Meaning*	*Symbol/Abbreviation*	*Meaning*
ϕ	Diameter	LG	Long
$S\phi$	Spherical Diameter	CSK	Countersunk
R	Radius	C'BORE	Counterbore
SR	Spherical Radius	SF or S'FACE	Spotface
□ or SQ	Square		Conical Taper
CYL	Cylinder or Cylindrical		Flat taper
PCD	Pitch Circle Diameter	M	Metric Thread
EQ SP	Equispaced		

- Chain Dimensioning



- Combined Dimensions

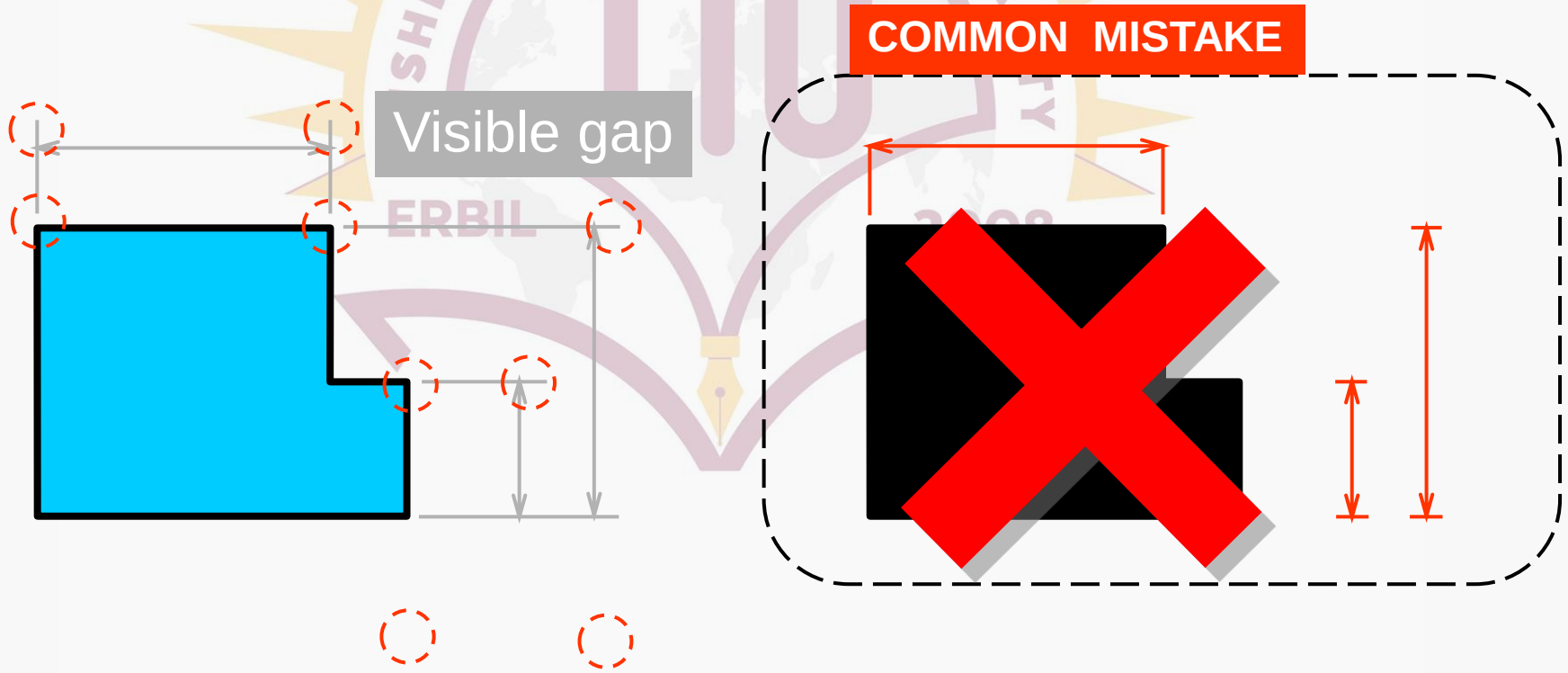
A combined dimension uses both chain and parallel dimensioning.



Recommended Practices

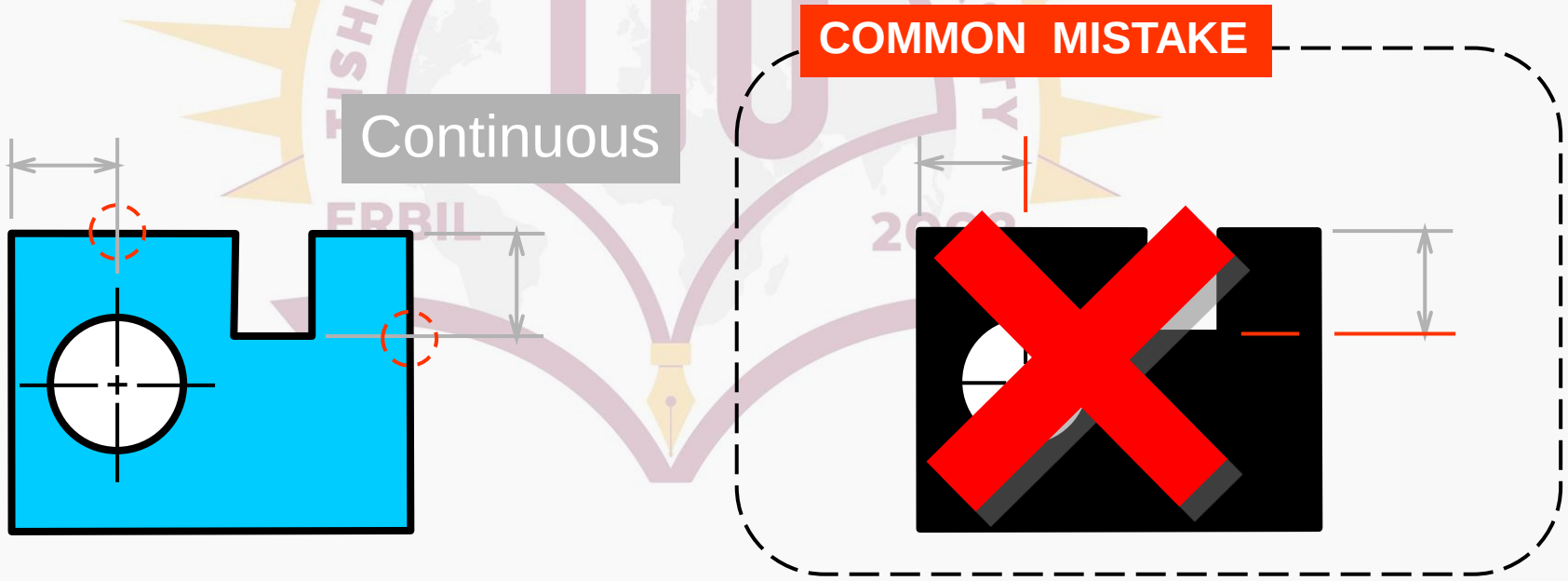
EXTENSION LINES

- Leave a **visible gap** (≈ 1 mm) from a view and start drawing an extension line.
- Extend the lines beyond the (last) dimension line 1-2 mm.



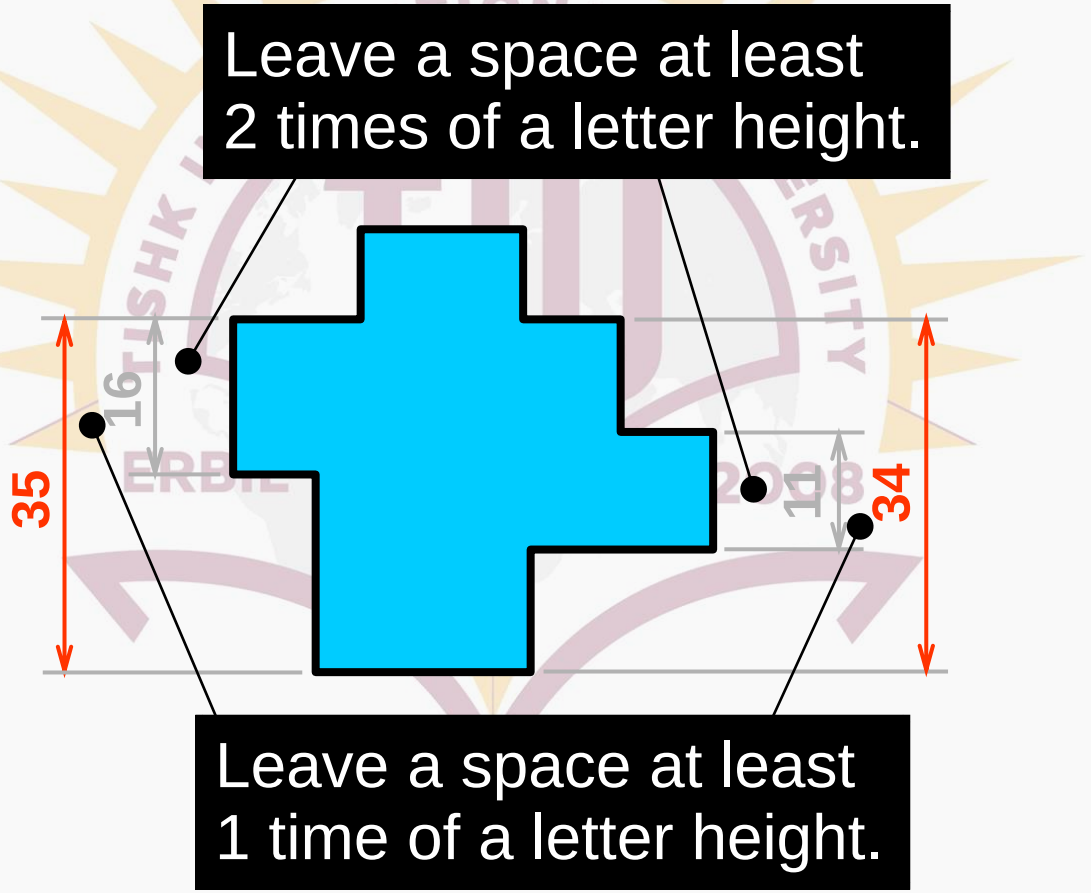
Extension Lines

- **Do not** break the lines as they cross object lines.



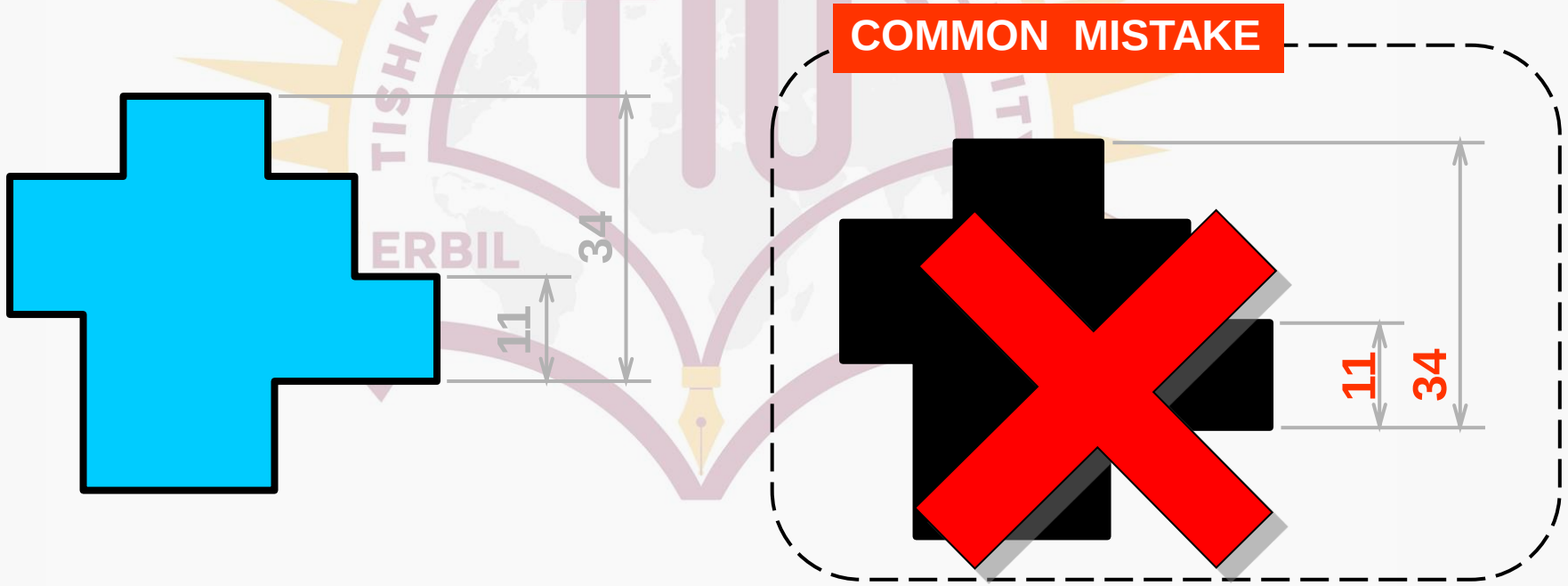
Dimension Lines

- Dimension lines should **not** be spaced too close to each other and to the view.



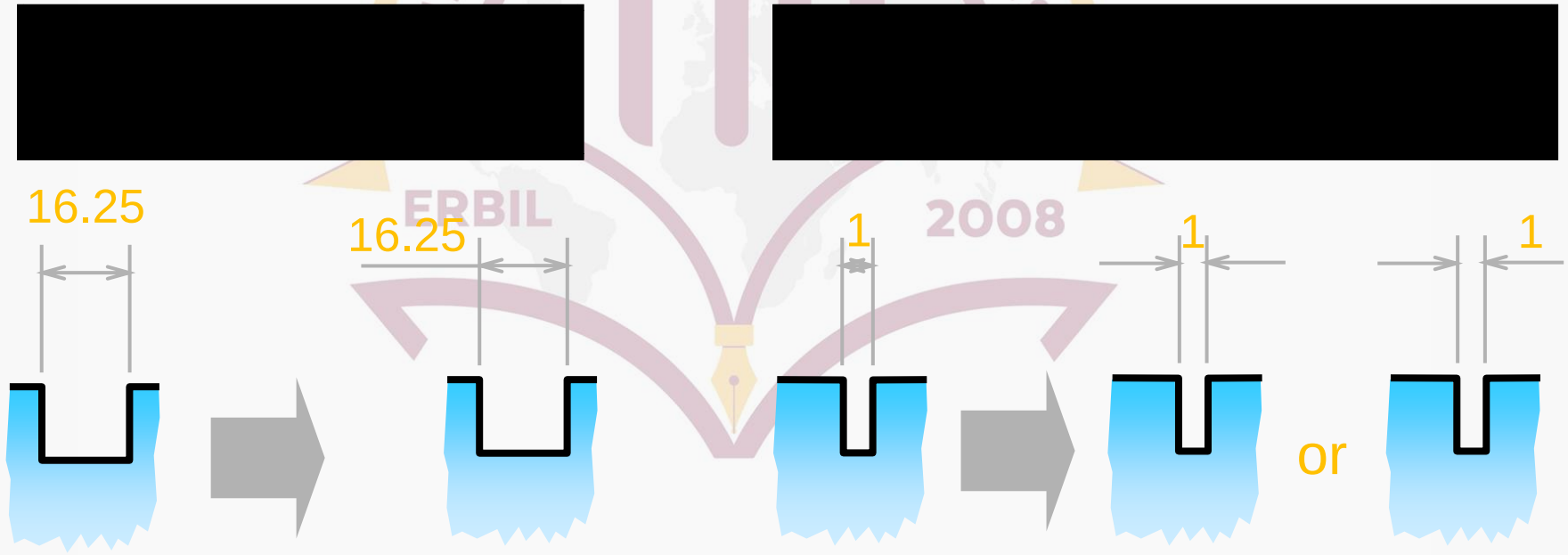
Dimension Figures

- The height of figures is suggested to be 2.5~3 mm.
- Place the numbers at about 1 mm *above dimension line* and *between extension lines*.

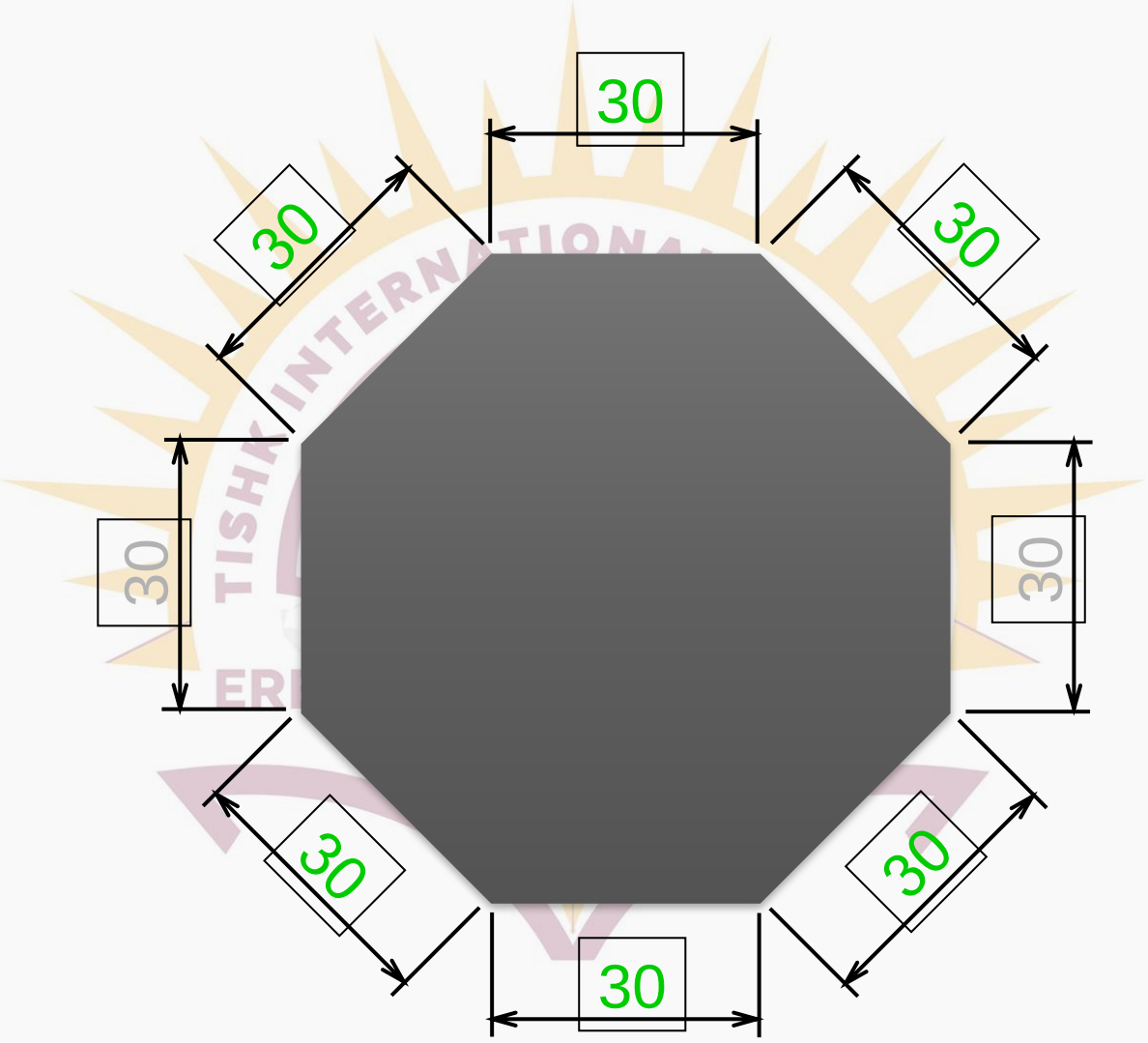


Dimension Figures

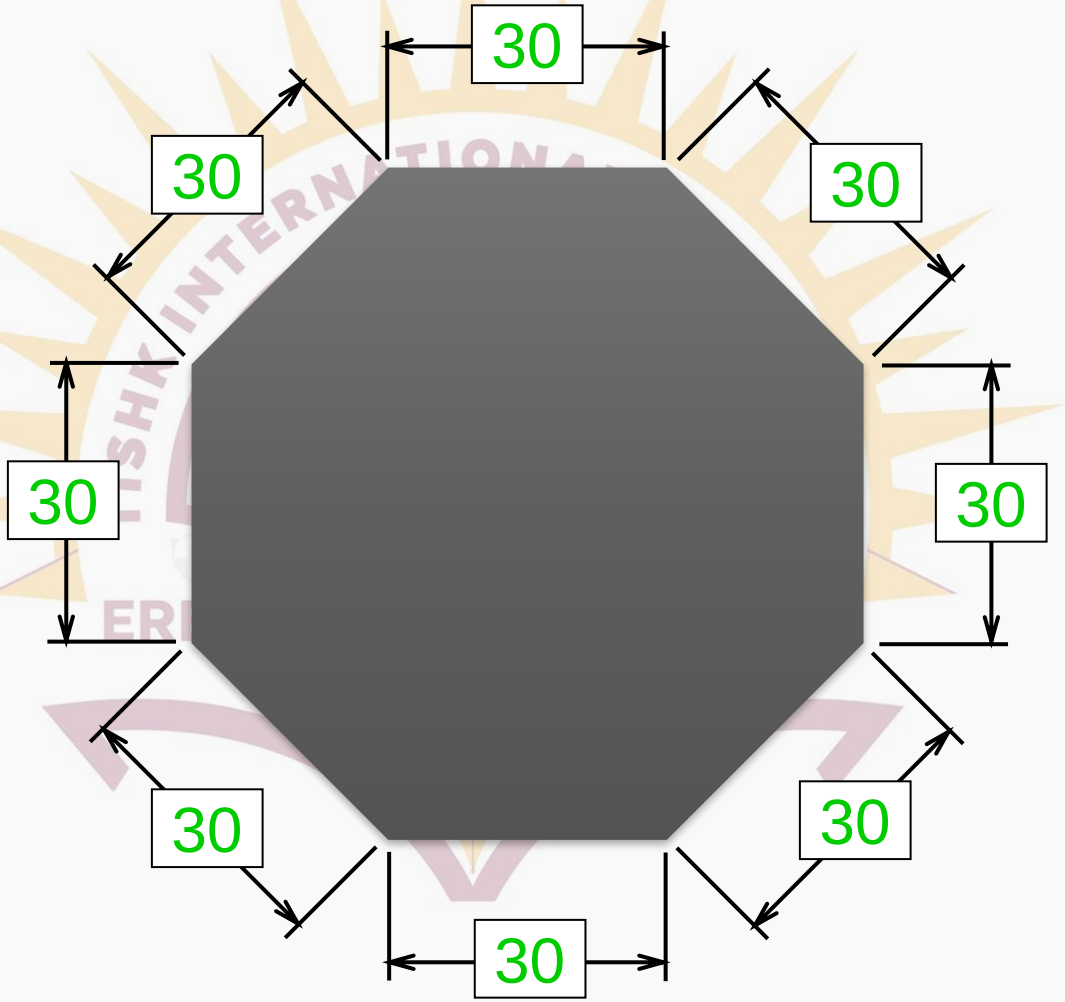
- When there is **not** enough space for figure or arrows, put it **outside** either of the extension lines.



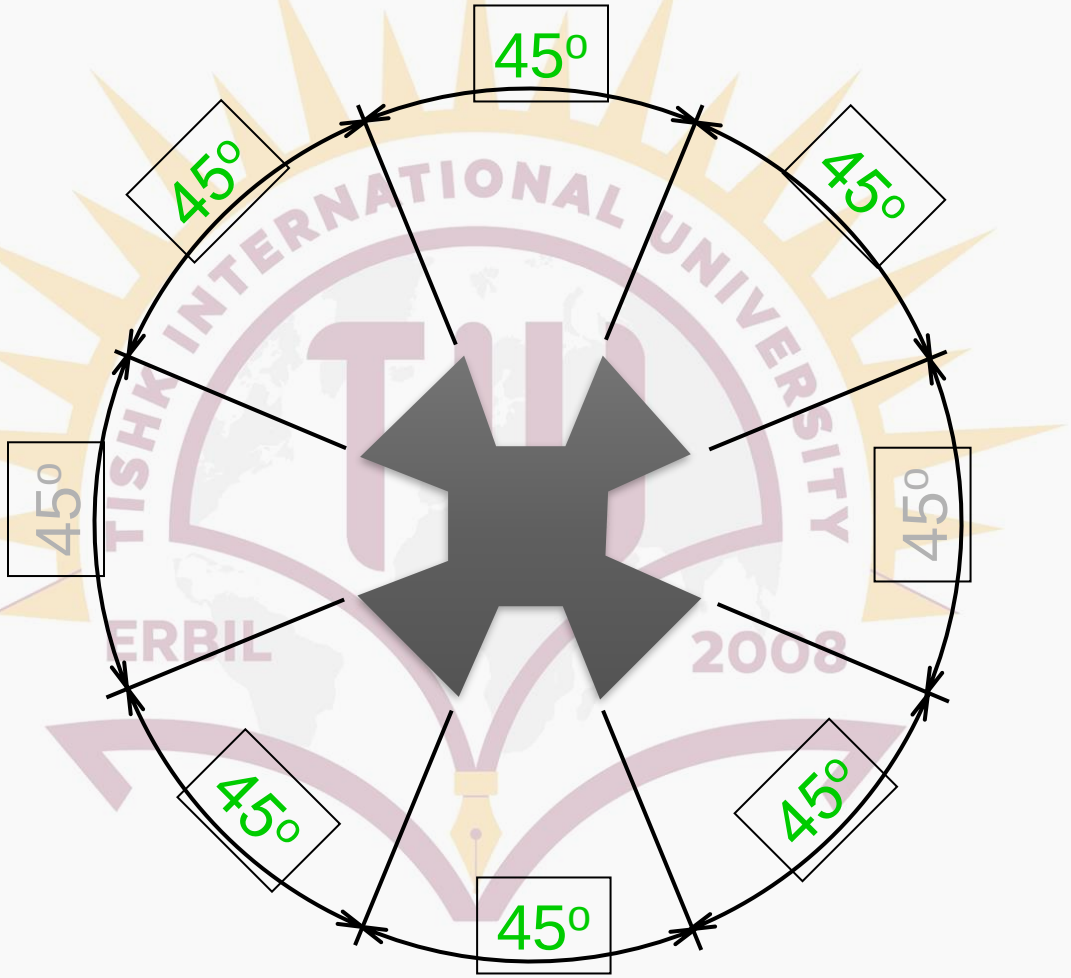
EXAMPLE : Dimension of ***length*** using ***aligned*** method.



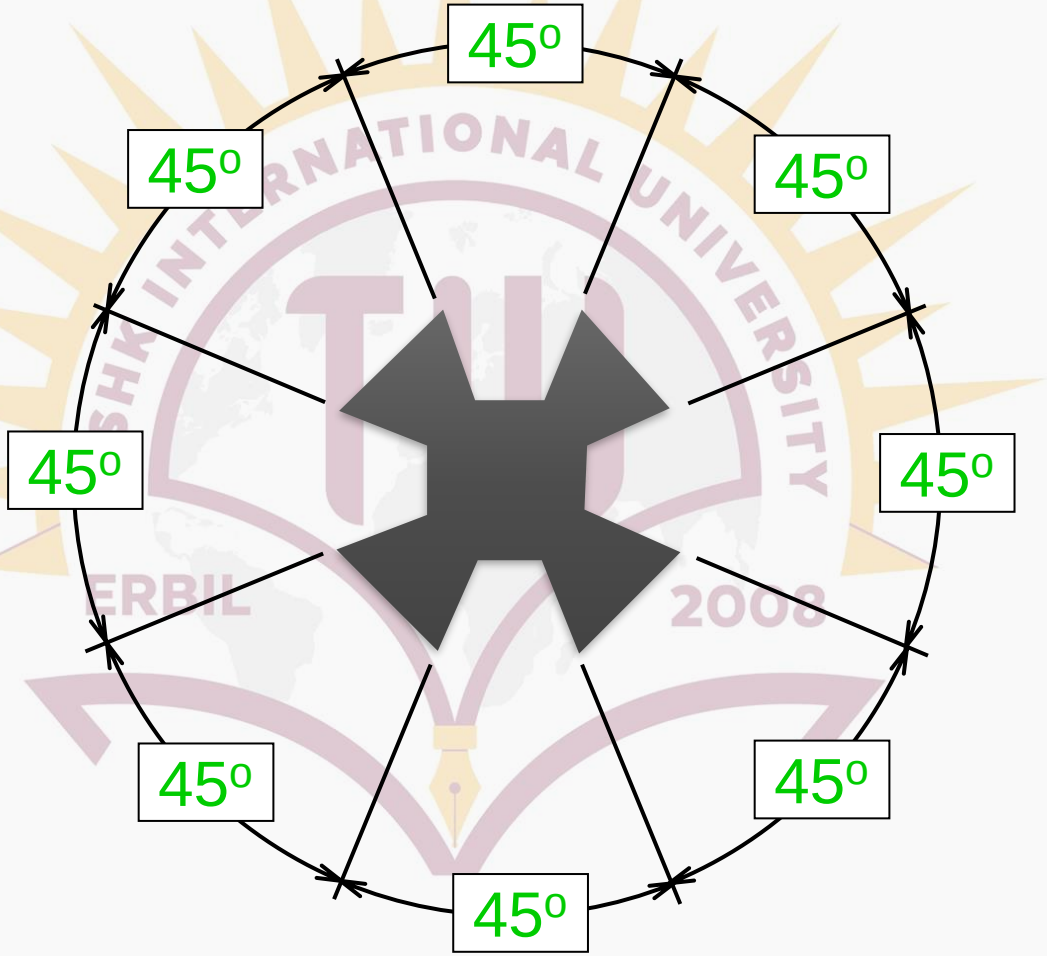
EXAMPLE : Dimension of ***length*** using ***unidirectional*** method.



EXAMPLE : Dimension of ***angle*** using ***aligned*** method.

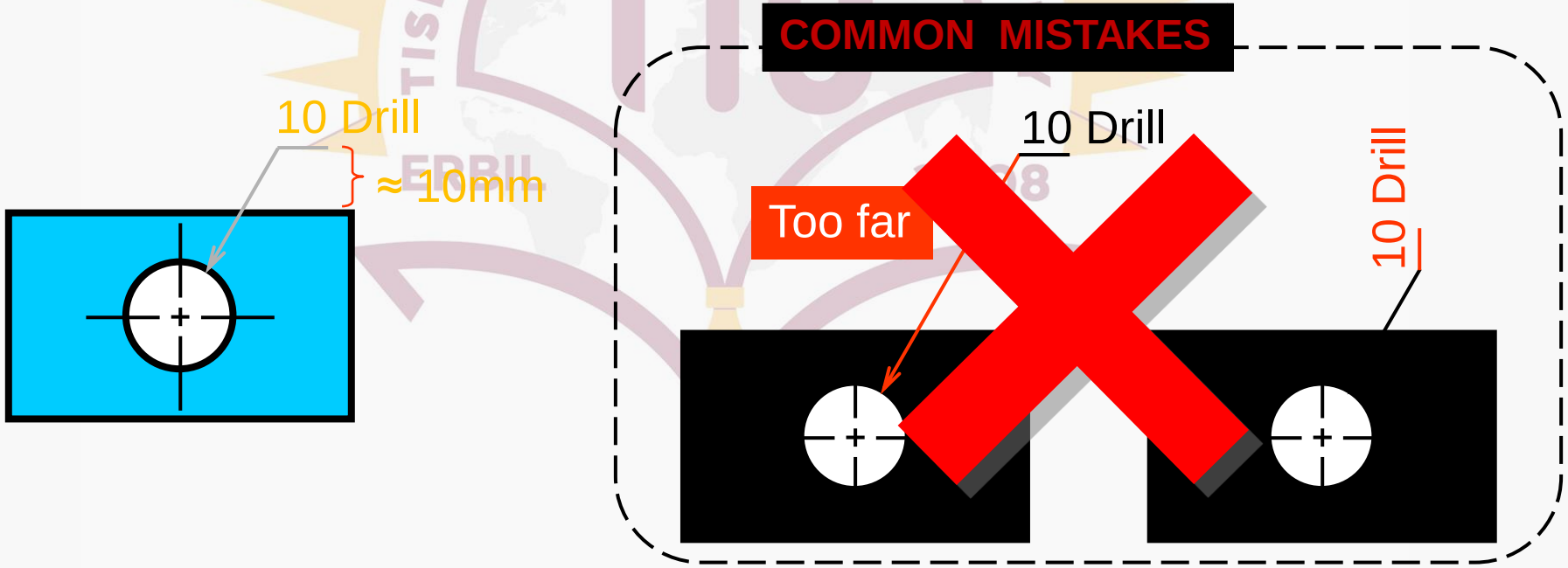


EXAMPLE : Dimension of ***angle*** using ***unidirectional*** method.



LOCAL NOTES

- Place the notes **near** to the feature which they apply, and should be placed outside the view.
- Always read **horizontally**.

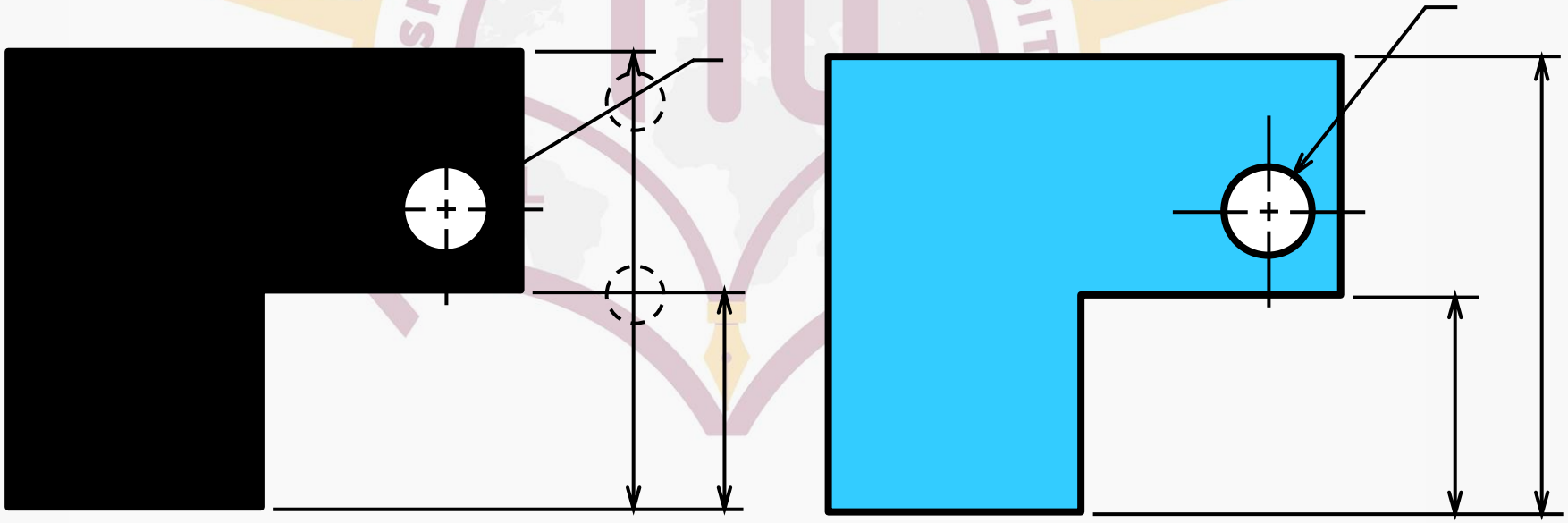


Placement of Dimensions

Recommended Practice

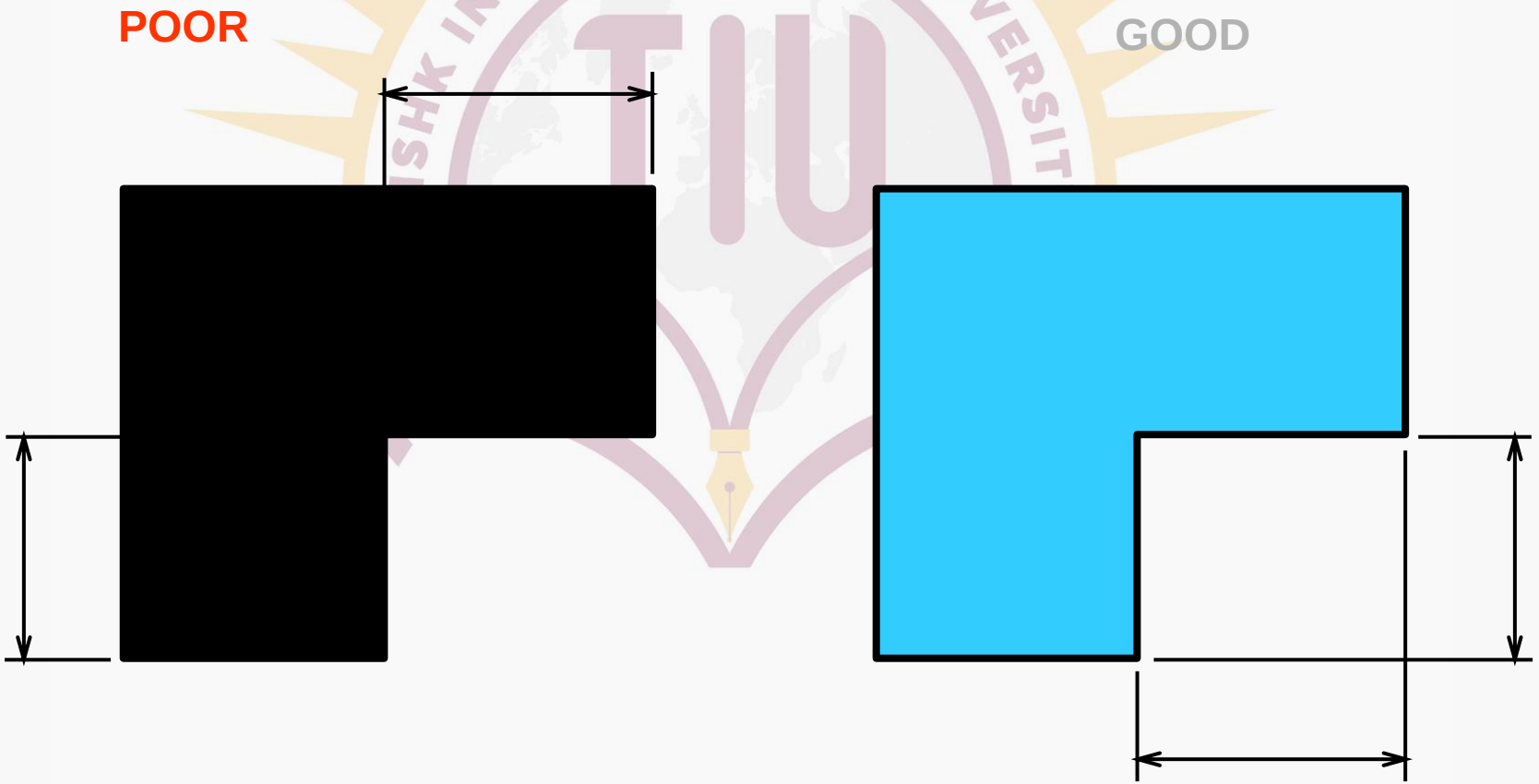
1. Extension lines, leader lines **should not** cross dimension lines.

POOR GOOD



Recommended Practice

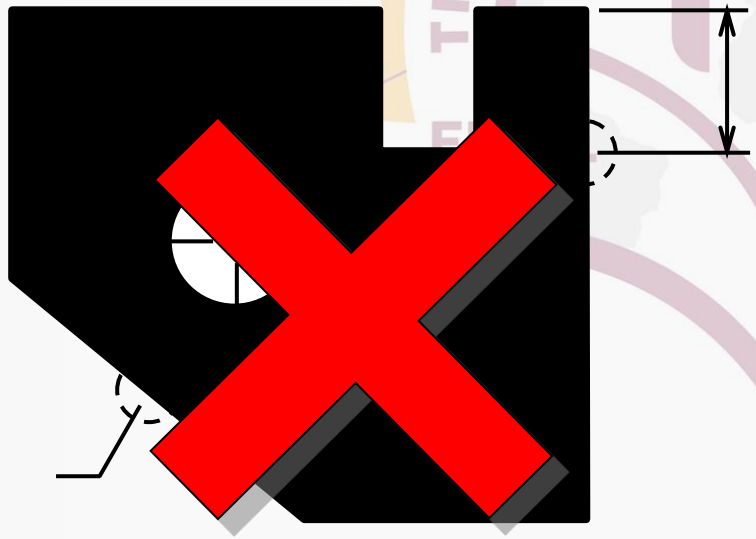
2. Extension lines **should be** drawn from the nearest points to be dimensioned.



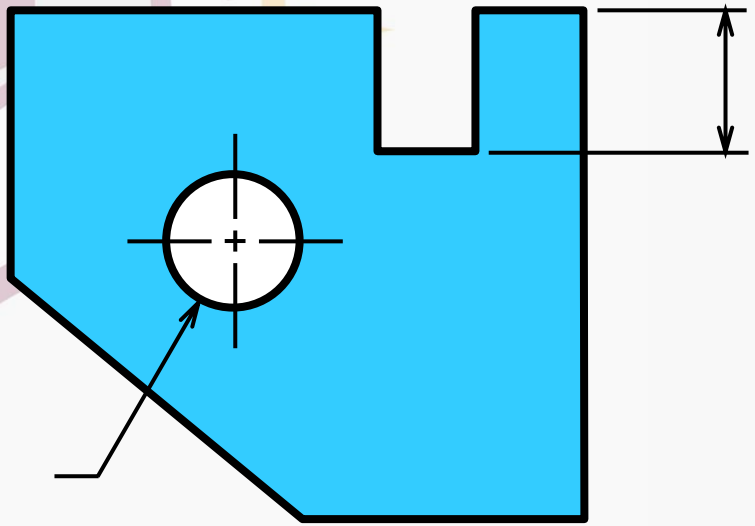
Recommended Practice

*3. Extension lines of internal feature **can** cross visible lines **without** leaving a gap at the intersection point.*

WRONG



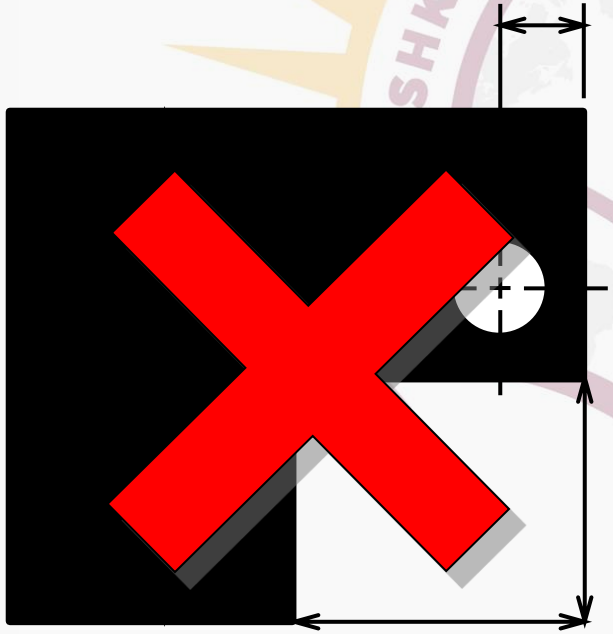
CORRECT



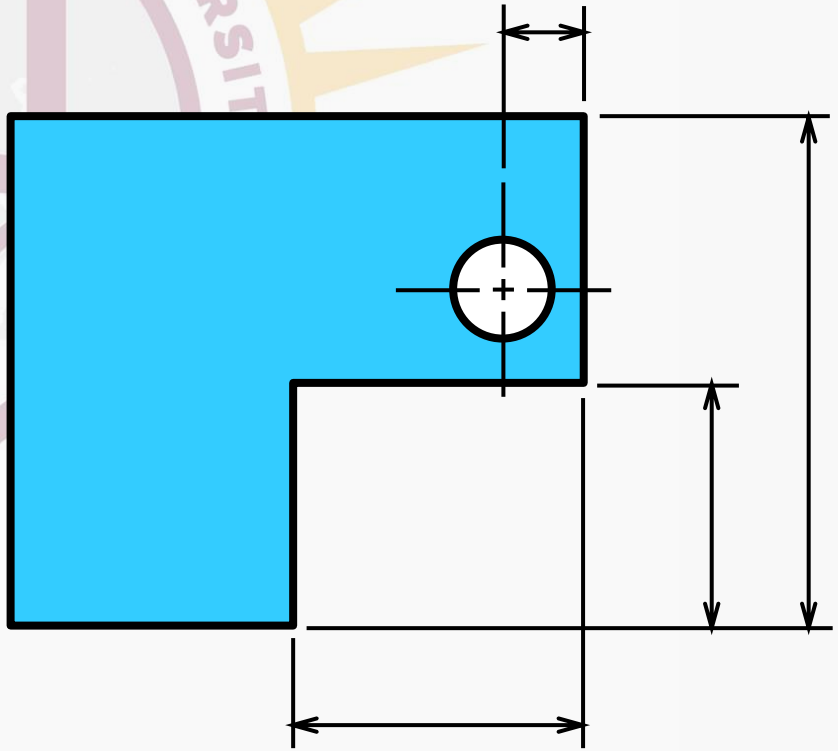
Recommended Practice

*4. **Do not** use object line, center line, and dimension line as an extension lines.*

POOR



GOOD

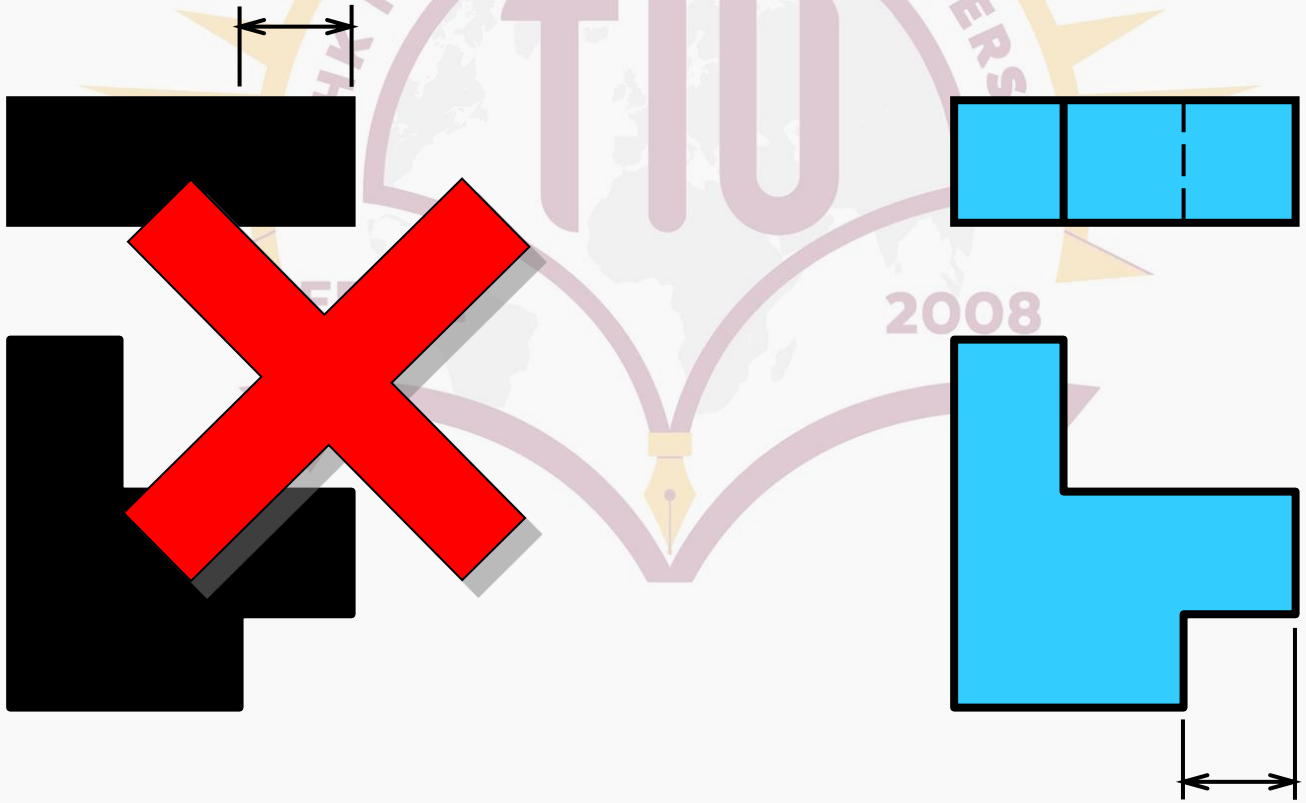


Recommended Practice

*5. **Avoid** dimensioning hidden lines.*

POOR

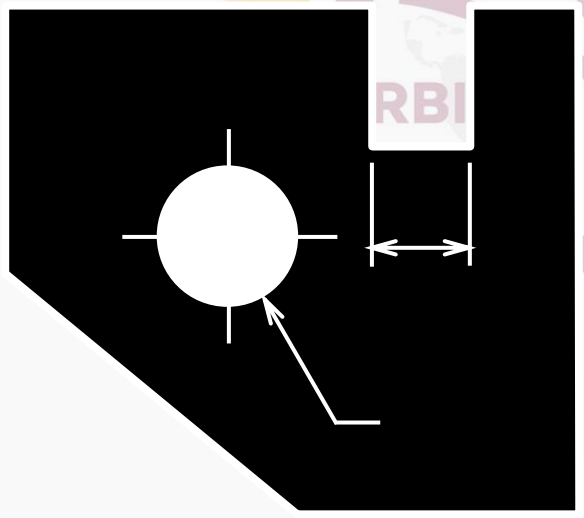
GOOD



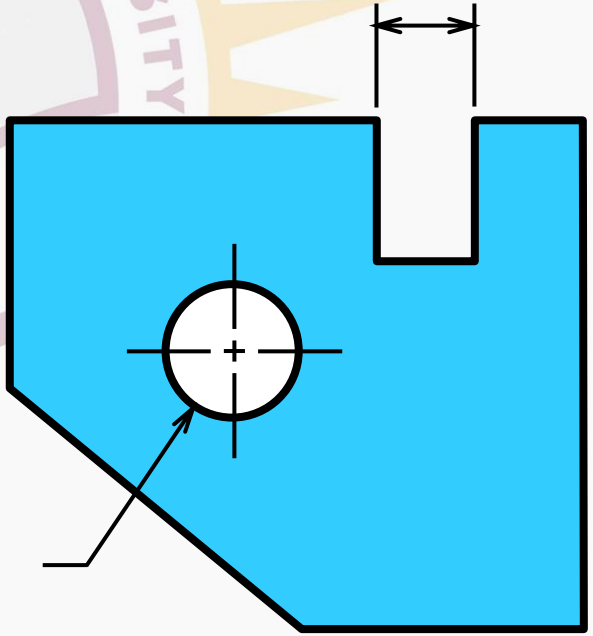
Recommended Practice

6. Place dimensions **outside** the view, unless placing them inside improve the clarity.

POOR

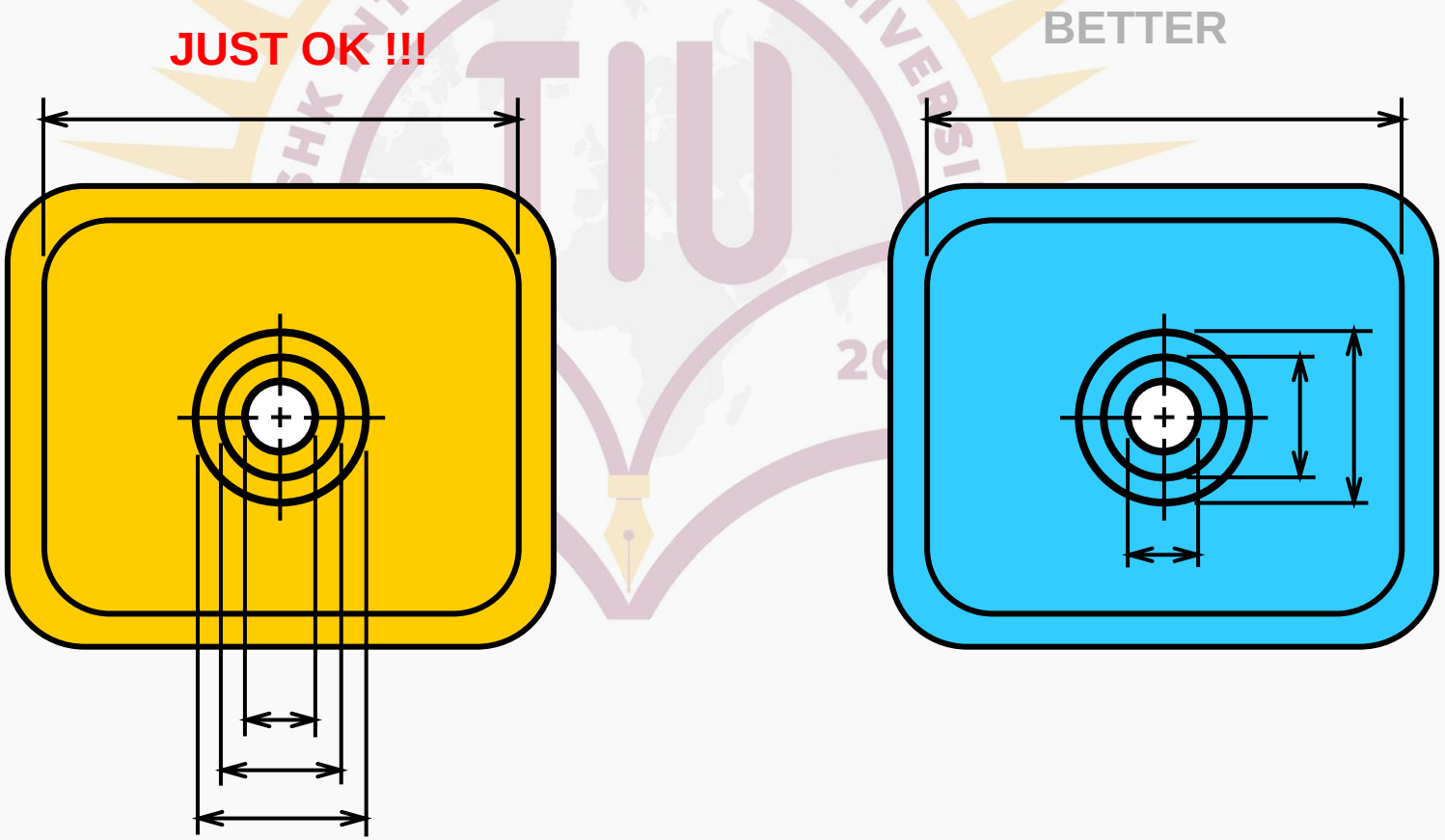


GOOD



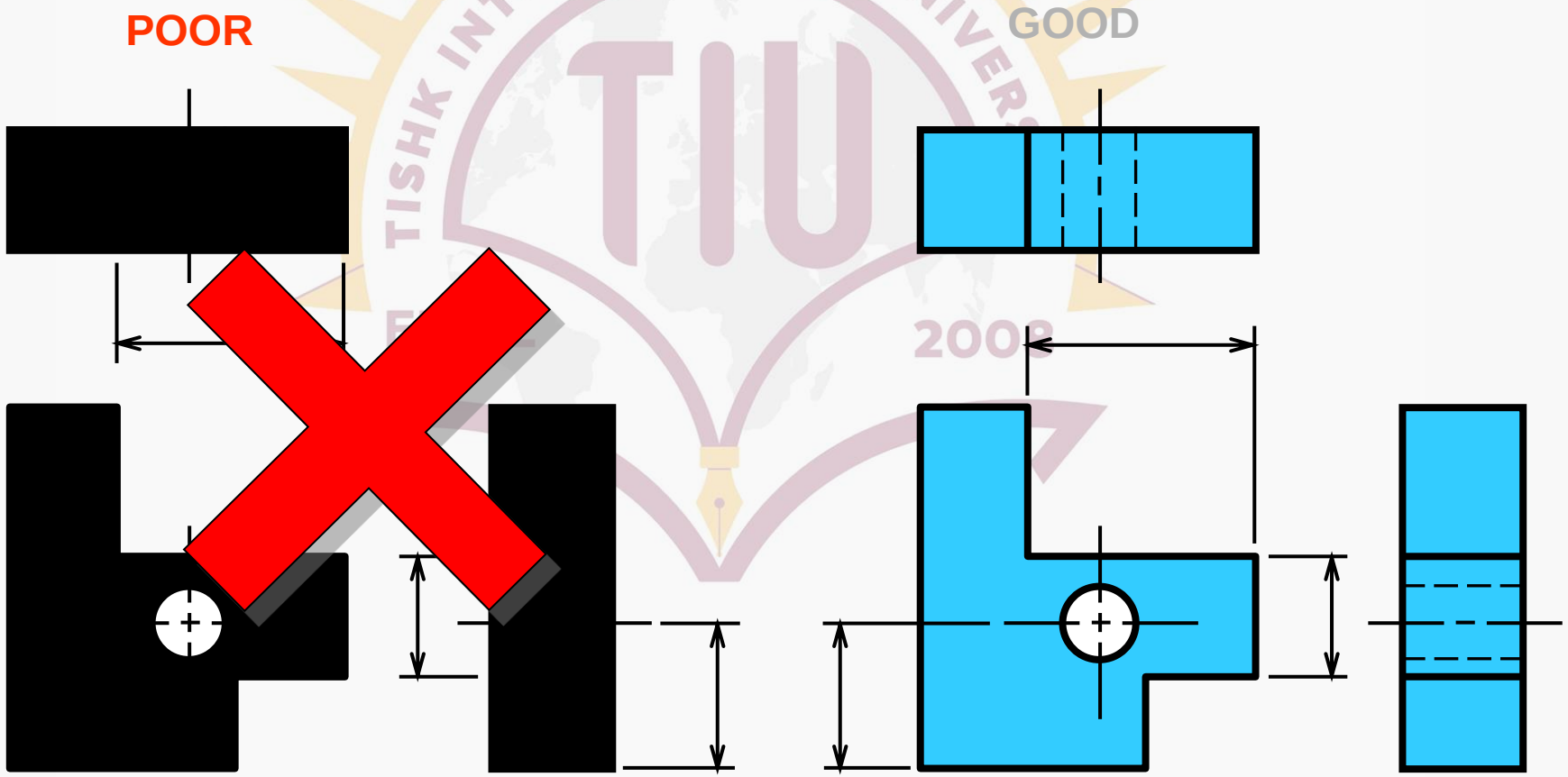
Recommended Practice

7. Place dimensions **outside** the view, unless placing them inside improve the clarity.



Recommended Practice

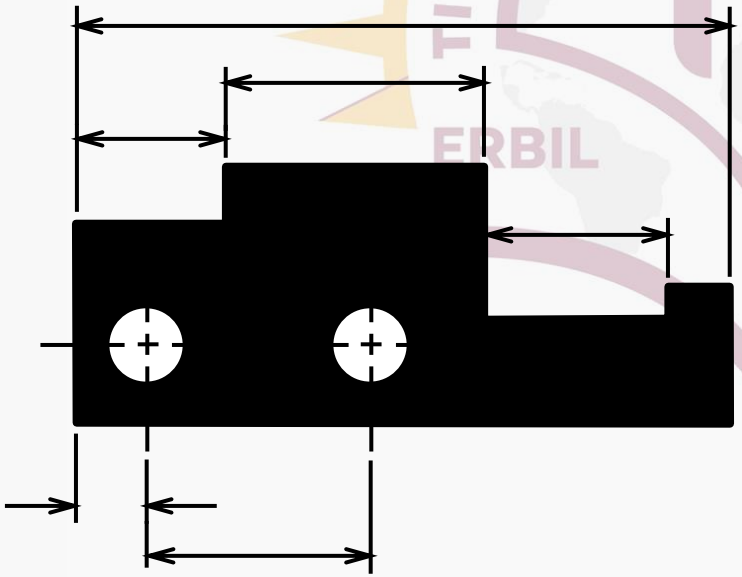
8. Apply the dimension to the view that clearly show the shape or features of an object.



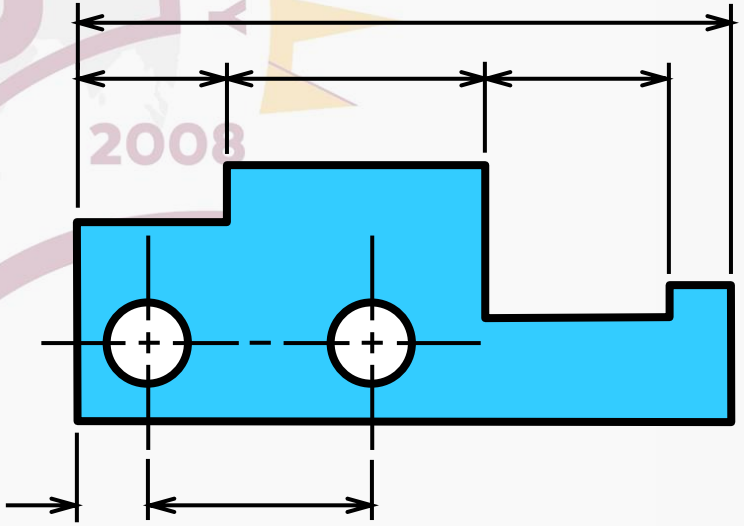
Recommended Practice

9. Dimension lines should be lined up and grouped together as much as possible.

POOR



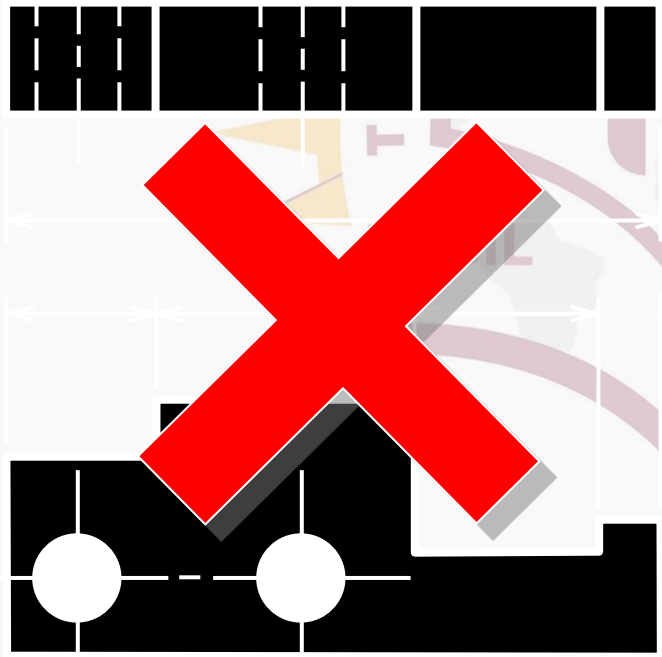
GOOD



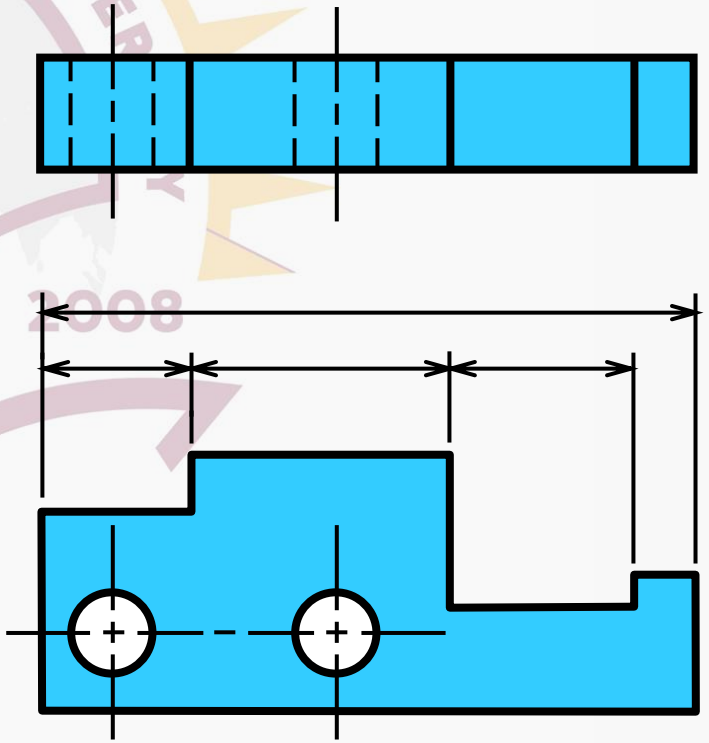
Recommended Practice

*10. **Do not** repeat a dimension.*

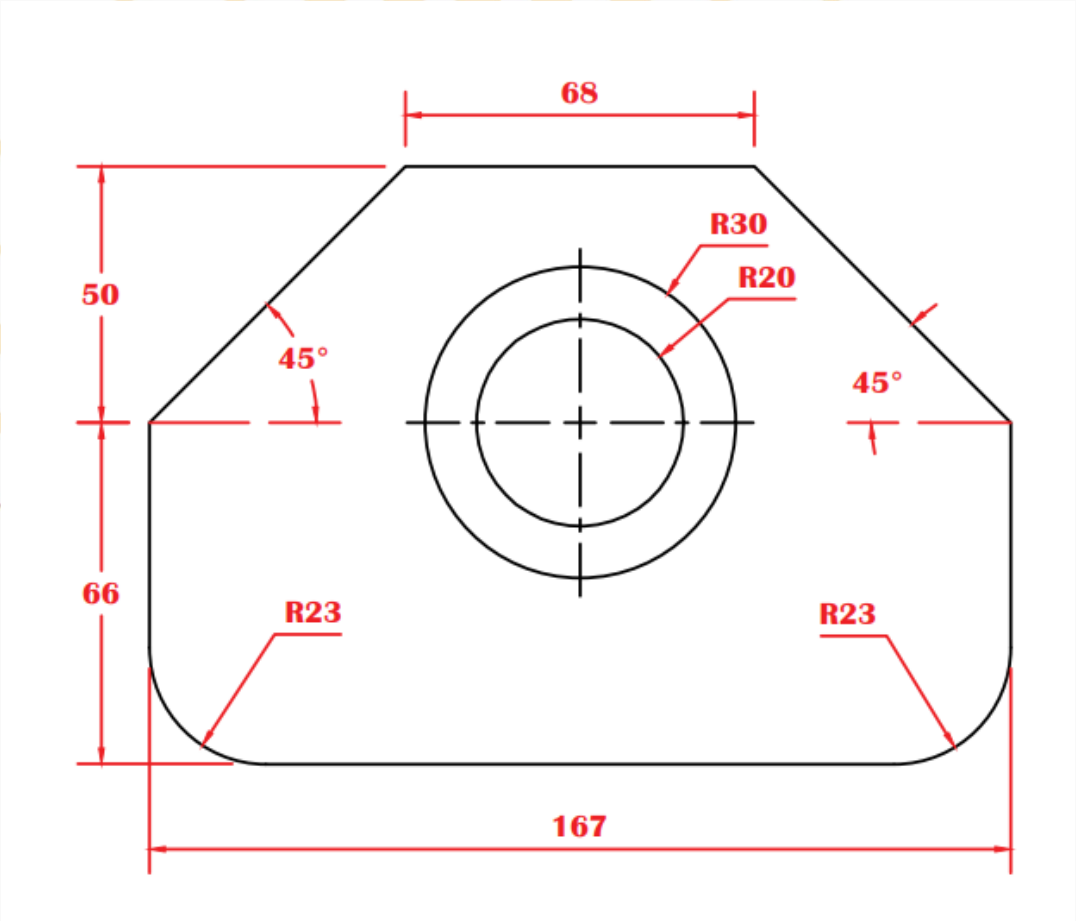
POOR



GOOD

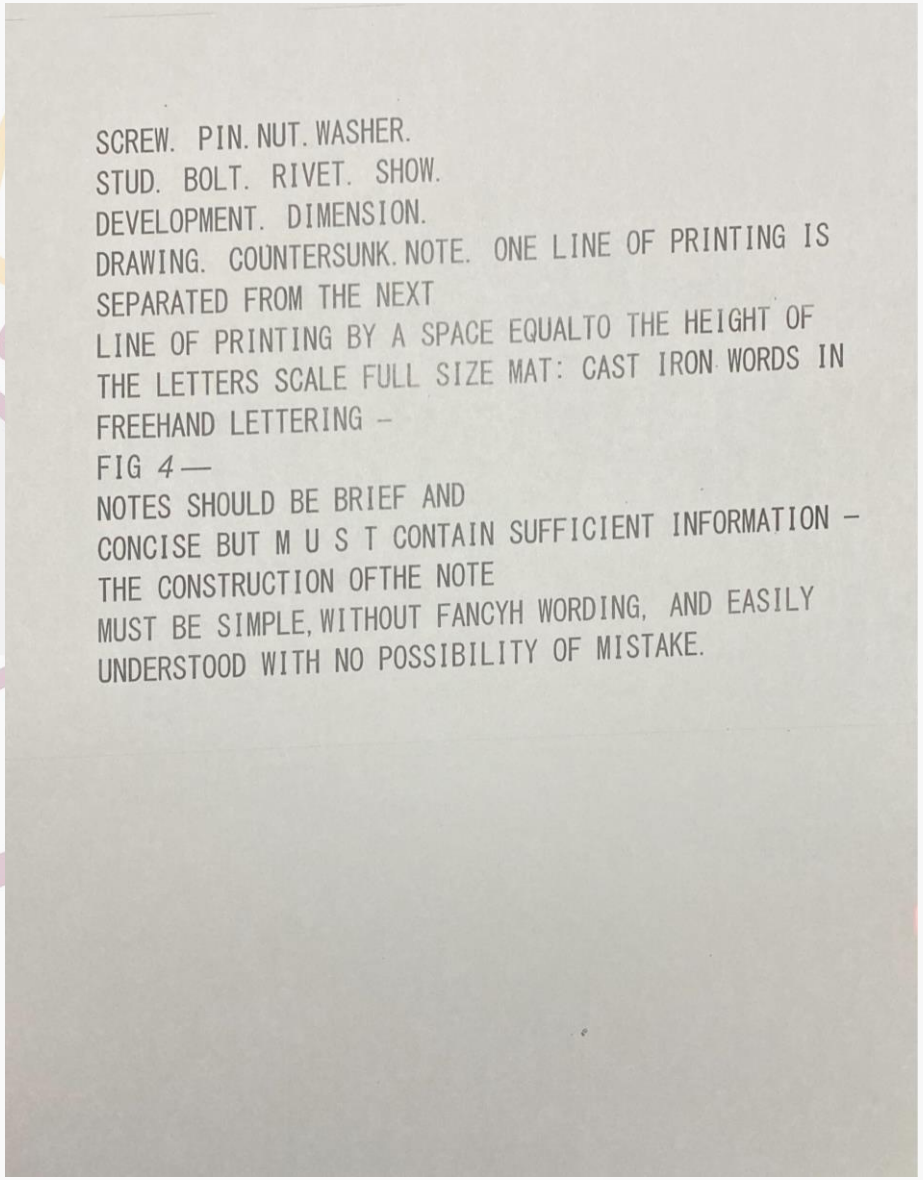


Classwork:



Homework 4.1:

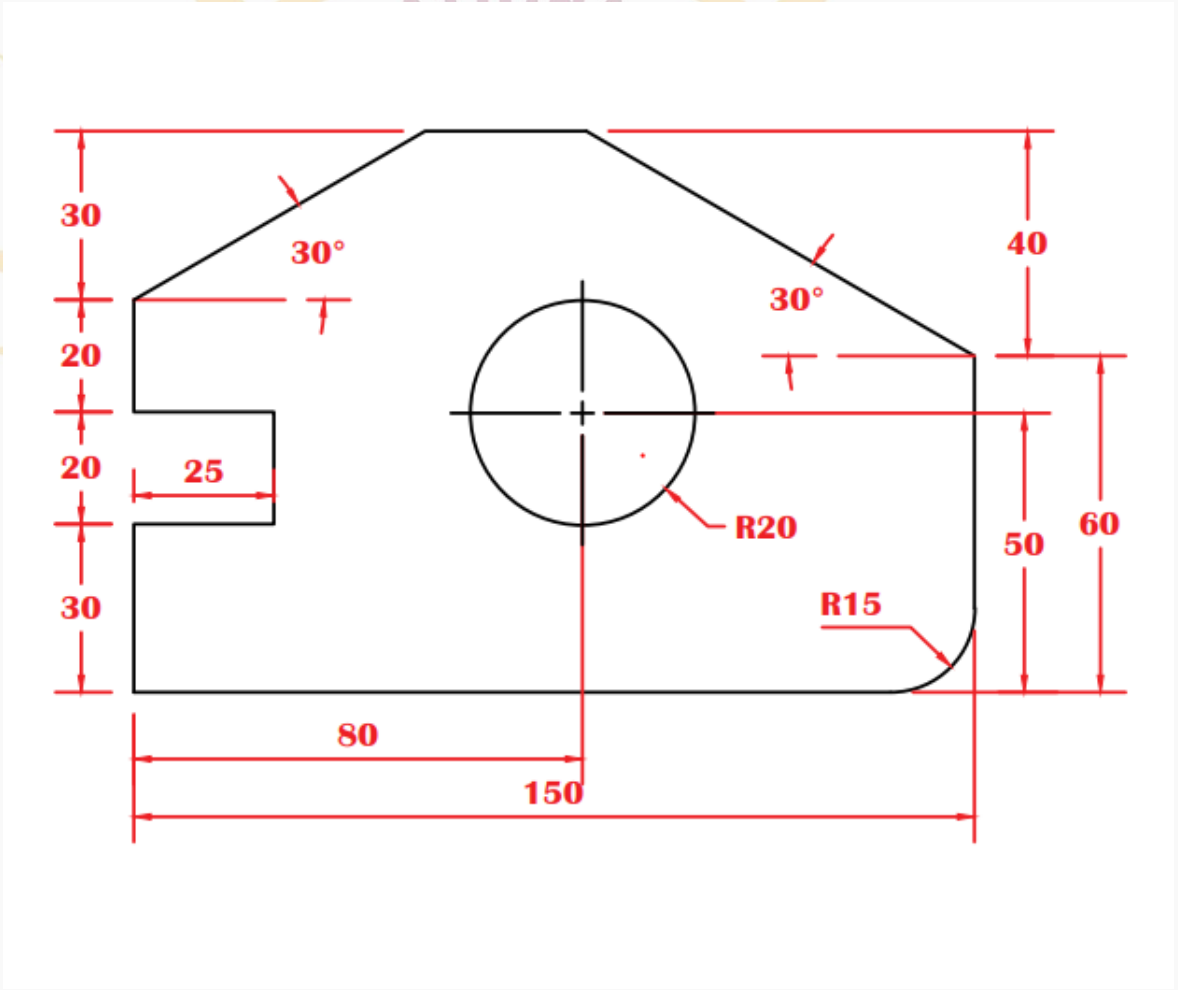
- Write the following piece 3 times. Draw the guide lines first, and then do the lettering based on BIS standards.



SCREW. PIN. NUT. WASHER.
STUD. BOLT. RIVET. SHOW.
DEVELOPMENT. DIMENSION.
DRAWING. COUNTERSUNK. NOTE. ONE LINE OF PRINTING IS SEPARATED FROM THE NEXT
LINE OF PRINTING BY A SPACE EQUALTO THE HEIGHT OF THE LETTERS SCALE FULL SIZE MAT: CAST IRON WORDS IN FREEHAND LETTERING –
FIG 4 —
NOTES SHOULD BE BRIEF AND
CONCISE BUT M U S T CONTAIN SUFFICIENT INFORMATION – THE CONSTRUCTION OFTHE NOTE
MUST BE SIMPLE, WITHOUT FANCYH WORDING, AND EASILY UNDERSTOOD WITH NO POSSIBILITY OF MISTAKE.

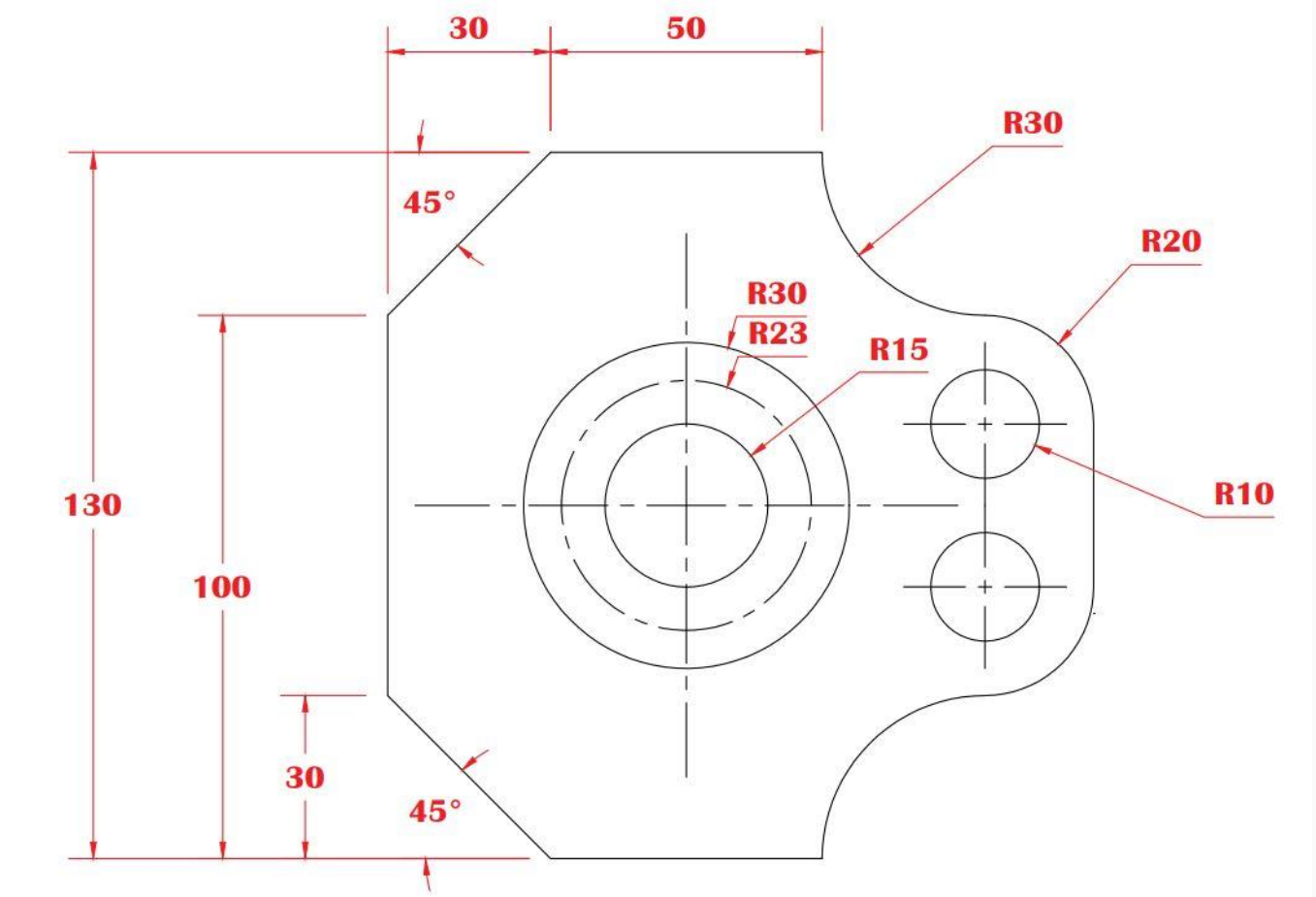
Homework 4.2:

Draw and Place dimensions:



Homework 4.3:

Draw and Place dimensions:



Homework 4.4:

Draw and Place dimensions: