



Technical Drawing Specifications Resource

A guide to support VCE Visual Communication Design study design 2013-17

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INTRODUCTION

This resource material is intended to provide advice and support on technical drawing specifications relating to key knowledge and skills in VCE Visual Communication Design study 2013-17. The content of this resource document offers guidance for technical drawing conventions relevant to the fields of practice that Visual Communication Design students explore. This includes communication, industrial and environmental design. This resource document draws upon conventions from the Australian Standards (AS). Specified labeling has been included in this resource for teaching and learning purposes. Students undertaking Units 1 – 4 of this study are not expected to know and employ all conventions from the Australian Standards.

The Australian Standards (AS)

Technical drawings are based on a set of standards that have been globally agreed upon by the International Standards Organisation (ISO). These standards are then tailored to the needs of each country, depending on their measuring system (metric or imperial), environmental conditions, manufacturing processes and developments in technology. The **Australian Standard AS 1100** provides the technical conventions for all Australian engineers, architects, designers, surveyors and patternmakers to follow.

Australian standards for technical drawing can be found at www.saiglobal.com

Presentation drawings

Students may incorporate technical drawing conventions based on the Australian Standards in their final presentations. However, these technical drawings and their use/inclusion of technical drawing conventions do not have to be produced at the level required for manufacturing purposes. Remember, the manufacture of functional objects is not a requirement of this study.

Key knowledge and skills

This resource material supports the key knowledge and skills required in the following Areas of Study:

Unit and Outcome	Area of Study
Unit One	
Outcome 1	Drawing as a means of communication
Unit 2	
Outcome 1	Technical drawing in context
Outcome 3	Applying the design process
Unit 3	
Outcome 1	Analysis and practice in context
Outcome 3	Developing a brief and generating ideas
Unit 4	
Outcome 1	Development of design concepts
Outcome 2	Final presentations

Note: This resource material may also assist those students using technical drawing methods in Unit 1, Outcome 2 and Unit 2, Outcome 2.

THREE-DIMENSIONAL DRAWING

The types of three-dimensional representation drawings that are relevant to this study include paraline (isometric and planometric) and perspective (one and two point).

PARALINE DRAWING

Objects are drawn with the receding lines remaining parallel to each other (hence the term ‘para-line’). Common types of paraline drawings include isometric and planometric.

Isometric Drawing

Isometric drawings are constructed with both sides receding from the corner edge at 30 degrees. The isometric drawing provides a comprehensive overall view of the object. Refer to Figure 1.

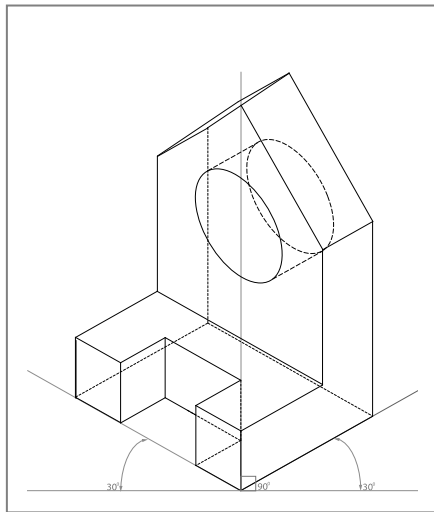


Figure 1
Isometric drawing

Planometric Drawing

Planometric drawings are very similar to Isometric drawings, however, the base (or plan) of the object retains its true form (is not altered) with both sides receding at 45 degrees (or one side recedes at 30 degrees and the other at 60 degrees). Refer to figure 2.

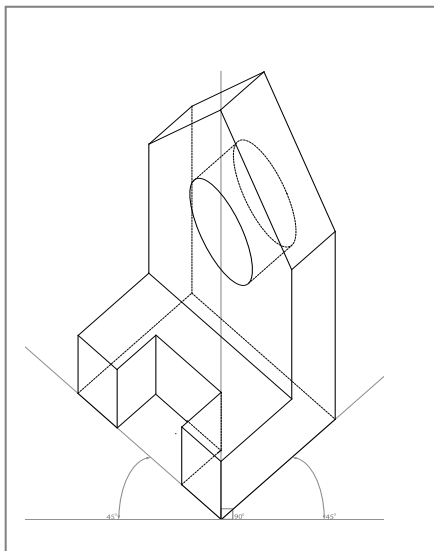


Figure 2
Planometric drawing

PERSPECTIVE DRAWING

Objects are drawn in a naturalistic manner consistent with human vision; the receding lines converge towards the horizon (eye level) rather than remain parallel to each other. The placement of the horizon line determines the location of the viewer and provides capacity for different views of an object or the relationship of parts to each other.

One-point perspective

Objects are drawn front on, with receding lines converging to one vanishing point on the horizon. Refer to Figure 3.

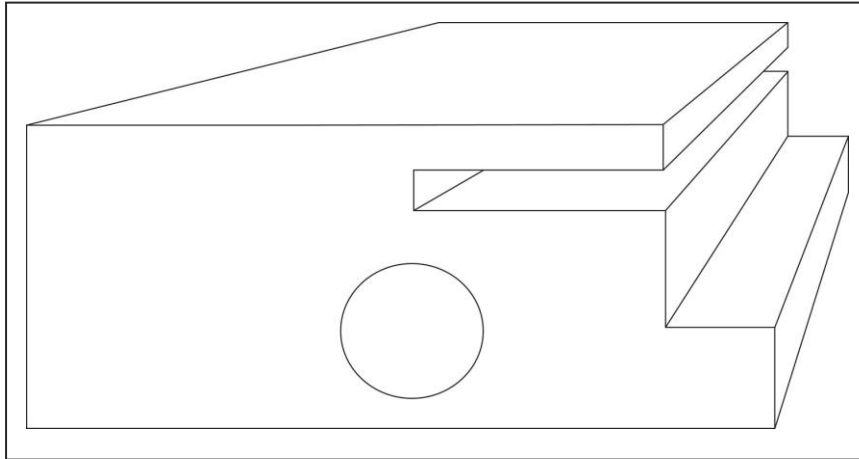


Figure 3
One-point perspective drawing

Two-point perspective

Objects are drawn with a corner closest to the viewer and side drawn with receding lines to two vanishing points on the horizon line. Refer to Figure 4.

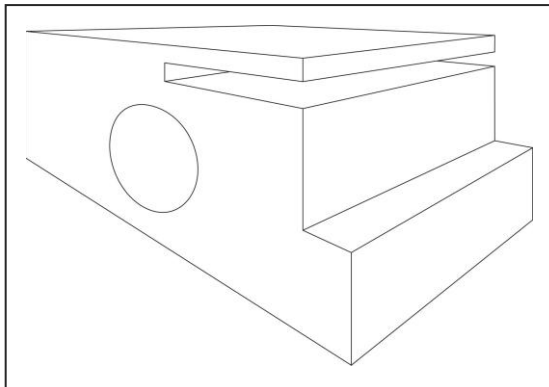


Figure 4
Two-point perspective drawing

ELLIPSES

The knowledge and understanding of how to draw an ellipse is important to this study. Whilst ellipse templates can be useful, students should know how to draft a freehand ellipse for paraline and perspective purposes.

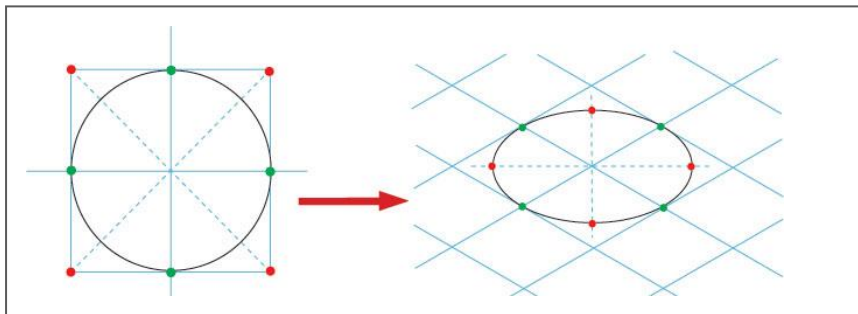


Figure 5
An isometric ellipse

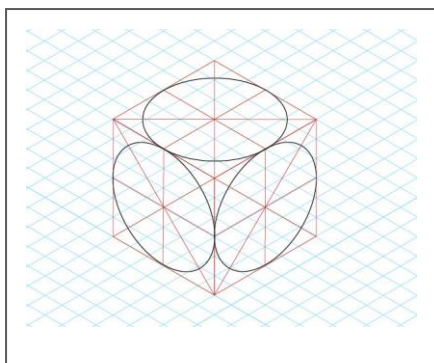


Figure 6
Orientation of ellipses on an isometric cube
One method of drawing an ellipse is to use the box method. In figures 5 and 6 a circle is drawn within a box using the tangent points for guidelines. In the isometric example four

arcs are sketched between the tangent points (green dots) cutting off the corners of the box. The ellipse is completed by sketching arcs as wide as possible within the box, carefully making a smooth curve where the four arcs meet. You can apply the same guidelines to a planometric or perspective box.

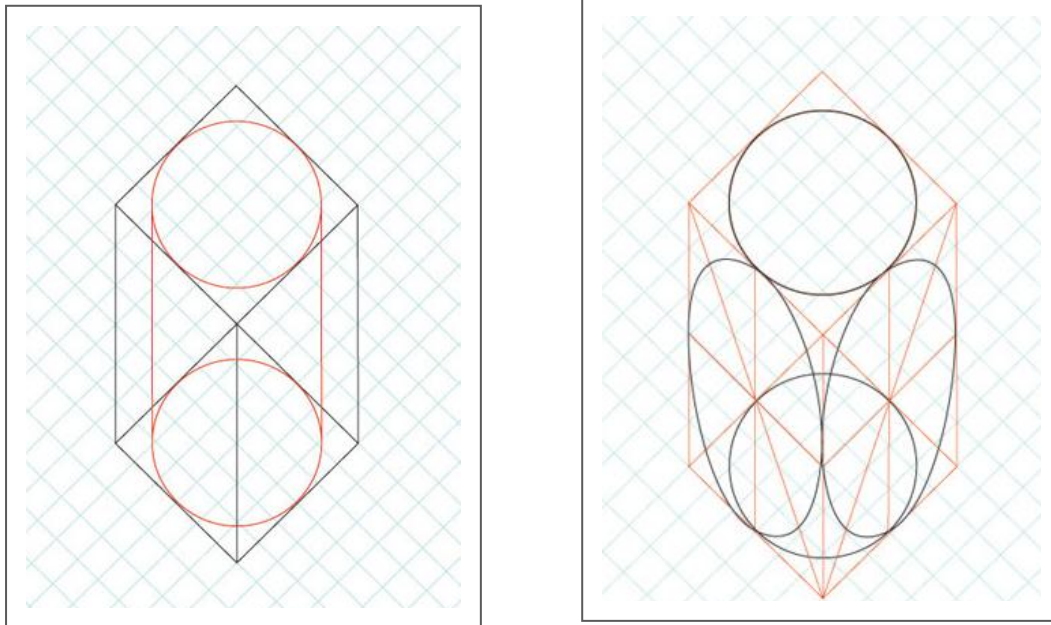


Figure 7
Orientation of ellipses on a three-dimensional planometric shape

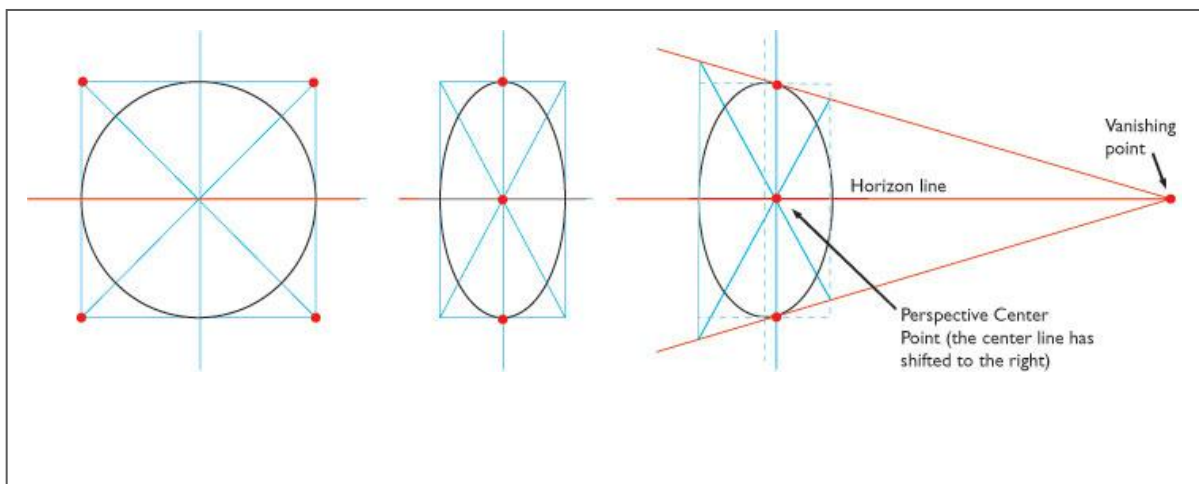


Figure 8
Ellipses in one point perspective

TWO-DIMENSIONAL DRAWING

Types of two-dimensional representation drawings applicable to this study include orthogonal, floor plans and elevations, and packaging nets.

PACKAGING NET

A drawing of a flat two-dimensional shape that when folded becomes a three-dimensional form. It can also be referred to as a development net. Often a packaging net will include tabs for stability and fastening. The drawings are to scale and involve the use of line conventions that indicate fold lines (broken lines) and cutting edge (solid outline). Refer to Figure 9.

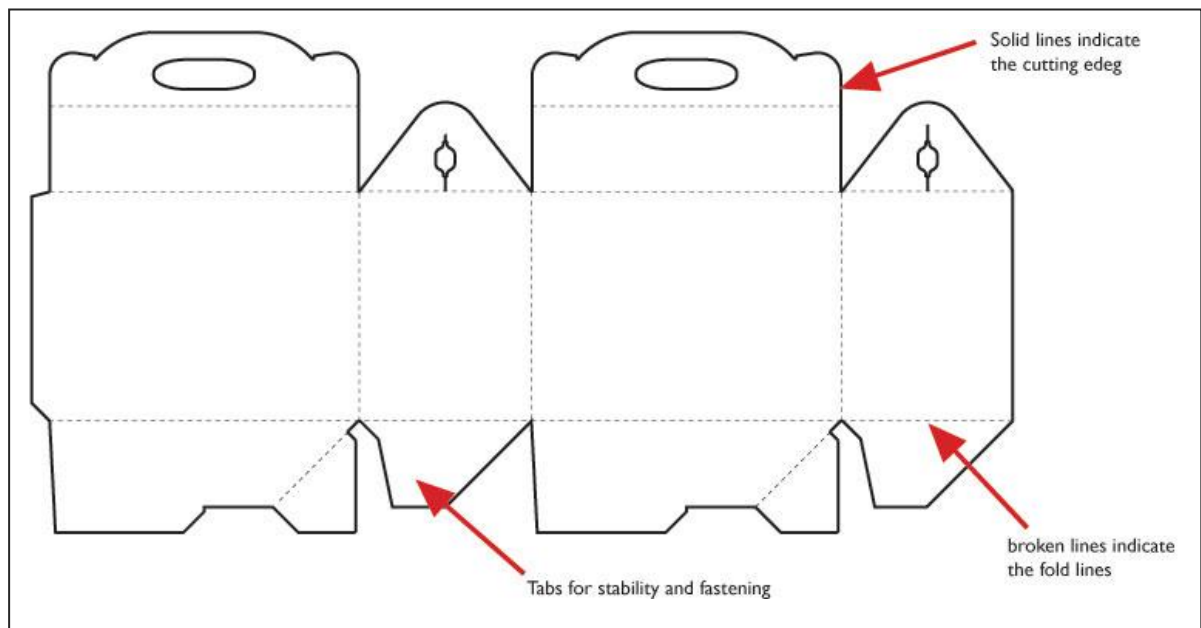


Figure 9
Packaging net

FLOOR PLANS AND ELEVATIONS

Scaled two-dimensional drawings used by architects involving a set of conventions regarding line types, dimensioning and symbols. Floor plans are views from above, while elevations refer to views of the side or facade. Please refer to page 20 of this resource material for further information on Architectural conventions relevant to this study.

THIRD-ANGLE ORTHOGONAL DRAWINGS

There are occasions where a three-dimensional drawing may not provide enough information about an object to be constructed. Orthogonal drawing is a multi-view two-dimensional drawing system that resolves this problem. Each view of an object (front, sides and the base) is drawn separately showing only two dimensions, but is kept aligned and to the same scale. Combining multi views allows all three dimensions to be considered. Third-angle projection refers to the layout of views. Refer to figure 10.

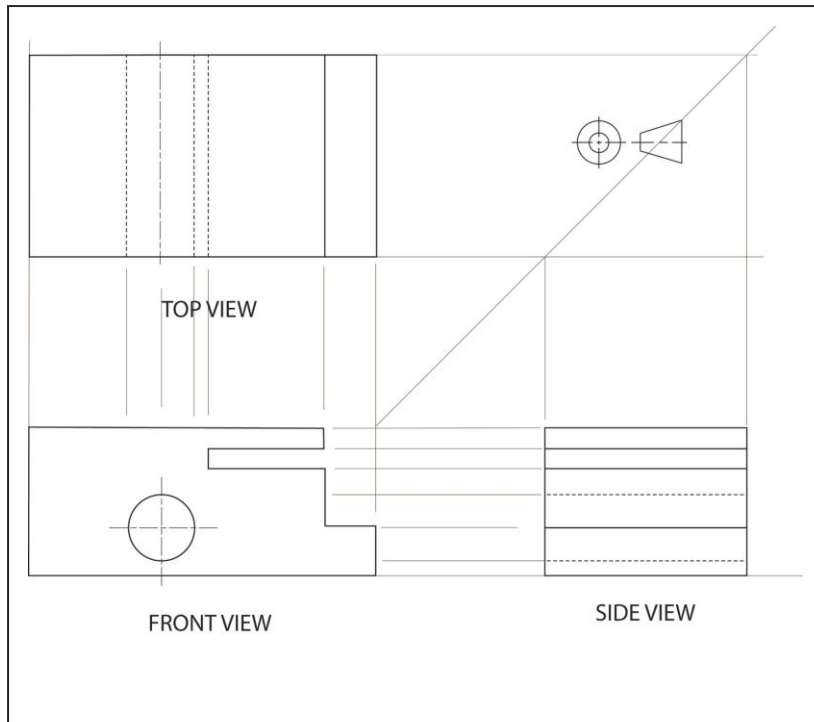


Figure 10
Third-angle orthogonal drawing

The views

Third angle orthogonal drawings can include as many views as required to communicate the features of an object. In practice only the views required to describe the object clearly are drawn. Hence you will often see only three views drawn as seen in Figure 10.

The views are known as:

FRONT VIEW

TOP VIEW

SIDE VIEW (left and/or right hand view)

(and at times) BASE/SECTIONAL VIEWS

Plan your layout

It is important to plan your drawing/solution and consider placement before you start.

Figure 11 shows appropriate positioning using an A3 sheet of paper. Notice there is also an isometric view positioned in the top right-hand corner. This is often placed there to provide a connection between the two-dimensional shapes of orthogonal and more visually representative three-dimensional isometric form.

NOTE: The layout used will vary depending on the information to be communicated. Consider the size of your paper choice, relative to the scale/dimension of the drawing, and the orientation. A vertical orientation may better suit taller, thinner objects such as a jug or drinking vessel.

Placement of views

The TOP VIEW is always directly above the FRONT VIEW and the SIDE VIEWS are always 'next to' and 'aligned to' the FRONT VIEW. At times the views can be placed apart equidistantly.

However, the views can be placed at different distances from the front view, depending on what information, such as dimensions, needs to be included.

If you want to place your views equidistant then you can use the **45 Degree Method** to place and project your views. The following steps describe the process.

1. The FRONT VIEW must be drawn first, then your vertical lines should be projected to give the width of the TOP VIEW.
2. Project the horizontal lines from the FRONT VIEW to give the height of the SIDE VIEW being represented.
3. Where the maximum width and height projection lines on the FRONT VIEW meet, a 45 degree line will need to be drawn.
4. The SIDE VIEW vertical lines will need to be projected to the 45 degree line (these lines must be 90 degrees). Where these lines meet the 45 degree line they will then need to return to the TOP VIEW vertical projection lines (these lines must be 180 degrees).
5. All line types should now be present on the TOP VIEW.
6. Referring to the FRONT and SIDE VIEW the various lines will need to be defined and drawn using the correct line type.
7. Once completed all views should be equidistant apart.

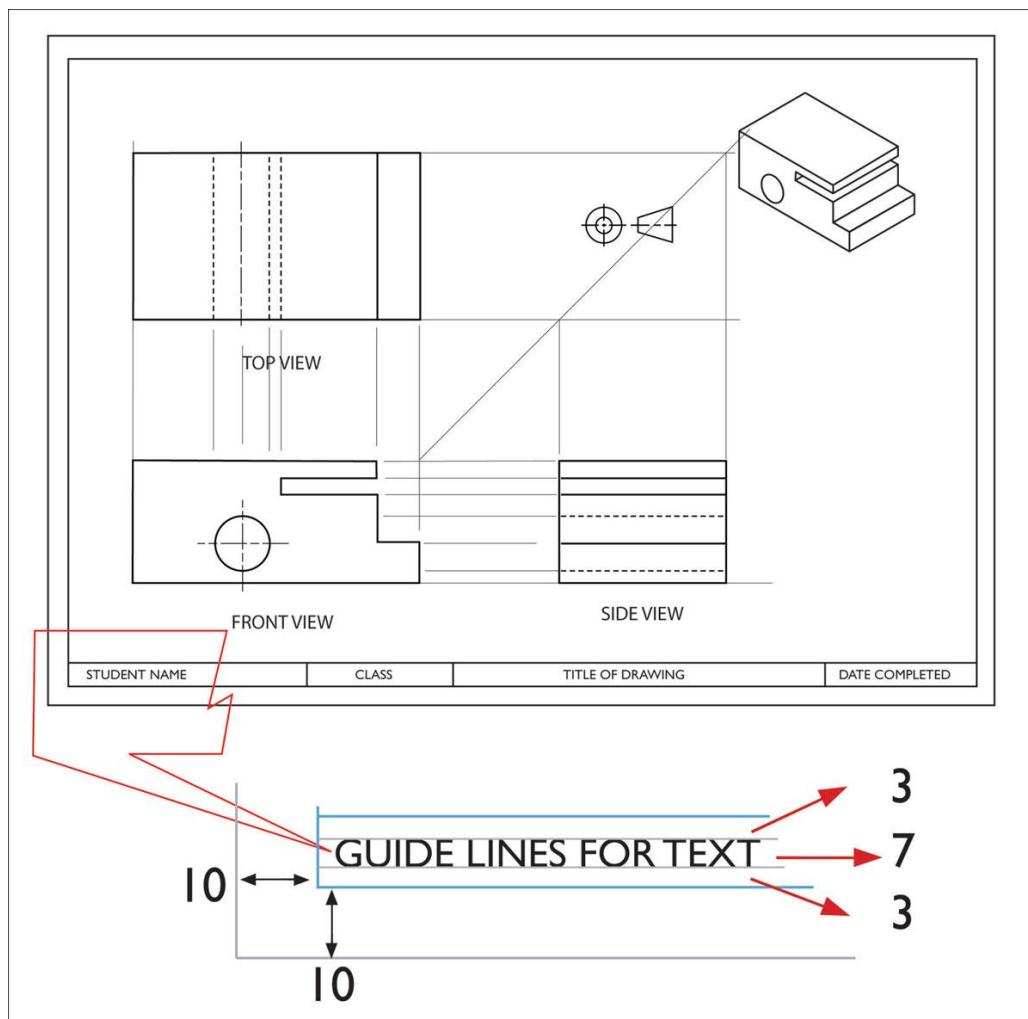


Figure 11

A **guide** for orthogonal drawing layout

Labeling orthogonal drawings

In VCE Visual Communication Design, students are required to label each view. Each VIEW must be labeled using an uppercase, sans serif typeface.

- For example GILL SANS typeface (or similar)
- VIEW labels are located in a centred position under each view, 10mm below the view, 5mm height.

LINE STYLES AND CONVENTIONS

The use of different line styles and widths is important in technical drawing as they are used to indicate details and features in a drawing. Line styles make drawings easier to read: for example, solid lines used to show the object will stand out from broken lines used to show hidden information. The Australian Standards incorporates a detailed list of line styles for use in different fields of design including architecture and engineering. For this study, it is appropriate for students to use a minimum of two line weights to meet line style conventions. This will include:

- A heavier line to draw the views that represent the object being drawn and dashed lines to represent hidden lines
- A thinner 'half weight' line to provide additional information such as centre, projection and dimension lines.




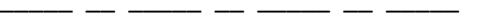
Line styles and conventions		
Thick continuous		VISIBLE LINES used on each view; includes arcs/circles/curves/title block and border
Thick dashes		HIDDEN LINES used on each view. Dashes start and end with contact to a visible or hidden lines
Thin continuous		THIN CONTINUOUS LINES used for dimensioning 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

Using these lines

- All lines on any particular drawing should be either in pencil or ink, but not a mixture of both. Lines on drawings should be selected according to their application (See Table 1 for preferred line types). It is desirable to incorporate two different line thicknesses on your technical drawings.
- Construction lines are very thin pencil lines or guidelines (as shown in figure 11). These assist with construction, alignment and placement, but are not formal lines and can be removed for final presentation drawings. If you are drawing using a computer use the following line thickness:

Line style	MM
VISIBLE LINES used on each view; includes arcs/circles/curves/title block and border	0.35
HIDDEN LINES used on each view. Dashes start and end with contact to a visible or hidden lines	0.35
THIN CONTINUOUS used for dimensioning lines, projection lines, leaders, letterform used in title block.	0.18
CENTRE LINES, axis of solid forms, pitch lines (think roof line) Note: centre lines show symmetry	0.18

Table 2

Suggested line thickness when using computer software for technical drawings

- The length and spacing of dashes should be consistent on any particular drawing(s). It is recommended that only one thickness of dash line be used in any one drawing. Dashed lines should start and end with dashes in contact with the visible or hidden lines from which they originate. If a dashed line meets a curved line tangentially, it should be with a solid portion of the line.
- Chain lines should start and finish with a long dash, but not too long, in a cutting plane.
- When centre-lines define centre points they should cross one another at dash portions of the line. Centre-lines should extend only a short distance beyond the features unless required for dimensioning or other purposes. Centre-lines should not stop at another line of the drawing.
- Three-dimensional objects have six sides primarily – top, base, left-hand side, right-hand side, front and back. Orthogonal drawing shows (in most cases) three. To compensate for the three views being left out, a system of visible and hidden lines are used to show where these changes in the object are located. These hidden lines provide additional and often necessary information.
- In orthogonal drawing each view needs to show how it changes both on the surface, (visible lines) and below or behind the surface (hidden lines). For example, there may be a hole drilled on the front of the three-dimensional form (object). A circular solid shape is drawn to record this on the view it is seen on. The effect on the other two views must also be explained using these line styles. Questions such as “Does the shaft go all the way through the object, or does it stop at a particular depth” are answered on the other two views. If the circle was on the base, the circle would be drawn with dashes on the top view. If there is not an annotated leader indicating the depth of the cylindrical hole, then students can presume the hole goes completely through the object. Refer to Figure 12.

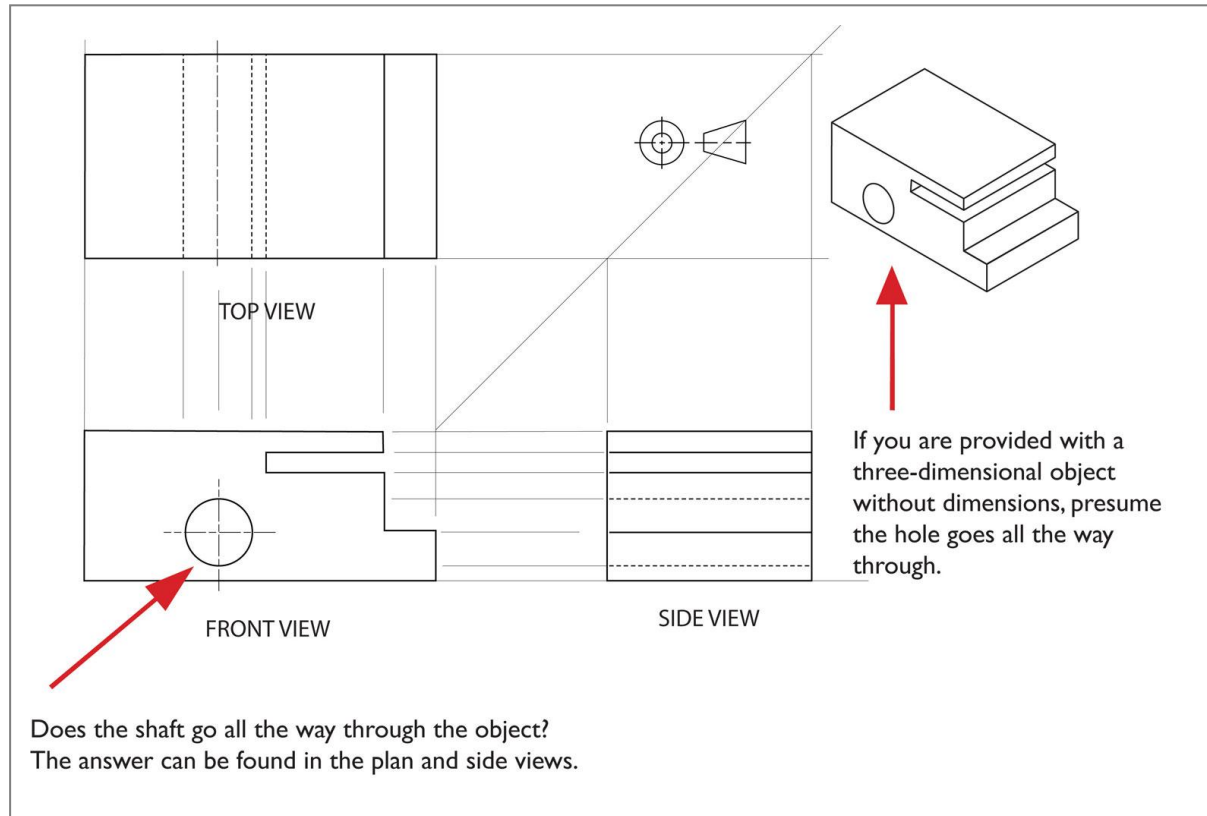


Figure 12
How to interpret the depth of a circle

Circles also need to use

- A thin chain line to indicate where the centre is positioned and again this impacts on each of the three views.

Lines that coincide

Frequently in orthogonal drawing visible outlines, hidden outlines and centre lines coincide. Which line has precedence? That is which line do you show on your drawing? The object in Figure 12 is the same object that has been seen in this document previously. However, the circle has been shifted slightly to the left and when drawn in orthogonal, causes some confusion in regards to line convention preference.

The standard procedure for this study is stated in these two rules:

1. Visible outlines are always shown in preference to hidden outlines or centre lines
2. Hidden outlines are shown in preference to centre lines

Refer to figure 13.

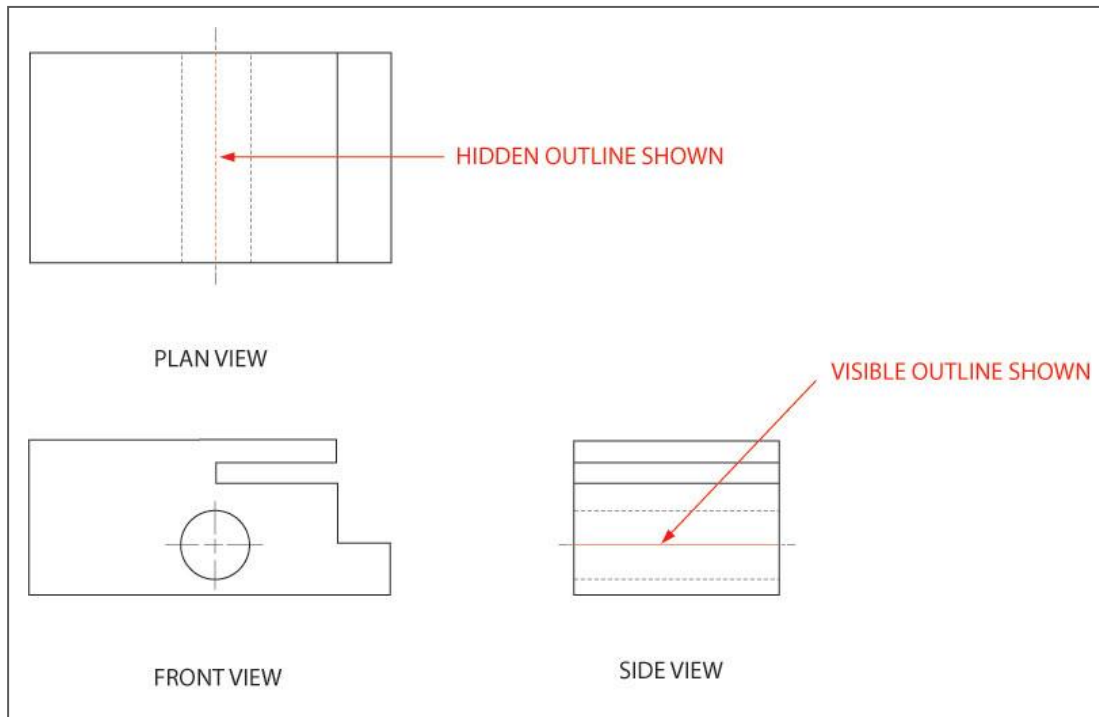


Figure 13

This orthogonal drawing appears similar to that seen in figure 9, 10 and 11. However, in this case the object's circle has been shifted slightly to the left. When drawing the centre lines on the top and side views you will find that they will coincide with other convention lines. The lines in red will take preference to the centre lines.

Third – angle Orthogonal Projection Symbol

Because there are two projection systems used world-wide, all drawings must show a projection symbol to identify the system used. The projection symbol is part of labeling requirements and is placed on the drawing along with the labeling of views. In this study, students should include the actual symbol over the written reference. When drawing this symbol you should maintain the same proportions and line conventions as seen in figure 14 and place your symbol in the top right hand corner as seen in Figure 12

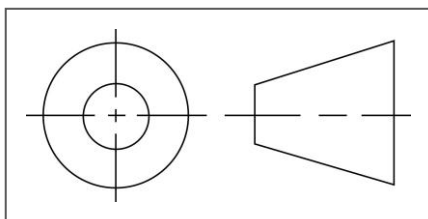


Figure 14

The third angle orthogonal symbol

DIMENSIONING AN OTHOOGONAL DRAWING

Placement of numeric information is known as dimensioning.

You can measure directly from an orthogonal drawing when the scale is 1:1 (full size). All dimensions are recorded using true size measurements. Where the object does not fit to the page, reduction ratios are used.

These start at 1:2, 1:5, 1:10, 1:20, 1:50 and 1:100 (house) for drawing smaller than full size.

Where the object is too small to work with easily enlarged ratios are used.

These start at 2:1, 5:1...for drawings larger than full size.

Each drawing needs to indicate the scale.

For example:

SCALE 1:1

ALL DIMENSIONS IN MM OR

SCALE 1:100

ALL DIMENSIONS IN MM

If the drawing is not dimensioned and is not drawn to specific scale, the term NOT TO SCALE should be indicated.

Dimension placement

The most important thing about dimensioning is to ensure that the measurements are placed both logically and clearly. The student should:

- ensure that they have dimensions for the height, width and depth
- ensure that they have included all crucial dimensions that allow the object to be interpreted
- dimension where the shapes are shown and try to avoid dimensioning hidden lines
- space dimension lines so that the dimensions are not over crowded
- not over-dimension the work as it can lead to confusion and an untidy drawing.

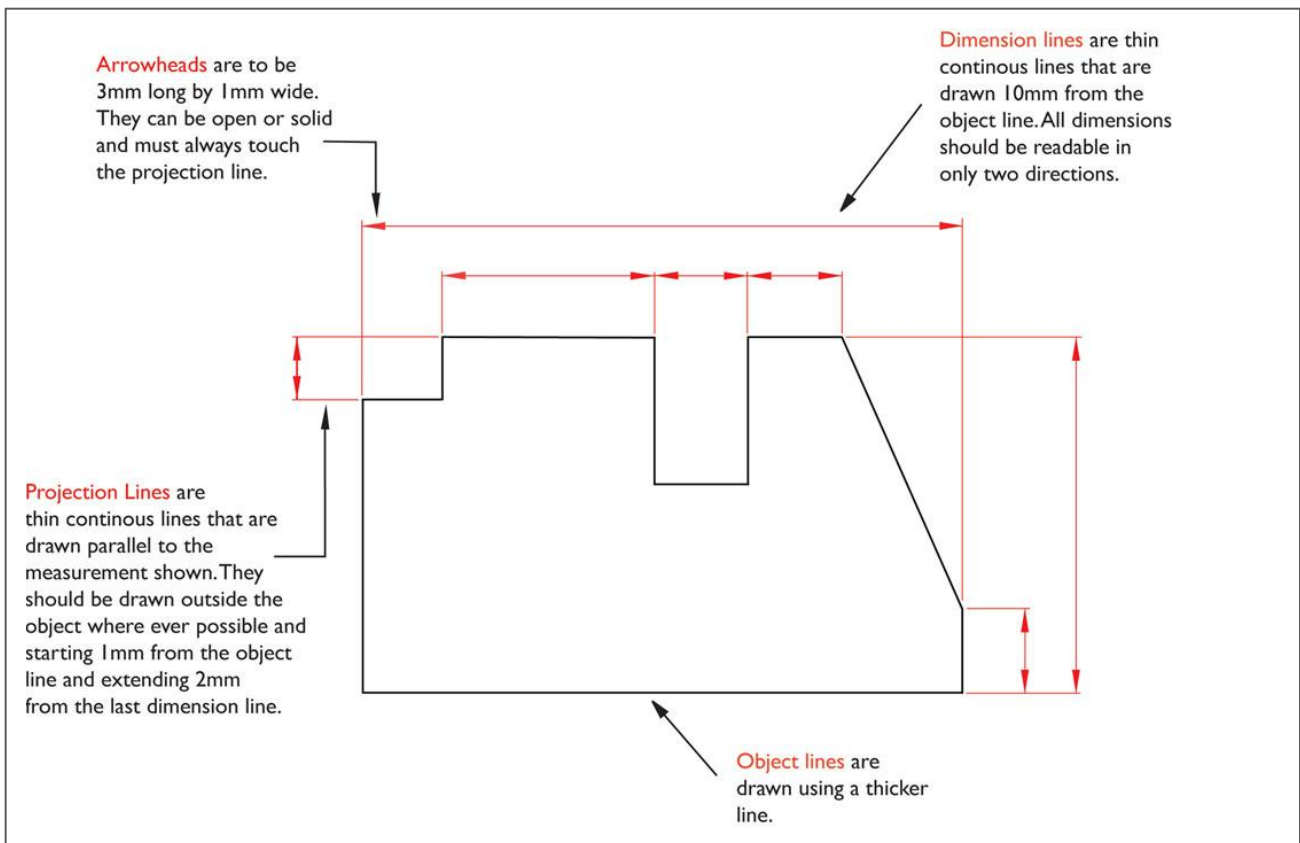


Figure 15
Object, dimension, projection lines and arrowheads

The following dimensioning guidelines apply to this study:

- The position where dimension lines should be placed is based on easy access. Placement between the views, with consideration of where other dimensions would need to be placed, is a good starting point.
- Wherever possible place dimensions outside the outline of the object
- It is a convention that all measurements are shown in millimetres. However, you do not write

'mm' after every measurement; rather you write 'ALL DIMENSIONS IN MM' in your title block or near the scale.

- Never repeat a dimension. Always check that you have not repeated a dimension on another view. Place dimensions on the view that shows a detail most clearly.
- Circles are usually dimensioned using the measurement of their diameter.
- There are dimension lines and projection lines. Projection lines are thin lines, which begin 1mm from the drawing and extend beyond the last dimension line by 2mm. They define the area being dimensioned and *never* touch the actual object. Dimension lines are also thin lines with arrows placed at each end that touch the projection line.
- Each dimension line starts 10mm from the object and is then 10mm apart. The smaller dimensions are placed closer to the object. Longest dimension lines are furthest away from a view (for example, total height).
- Each Dimension Line has an arrowhead that can be open or closed. Arrowheads touch (but do not cross) projection lines.
- Dimension numbers can be written vertically or horizontally. The selection of vertical or horizontal writing must be consistent throughout the drawing. For easy reading numbers are to be placed as read – the drawing orientation. Refer to figures 16 and 17.

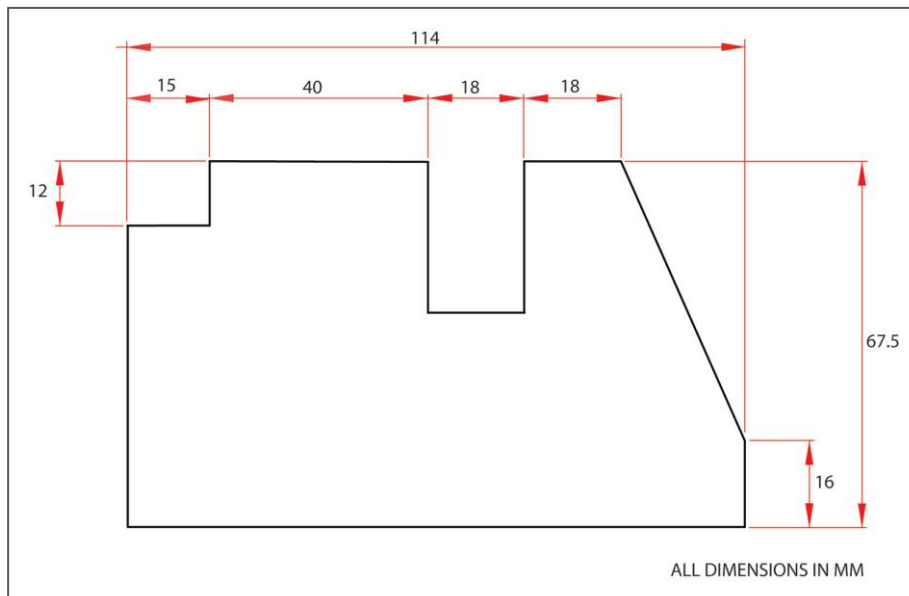


Figure 16

Dimension numbers placed horizontally and vertically (the orientation of the page does not have to be changed).

- REMEMBER: Draw the number characters very clearly to prevent misinterpretation. The numbers 3, 5, 8 need to be carefully drawn for the same reason.
- In Visual Communication Design it is acceptable to dimension around the outside or you may place your dimension between the views. Refer to figure 18.

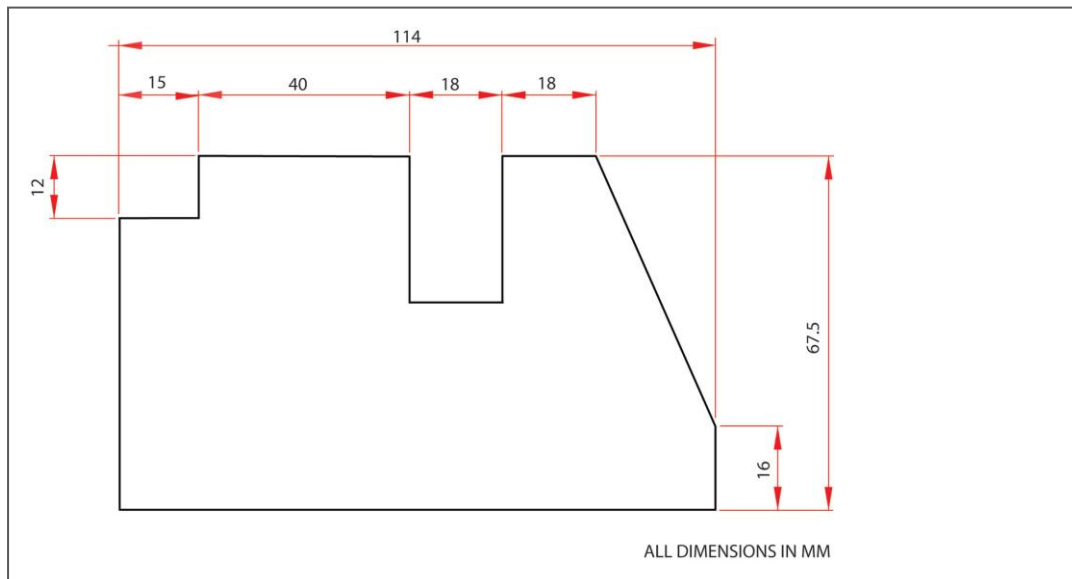


Figure 17
Dimension numbers are placed horizontally (note that the page has to be turned to the right once).

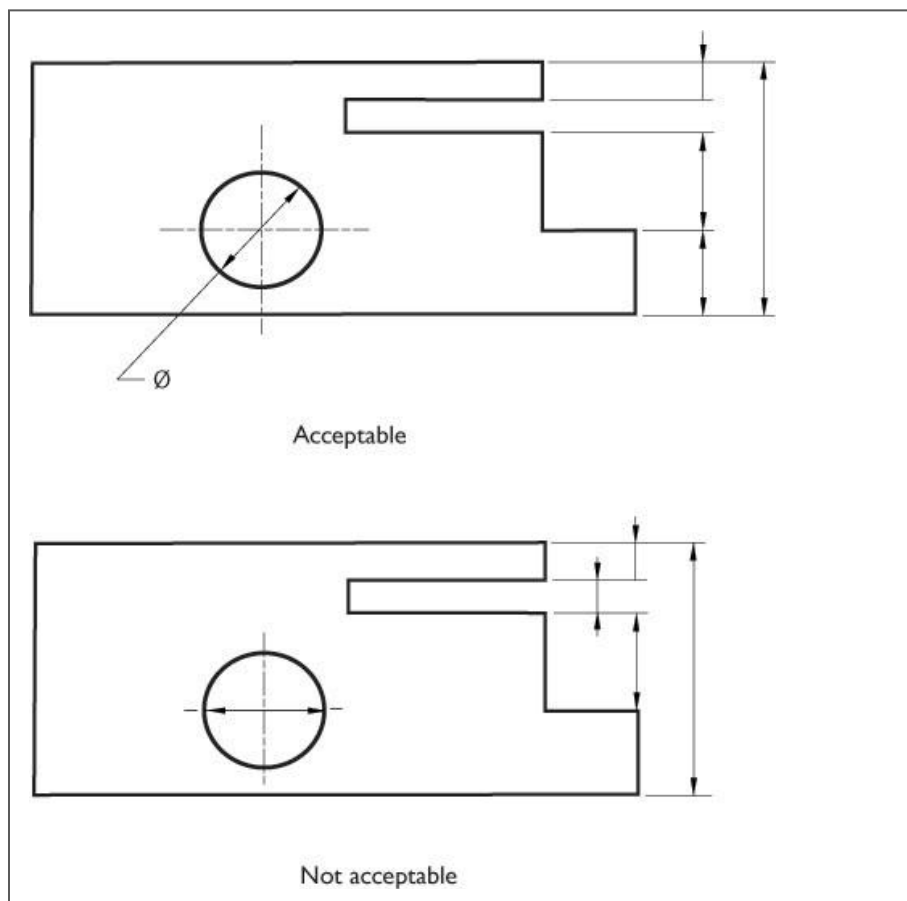


Figure 18 acceptable and unacceptable dimension placement

Dimensioning circles

Circles are usually dimensioned by their diameter. The symbol \emptyset means the diameter and 'R' refers to radius. When dimensioning part of circle (arc) use the R for radius. When you are showing a circle on an orthogonal drawing you need to include the centre line. The centre line is a chain line that is

placed through the centre of the circular feature. When dimensioning a circle often a leader is used. Leaders stop with an arrowhead touching a line, within the outlines of a view. They are always 'sloped' and are used to carry dimension numbers for diameters (\varnothing) and radii. They may carry a notation, for example, $\varnothing 20$ deep.

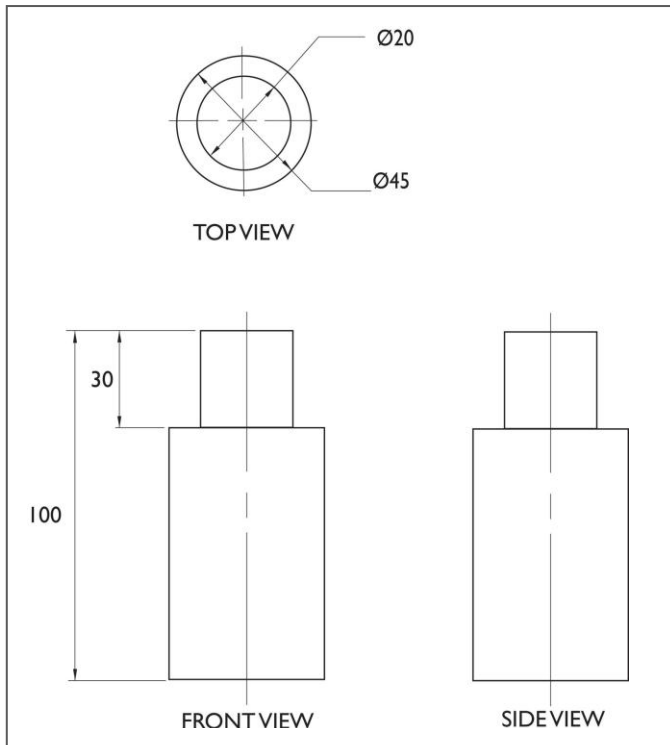
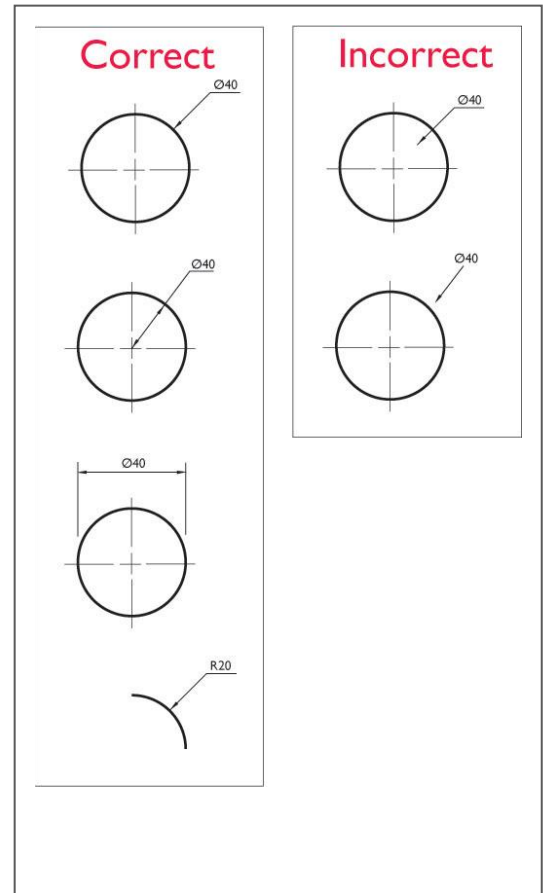


Figure 19
Dimensioning circles



ARCHITECTURAL CONVENTIONS

Architectural drawing

Architectural drawing is also a two-dimensional drawing system. While based on similar principles of projection, it does not follow the same guidelines as orthogonal drawing because the nature of the task is different.

Where orthogonal drawing uses TOP VIEW, architectural drawings use the term PLAN VIEW. FRONT VIEW and SIDE VIEW are known as FRONT ELEVATION and SIDE ELEVATION.

Each ELEVATION is known respectively as North elevation, East elevation, South elevation and West elevation.

These labels are placed below each view and use the same style of letterform for easy reading.

To make this work effectively, architectural drawings have a NORTH ARROW to quickly show orientation. They may also include a site plan to show where the house is placed on the block.

Architectural drawings usually work to a scale of 1:100, in other words 10mm (or 1 cm) equals 1 metre (1000mm).

Dimensioning for architectural drawings

Dimension lines reflect the way the building is 'pegged out'.

Dimension lines are supported by projection lines.

In architectural drawings (figure 20) arrows become 45 degree strokes through each line, and lines always cross over by 2mm. The lines begin 2mm outside the building structure. The lines are positioned this way because the data they carry is more complex. Each line should add up to the same amount because they are describing different aspects of the same length.

There are many different symbols for architectural features. Refer to figure 21 for some examples. Remember, symbols also need to reflect the same scale as the plan and elevation views.

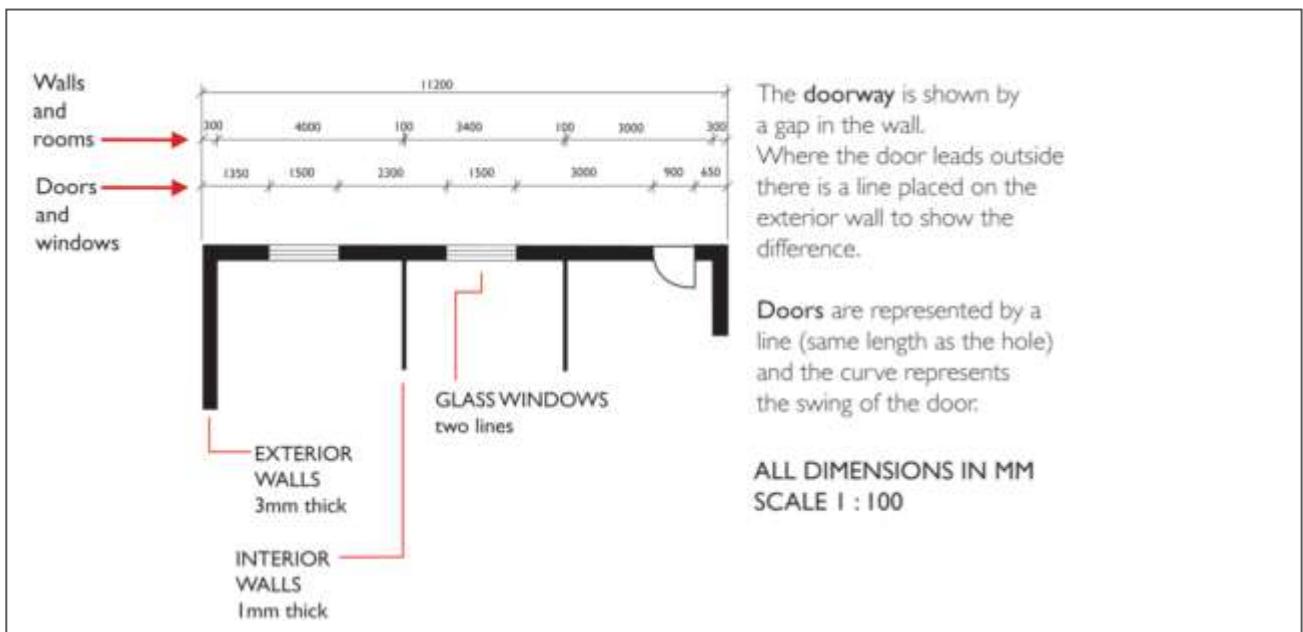


Figure 20: Dimensioning a floor plan

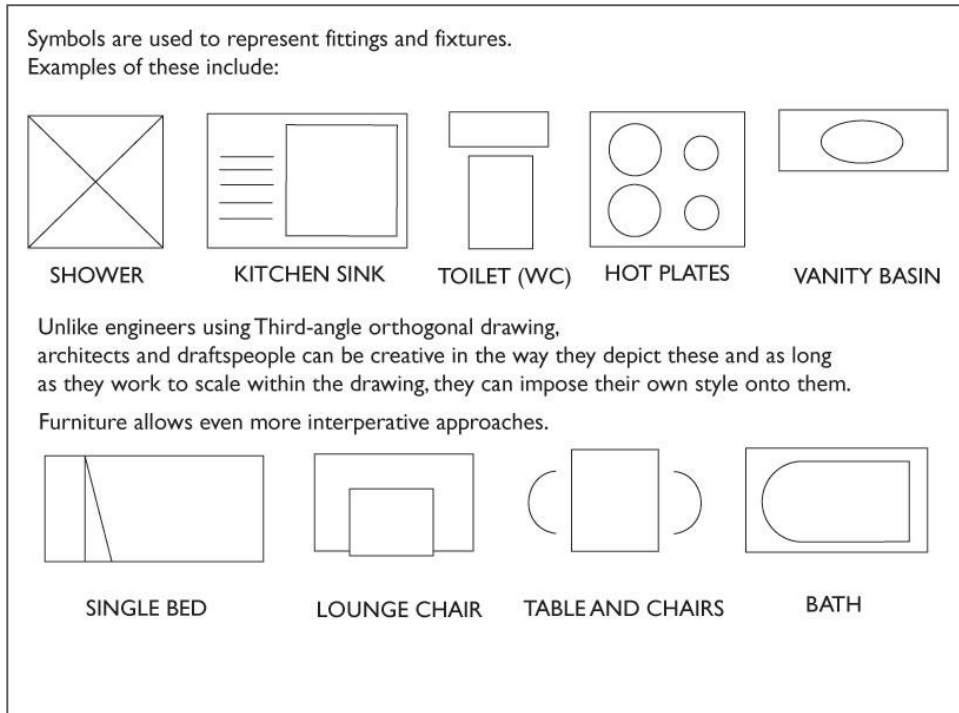


Figure 21
Examples of architectural symbols