TECHNICAL DRAWING SPECIFICATIONS

A GUIDE FOR VCE VISUAL COMMUNICATION AND DESIGN STUDENTS

The aim of this support material is to define Third-angle Orthogonal Drawing Conventions for use in VCE Visual Communication and Design. This material reflects established practices consistent with the Australian Standards for Technical Drawing Specifications and is directly related to the key knowledge and skills in Units 1 to 4. The study does NOT require skills and knowledge to be taught for First-angle Orthogonal.

This resource supports the key knowledge and skills required in the following outcomes:

Unit and Outcome	Area of study
Unit 1 Outcome 1	Instrumental drawing
Unit 2 Outcome 1	Representing and communicating form
Unit 3 Outcome 1	Visual communication design
Unit 4 Outcomes 2 and 3	Developmental work and Final presentations
	(If the choice of topic requires Orthogonal Drawing)

NOTE:
Lineweights have been exaggerated to emphasise the role of different thicknesses.
All linework is one colour; usually black (ink) or greylead pencil, on a working drawing.
Where colour is used, it is to emphasise specific information.
Line characteristics rather than colour reflect how convention is applied.

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THIRD-ANGLE ORTHOGONAL DRAWING

Two-dimensional drawing systems are used by an informed audience to 'read' technical information about a product or construction. Aesthetic qualities are not considered. This coded drawing system uses conventions (rules) that Australian engineers and designers work from. It is a technical design language that is recognised internationally and ensures plans can be used to build/manufacture engineered products throughout the world. There are two projection systems world wide, all drawings must show a projection symbol to identify the system in use.

By 'flattening' an object to be engineered, information remains accurate. This system is designed to prevent production confusion and inaccuracies, and costly delays. These are known as multi-view drawings. Each face from a three-dimensional (proposed/existing) object is separated and converted to this coded line and symbol language to clearly show changes of direction on the surface (visible and hidden). The views are known as:

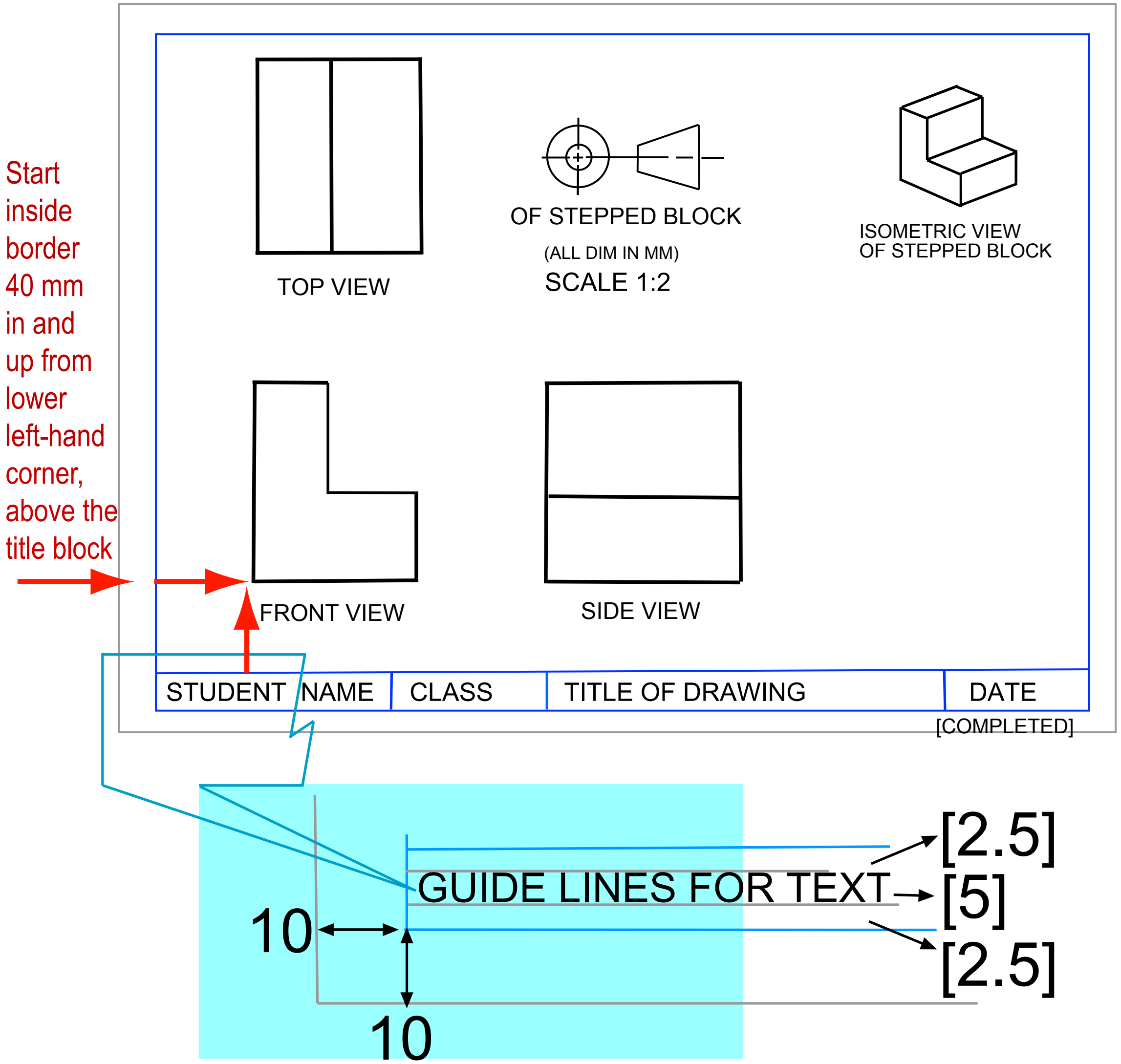
FRONT VIEW
TOP VIEW
SIDE VIEW (left and/or right-hand view)
(and at times) BASE/SECTIONAL VIEWS

PLACEMENT OF VIEWS

The TOP VIEW is always directly above the FRONT VIEW, and the SIDE VIEW is always 'next to' and 'aligned to' the FRONT VIEW. Both FRONT and TOP VIEWS are placed equidistant from the FRONT VIEW.

Plan a 'LAYOUT' before commencing your DRAWING

It is important to plan your solution and consider placement before you start. The following example 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 help students to make a connection between the two-dimensional shapes of orthogonal and a more visually representative three-dimensional isomentric form. It is also good practice. Consider the size of paper you choose, relative to the scale/ dimension of drawing, and the orientation. A vertical orientation may better suit taller, thinner objects such as a jug or drinking vessel. You may also need to plan for dimensions.



Set the drawing out in pencil first. Blue line shows border.
The letterform needs to 'float' in the title block space.

LABELLING: An important part of observing Engineering conventions for visual communication students. The projection symbol/specific object title/scale – can sit in the 'empty' quadrant as shown.

Pencil: Recommended H/2H or use **HB** lightly if you are leaving impressions in the paper surface.

Keep your line work VERY CLEAN and EVEN.

USING THESE LINES

Visible lines are used to show a change in direction on each surface of a three-dimensional form.

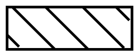
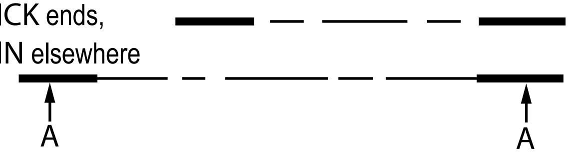
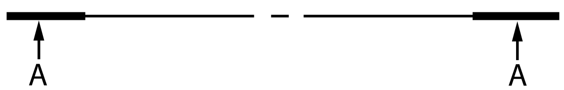
Three-dimensional objects have six sides primarily – top, base, left-hand side, right-hand side, front and back.
Orthogonal drawing shows (in most cases) three sides.
To compensate for three views being left out, a system of visible and hidden lines are used to show where these changes in the object are located.

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 in the top 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 this coded line system.
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. If there isn't an annotated leader indicating the depth of the cylindrical hole, then students can presume the hole goes completely through the object.

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. These lines cross over the edge of a shape by about 2 mm
They are drawn half weight to indicate that they are not actually part of the object itself.

Sometimes SECTIONAL VIEWS are required to show more accurately what is happening inside the object.
The cutting plane is shown on one of the Orthogonal views, indicating viewing direction while the effected view uses HATCHING to show the the section effected by the cut. Notice that both line thickness types are used.

A TWO WEIGHT LINE SYSTEM IS APPROPRIATE FOR USE IN VISUAL COMMUNICATION AND DESIGN. The heavier line is used to draw the views that represent the object being drawn. Thinner 'half weight' lines are used to provide additional information including labels. Thin lines deliver support information and need to extend about 2 mm beyond each OBJECT VIEW or DETAIL WITHIN THE VIEW, to prevent confusion.

THICK continuous	VISIBLE LINES used on each view includes ARCS/CIRCLES/CURVES TITLE BLOCK/BORDER
THICK dashes	HIDDEN LINES used on each view Dashes start and end with contact to a visible or hidden lines
THIN continuous	DIMENSION LINES, PROJECTION LINES, HATCHING FOR SECTION LINES, SHORT CENTRE LINES, INTERSECTION LINES, DIMENSIONING LEADERS, LETTERFORM USED IN TITLE BLOCK FOLD LINES ON A SURFACE TEMPLATE Note: Centre lines show symmetry
THIN chain	CENTRE-LINES, AXIS OF SOLID FORMS, PITCH LINES (think ROOF LINE)
CUTTING PLANES: SECTION A - A 	45˚ thin lines known as HATCHING shows the area effected by the 'cut'
THICK ends, THIN elsewhere 	CUTTING PLANE (indicating location of 'sectional cut' Arrows also support this by indicating viewing direction
	Where the cutting plane is also a CENTRE LINE, it takes on some of the centre lines qualities

LINE THICKNESS reflects a calibrated metric system that matched line thickness to paper sizes.
PENS that control the exact flow of ink are used. Specialist computer programs also use this system.
Recommended line weights for classroom applications are dependent on access for students:

CALIBRATED INK PENS	– **THICK .7** / thin .35 **OR** **THICK .5** / thin .25
FINE LINERS	– select two that clearly show ASSIGNED LINEWEIGHTS
LEAD PENCIL	– apply different pressures to deliver weights. (2H, H, HB? test which suits) Line quality needs to be even and clean for best results.

In VCE Communication and Design,
students are required to label each view.

LABELS AND DIMENSIONS

Placement of numeric information is known as DIMENSIONING. Placement of measurements is a requirement on a WORKING DRAWING.

SCALE

Measure directly from an orthogonal drawing where the scale is 1:(full size). All drawing 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 SCALE 1:100

LABELLING

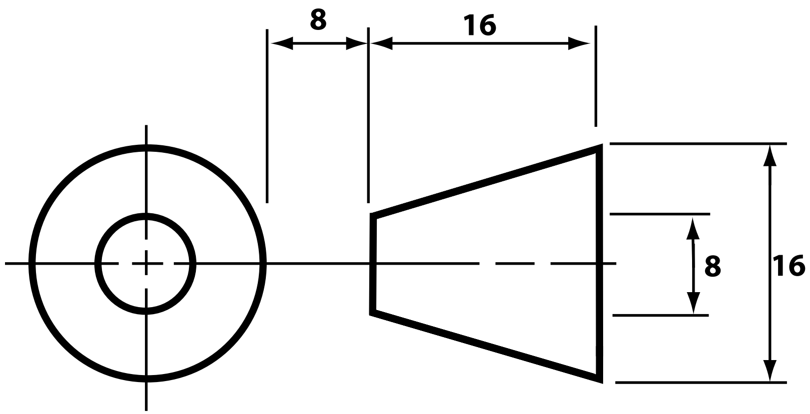
Each VIEW must be labelled using CAPITAL/UPPER CASE lettering, using a SANS SERIF letterform, SINGLE STOKE VERTICAL GOTHIC is recommended as convention. If using a program such as Illustrator, a FONT known as GILL SANS presents very closely to requirements as there is no serif on ‘number one’.
‘VIEW labels’ are located in a ‘centred’ position, UNDER each view, 10 mm below the view, 5mm in height. Labelling of each VIEW meets VCE Visual Communication and Design study requirements.

THIRD-ANGLE ORTHOGONAL **PROJECTION SYMBOL**

The projection symbol is part of labelling requirements, and is placed on the drawing along with TITLE OF WORK, SCALE, DATE COMPLETED, NAME – Including the actual symbol on the drawing is preferred over written reference; ‘THIRD-ANGLE ORTHOGONAL PROJECTION’

For .5/.25 ink system, 7 and 10 mm diameters apply.
For .35/.7 inked line system, 8 and 16 mm diameters apply.
Adapt this to thick lines – object – and thin (1/2 weight) lines – centre lines.
If using fine liners or lead pencil use the 8:16 mm dimensions.

The dimensions are based on the diameter of the small and large concentric (shared centre) circles.

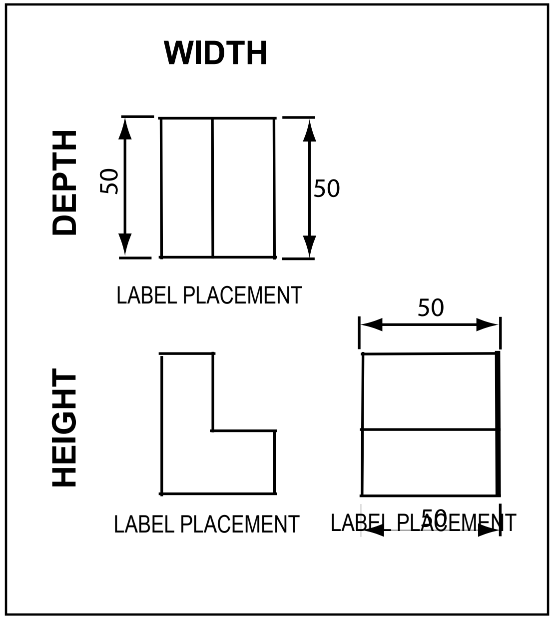


Computer vector programs such as AutoCAD provide engineering symbols.
The symbol above was constructed using information and communications technology (ICT) in the digital imaging program Illustrator. This symbol can be constructed by hand, using instrumental drawing, and sketched freehand when developing orthogonal concepts.

DIMENSION PLACEMENT

Dimensions are placed on drawings. For example, all depth lines are giving the same measurement so each of the shown dimensions are redundant except one. The decision to position a dimension line 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.

Notice the dimension numbers are placed on top of the horizontal line or on the side furthest from the orthogonal view for vertical lines.
Also notice that placing the labels first prevents potential clashes.



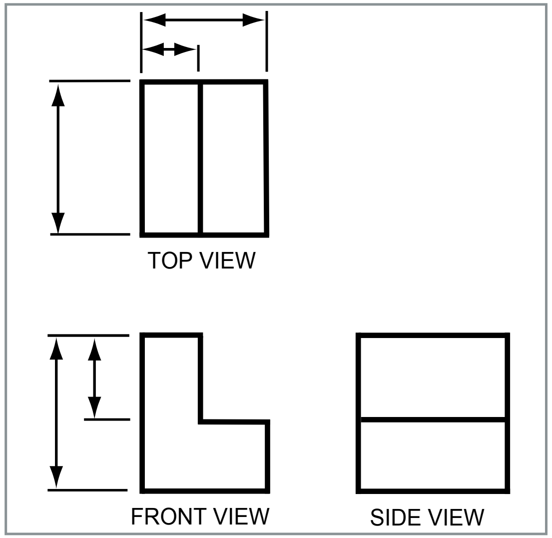
The views must be equidistant apart, i.e. the same space between each one. This allows for labels and dimensions.

A 40 mm gap is generally suitable.

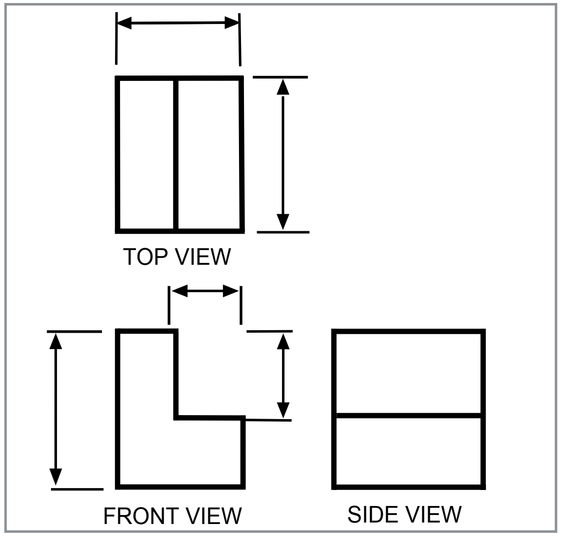
Notice that 'mm' are not written next to the number. This is because engineering drawings are not in centimetres (cm).

Numbers can be written vertically or horizontally as long as they are consistent. For easy reading, numbers are to be placed as read – with title block on the bottom of the page. You may also turn the page once to the right to read dimension numbers.

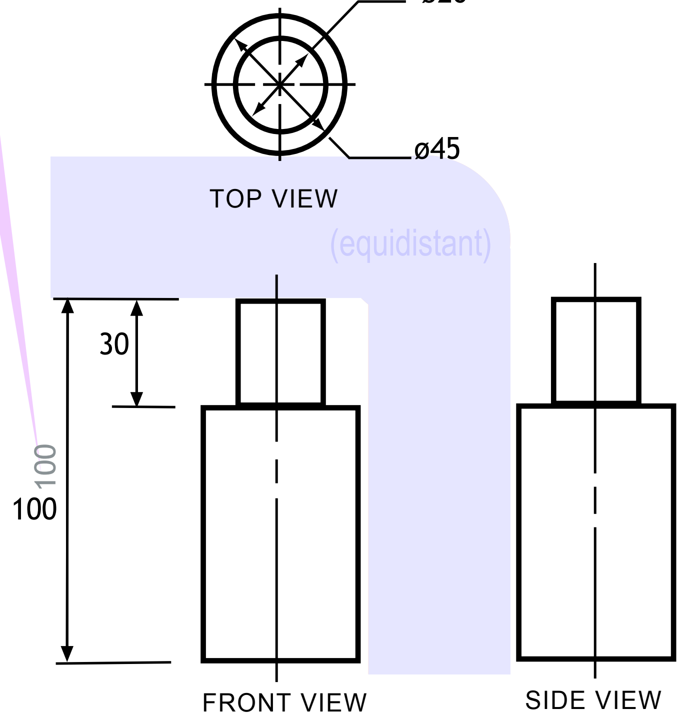
In VCE Visual Communication and Design, it is acceptable to dimension around the outside as shown in option one, or you may work between views shown in Option 2.



Option 1



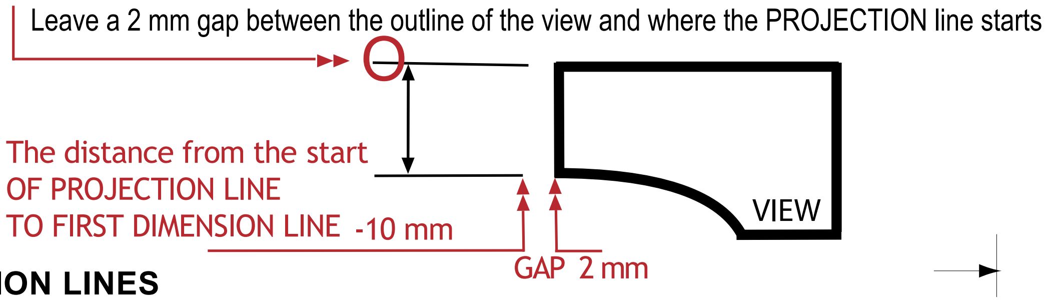
Option 2



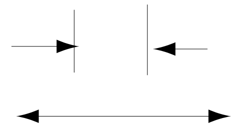
PROJECTION LINES

PROJECTION LINES SUPPORT **DIMENSION** LINES

PROJECTION LINES extend OUT 2 mm beyond the last dimension line



DIMENSION LINES



Measurements are known as dimensions.

DIMENSION lines carry the measurements.

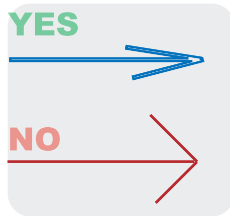
Dimension lines are drawn between projection lines.

Each dimension line has an ARROW HEAD that can be open or closed.

Arrowheads touch (but don't cross) projection lines.

Arrowheads are usually three times longer than they are wide if manually drawn.

COMPUTER DRAWN dimension lines place arrowheads on lines and are closed.



LEADERS

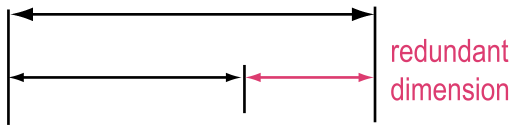
Leaders stop with an arrowhead touching a line, within the outlines of a view.
They are always 'sloped' (often 45˚) and are used to carry dimension numbers for diameters (ø) and radii (R). They may carry a notation. For example, 'bore' 25, 20 deep.

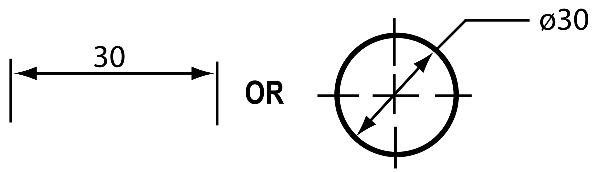
DECIDING WHERE TO PLACE DIMENSIONS

CONSIDER: Placement of VIEW labels first, '**CENTRED, BELOW EACH VIEW**'.

Consider where MEASUREMENT is easily found and read.

Don't repeat a dimension as this is 'over dimensioning'.
Example – defining a diameter
(1) with a dimension line (2) a leader





Where possible, place outside views.

Consider placement between adjacent views (adjacent means 'next to' – between views – if appropriate)

Longest dimension lines are furthest away from a view (for example, total height)

Place dimension numbers so that they can be read from the bottom or right side.

Place numbers above dimension line establishing a visable clearance.

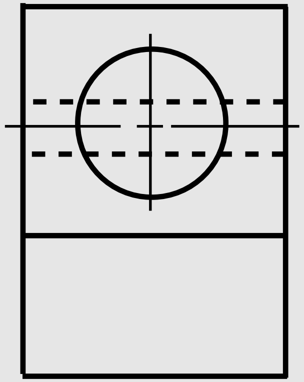
REMEMBER: Draw the number characters very clearly to prevent misinterpretation.

The numbers 3, 5, 8 need to be carefully drawn for the same reason.

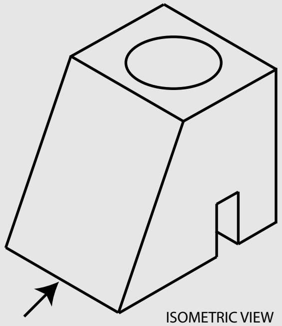
YES	NO
1 and 7	1, 1 and 7

SECTIONS

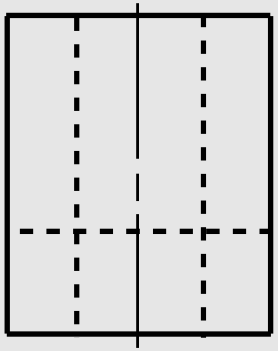
Sections are about showing what is happening on a cutting plane.



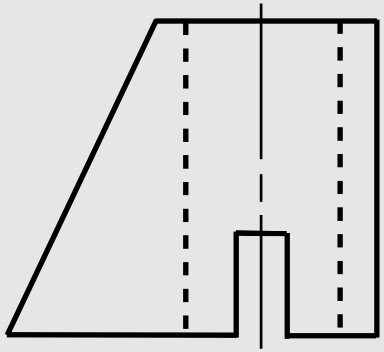
TOP VIEW



ISOMETRIC VIEW

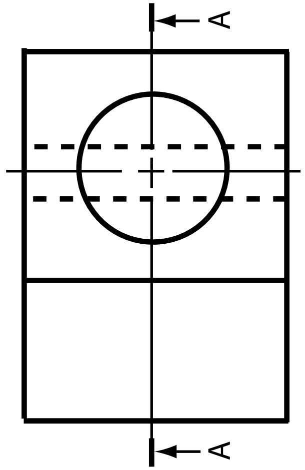


FRONT VIEW

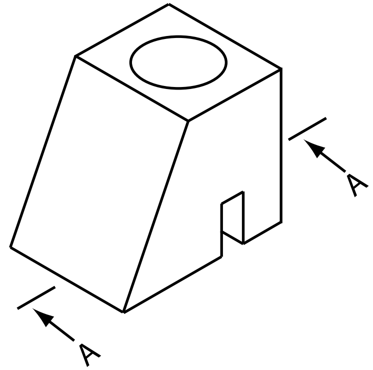


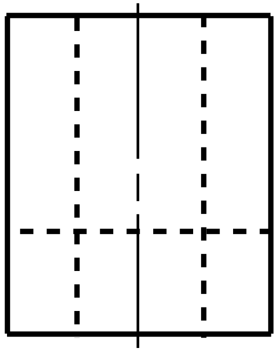
SIDE VIEW

THIS A THIRD-ANGLE ORTHOGONAL DRAWING WITHOUT A SECTION

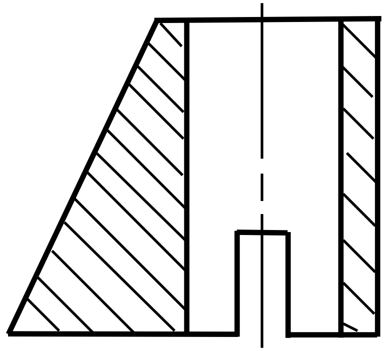


TOP VIEW





FRONT VIEW

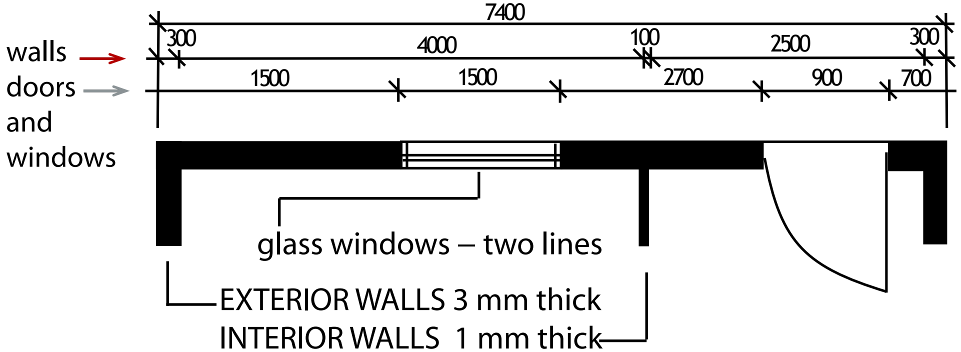


FULL SECTION A-A

NOTICE HOW ONLY ONE VIEW SIGNIFICANTLY CHANGES WHEN THESE DRAWINGS NEED TO SHOW WHAT IS ACTUALLY AFFECTED BY THE CUT ONLY

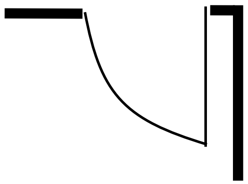
Architectural dimension lines look different

(because there are so many measurements)



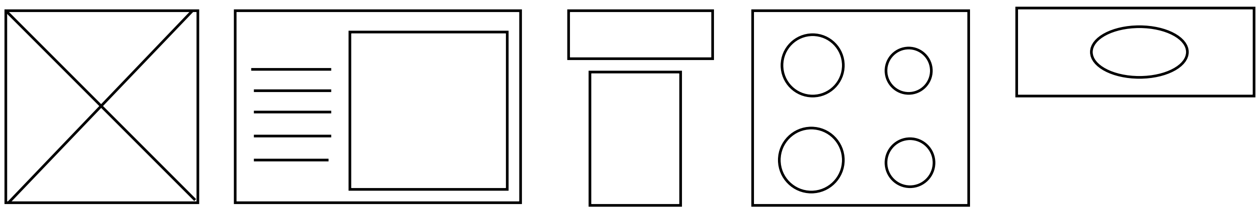
SCALE 1:100

DOORWAY is shown by a gap in the wall. Where the door leads outside there is a line placed on the exterior wall to show the difference.



A DOOR itself is represented by a line (same length as the hole) and the curve represents the swing of the door. This is one approach. There are double swing doors, sliding doors, archways …

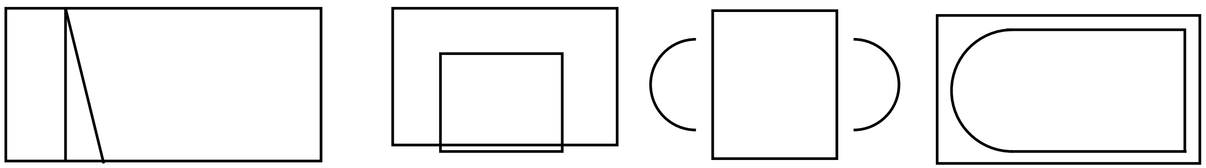
Symbols are used to represent fittings and fixtures.
Examples of these include:



SHOWER KITCHEN SINK TOILET (WC) HOT PLATES VANITY BASIN

Unlike engineers using THIRD-ANGLE ORTHOGONAL DRAWING, architects and draftpersons can be creative in the way they depict these and as long as they WORK TO SCALE WITHIN THE DRAWING, they can impose their own style onto them.

FURNITURE allows even more interperative approaches.



SINGLE BED LOUNGE CHAIR TABLE AND CHAIRS BATH

ARCHITECTURAL DRAWING

Architectural drawing is also a two-dimensional drawing system. While based on similar principles of projection, it doesn't follow the same guidelines as orthogonal drawing because the nature of the task is different.
Where an orthogonal drawing uses TOP VIEW, architectural drawings use the term PLAN VIEW.

FRONT VIEW and SIDE VIEW are known as ELEVATIONS.

Each ELEVATION is known as NORTH ELEVATION, EAST ELEVATION, SOUTH ELEVATION, WEST ELEVATION.

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

To make this work, 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 10 mm (or 1 cm) equals 1 meter (1000mm).

Dimension lines reflect the way the building is 'pegged out'. Dimension lines are supported by projection lines.

Here arrows become 45 degree strokes through each line, and lines always cross over by 2 mm. They start 2 mm out from the building structure. They are done 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. A sample of them is shown.

Remember, symbols also need to reflect the same scale as the plan and elevation views.