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Unit Resource Manual

Manufacturing Skills Australia Courses

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Aims of the Competency Unit:

This unit of competency covers producing drawings or similar graphical representations where the critical dimensions and associated tolerances and design specifications are predetermined.

This unit applies to any of the full range of engineering disciplines. All work is carried out under supervision and all specifications, dimensions and tolerances are predetermined. The unit covers application of introductory drafting skills to select and apply drawing protocols.

Manual drafting or computer-aided design (CAD) drawing equipment may be used.

If CAD skills are required, MEM30031A Operate computer-aided design (CAD) system to produce basic drawing elements should be selected.

Drawings are completed to Australian Standard (AS) 1100.101–1992 Technical drawing – General principles.

This unit applies to all engineering and manufacturing environments

Unit Hours:

72 Hours

Prerequisites:

MEM09002B Interpret technical drawings (recommended only).

Elements and Performance Criteria

1.	Identify drawing requirements	1.1	Identify information requirements for work and obtain all relevant job requirements and design specifications in accordance with workplace procedures.
		1.2	Identify, interpret and analyse drawing requirements, specifications and relevant workplace information.
		1.3	Interpret and apply industry terminology for drawing work.
		1.4	Confirm communication practices required during drawing work.
		1.5	Estimate time requirements for completing work.
2.	Select drawing features	2.1	Set up drawing list or register.
		2.2	Determine level of detail and numbers of drawings required for work.
		2.3	Plan presentation and layout, and determine drawing sheets, text style and size, and scales, appropriate for drawing work.
		2.4	Identify features and applications of line types and thicknesses and select for drawing work.
		2.5	Establish datums and dimensions.
3.	Prepare and detail drawings	3.1	Prepare drawings in plane orthogonal, isometric projection or equivalent.
		3.2	Detail drawings in third angle projection, including auxiliary views, sections and assemblies.
		3.3	Draw sections through engineering components incorporating correct use of cutting plane symbols and conventions.
		3.4	Include appropriate symbols for limits and fits, surface texture and geometric tolerances.
		3.5	Resolve problems in consultation with a supervisor.
		3.6	Check drawing compliance with work instructions and specifications.
4.	Select physical dimensions and produce engineering parts list	4.1	Where required, select components and/or materials from supplier/manufacturer catalogues using predetermined design specifications.
		4.2	Produce an engineering parts list in accordance with workplace procedures.

5.	Complete drawing documentation	5.1	Obtain approval for drawings and/or parts list.
		5.2	Store approved drawings and/or parts lists.
		5.3	Catalogue and issue drawing and documentation in accordance with workplace procedures.

Required Skills and Knowledge

Required skills

- correctly using and maintaining equipment, including CAD
- manual drafting, filing and printing
- reading and interpreting specifications
- communicating with supervisor to confirm work requirements and outcomes
- visualising components
- preparing a drawing in plane orthogonal, isometric projection or equivalent
- determining drawing protocols required to complete drawing to industry standard
- selecting and locating text to support presentation
- establishing datums and dimensions for drawings
- drawing sections through an engineering component incorporating correct use of cutting plane symbols and conventions

Required knowledge

- drafting media, including cartridge paper, tracing paper, drafting film and plain printing paper
- layout conventions
- effective use of blank space, location of notes and symbols
- sectioning
- overview of graphical techniques
- assembly drawings and explosion drawings
- schematics/line drawings, graphs and pictorials
- standard engineering drawing symbols, references and terminology
- application of surface finish symbols to drawings
- uses of different scales in industry applications
- uses and types of line weights
- uses and types of drawing sheets
- type of information provided with drawings

Topic Program:

Topic	Skill Practice Exercise
Topic 1 – Drawing Standards & Projection:	MEM30032-SP-0101 to MEM30032-SP-0114
Topic 2 – Laying Out an Engineering Drawing:	MEM30032-SP-0201 to MEM30032-SP-0210
Topic 3 – Drawing Sheets:	MEM30032-SP-0301
Topic 4 – Dimensioning:	MEM30032-SP-0401 to MEM30032-SP-0404
Topic 5 – Sections:	MEM30032-SP-0501 to MEM30032-SP-0510
Topic 6 – Lettering & Notations:	MEM30032-SP-0601 to MEM30032-SP-0603
Topic 7 – Scales:	MEM30032-SP-0701 to MEM30032-SP-0702
Topic 8 – Assembly Drawings:	MEM30032-SP-0801
Topic 9 – Detail Drawings:	MEM30032-SP-0901
Topic 10 – General Tolerance Dimensions:	MEM30032-SP-1001 to MEM30032-SP-1004
Topic 11 – Surface Finish Indication:	MEM30032-SP-1101 to MEM30032-SP-1104
Topic 12 – Geometric Tolerance:	MEM30032-SP-1201 to MEM30032-SP-1204
Topic 13 – Identify Drawing Requirements:	
Topic 14 – Information Provided With Drawings:	
Practice Competency Test	MEM30032 –PT-01

Contents:

Topic 1 – Drawing Standards & Projection:

Required Skills:

On completion of the session, the participants will be able to:

- Produce a simple drawing in Orthogonal Projection.
- Use different line constructions to identify features on an orthogonal view..

Required Knowledge:

- Australian Standard controlling the preparation and presentation of all drawings in Australia.
- The difference between First and Third Angle Projection.
- Manual and computerised drafting equipment.
- Types of line construction and line widths used in preparing a drawing.

Standards - General Information:

The preparation of plans for the construction of buildings and machines is as old as written history. Original drawings were carved on rock or sketched onto papyrus. One of the oldest drawings of an engineering component is a cave painting of a bow in Castellon, France in about 8000BC. As civilisation grew and the skills became more advanced, plans were produced on other mediums such and bark and paper using a variety of instruments to assist in creating better quality drawings.

Figure 1.1

Figure 1.1 shows a detail drawing of various halls, rooms and antechambers around the central courtyard of the Palace of Nur Adad in Larsa, Babylon around 1865 to 1850BC and was drawn in clay. Although there is no writing on the tablet, we can be sure of what it depicts. Firstly, it is written on the characteristic purplish Larsa clay. Secondly, the design of the palace and the proportions correspond almost exactly with the building remains of the Nur Adad temple unearthed by French excavations that started in 1903. So far, the only example of an identifiable plan of a known building on a clay tablet.

Figure 1.2 shows Leonardo De Vinci's drawing of a helicopter (1490-1500). Though the first actual helicopter wasn't built until the 1940s, it is believed that Leonardo da Vinci's sketches from the late fifteenth century were the predecessor to the modern day flying machine. As with many of da Vinci's ideas, he never actually built and tested it – but his notes and drawings mapped out exactly how the device would operate.

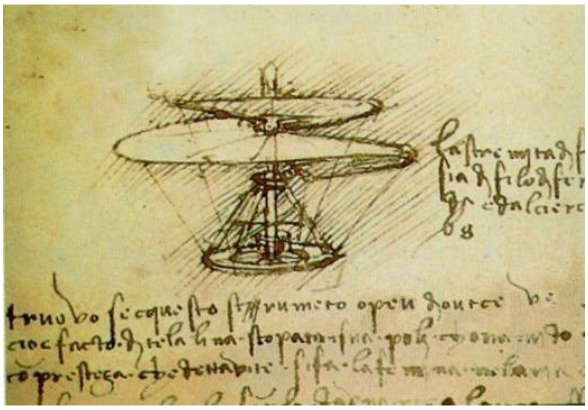


Figure 1.2

Michelangelo produced the preliminary sketch for San Giovani de' Florentini in 1559 on paper as shown in Figure 1.3.

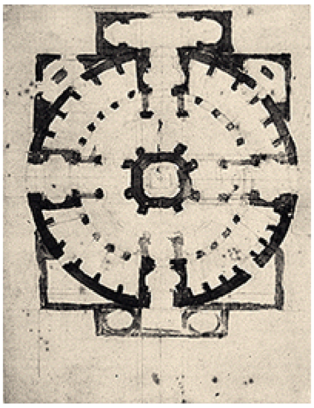


Figure 1.3

During the Industrial Age in the 1850's drawings became elaborate and were prepared by qualified architects, engineers and draughtsmen and can be seen in Figure 1.4, Robinson's New York Utility plan showing the sewer, gas, water services and ventilation.

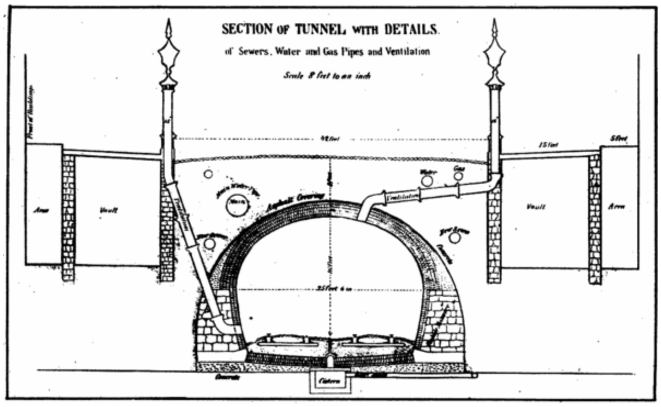


Figure 1.4

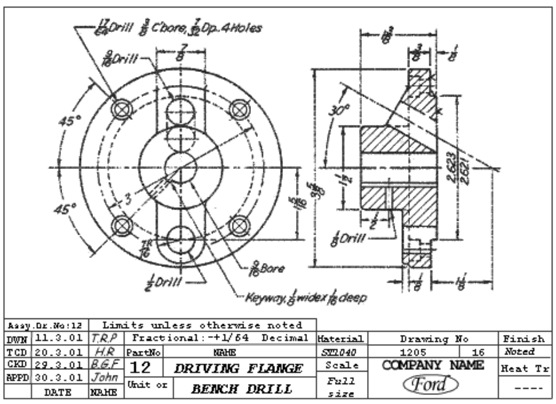


Figure 1.5

Figure 1.5 shows the detail drawing of a Flange drawn by hand in 2001 on tracing paper.

Drawings were created by the designer with little thought to conformity or any standard; some drawings had some dimensions or sizes however many drawings showed the basic shape or overall sizes and the actual details were left up to the engineer and supervisor on the job.

Standards have existed since the beginning of recorded history. The ancient Egyptians developed the 365 day calendar in 4236BC basing the rising of the "Dog Star" or Sirius every 365 days. In 1120AD, King Henry I of England instituted the "ell" which was the equivalent to the length of his arm.

The earliest standards were the physical standards for weights and measures which provided a single reference point and against which all other weights and measures in the society could be standardised. As trade and commerce developed, written documents developed which set down mutually agreed standards for products and services such as shipbuilding, housing, electrical/electronic goods, clothing and nearly any object that has to be manufactured. Initially, the standards were unique documents and formed part of a single contract between the supplier and the purchaser. Later the concept of common standards evolved where the same standard could be used across a range of transactions; this portability offering a uniform set of criteria, is the basis of modern standardisation.

After the rapid industrialisation of the early 19^{th} century, the general absence of national standardisation caused high inefficiencies. Lack of conformity was a major cost as evidenced with the different railway gauges between the different states; each carriage had to be unloaded from one carriage in New South Wales and loaded onto another carriage in Victoria when transporting goods between the states. It wasn't until the end of the 19^{th} century that the value of standardisation in sizes, specifications, materials, testing and conformance was recognised as a national priority. By 1900, standardisation was flourishing and has continued to where is has now become intrinsic to modern society and has extended far beyond the initial focus to include consumer safety, occupational health and a myriad of other topics, all of which serve to improve the quality and comfort of everyday life.

Standards are the tools we use to organise our technical world and measures we employ to establish norms for management procedures; they underpin consumer expectations that products purchased will be safe, reliable and fit-for-purpose. Standards have become such integral components of our economic, social and legal systems that they are often taken for granted and their crucial role in modern society is often not recognised.

Australian Drawing Standards:

A Standard is a published document which sets out specifications and procedures designed to ensure that a material, product, method or service is fit for its purpose and consistently perform in the way it is intended. Standards establish a common language which defines quality and establishes safe criteria. Standards and conformance are the keys to ensuring the quality and consistency of physical, chemical and biological measurement throughout Australian society and the economy.

The benefit of standards to both the Public and National Interest are:

- Standards Protect Australians.
- Standards Support Australian Innovation.
- Standards Boost Australian Production and Productivity.
- Standards Make Australian Business More Competitive.
- Standards Link Australia to the World.
- Standards Complement Australian Regulation and Make Markets Work Better.
- Working on Australian Standards Rewards Participants.

The Australian Standards applying to the preparation and presentation of drawings in Australia is AS1100 and sets the standard for linework, lettering, dimensioning, symbols, borders, sheet sizes etc.

Manual Drafting Equipment:

The equipment used to produce a drawing depends on the method of drafting being used; i.e. computer, drawing board, photographic etc. Drawings prepared electronically (computers) require little more than a computer, keyboard, monitor, software and a printer/plotter. Drawings being prepared manually varies depending on the medium and methods used. The equipment usually consists of:

Drawing Board:

A drawing board is the surface upon which a drawing is prepared. A drawing board can be a simple sheet of plywood with a layer of thick paper or vinyl to allow a good quality line to be drawn or an elaborate drafting machine with movable arms and rules which can be rotated. Most drawing boards are used on a flat table and may be slightly inclined for an easier working position. Drafting machines can be raised or lowered, positioned vertically or horizontally, and some can rotate to allow the draftsperson to work upside down at the top of the drawing without having to remove and reposition the drawing.

Drawing Board with T-square

Drafting Machine

Drawing boards and machines have been largely replaced by the computer.

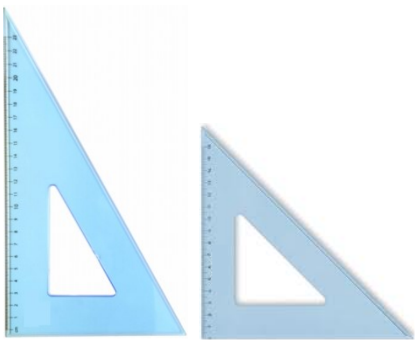
T-square, Set Squares and Protractor:

The T-square has a long horizontal arm called the *Blade*, fastened to a shorter vertical arm called the *Head*. The upper edge of the blade and the inner edge of the head are the working edges. The working edge of the blade must be straight or the drawn lines will curve; the head must not be convex or the head will rock and the drawn lines will not be parallel.

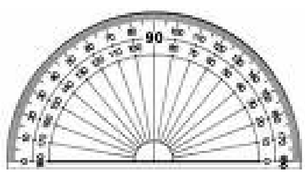
Set squares are available in 45° and 30°x60° styles; they are made from transparent plastic which allows lines on the drawing below the set-square to be seen.

Protractors are used for measuring and setting out angles other than those obtainable with the set-squares. Protractors are normally made from transparent plastic similar to set-squares.

T-Square



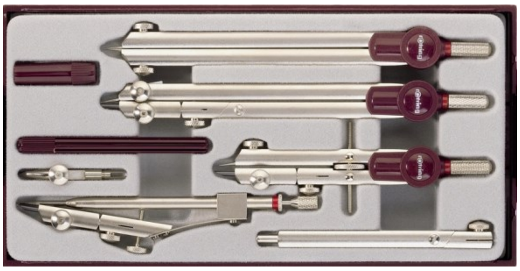
Set Squares



Protractor

Compass Set:

A compass has one leg which carries a pencil; the legs are connected by a bow-shaped spring instead of a joint. An adaptor can be inserted into the pencil leg and an ink pen used in place of the pencil. Compasses are used to draw arcs or circles.



Compass Set

Bow Compass

When using the pencil attachment with the compass, the pencil graphite is placed with the bevelled edge on the outside. The pin on the leg is placed at the point where the circle centre is required, the radius is set and the compass rotated about the pin by rotating the handle between the thumb and forefinger.

Technical Pens:

Technical pens consist of a cone which is a tube with a needle point; inside the pen's body is a reservoir that supplies ink to the cone. Technical pens are available in a large range of standard widths. For optimum line work quality, the cones are manufactured in a variety of materials (mild steel, tungsten tip, ceramic tip) depending on the drawing material being used.

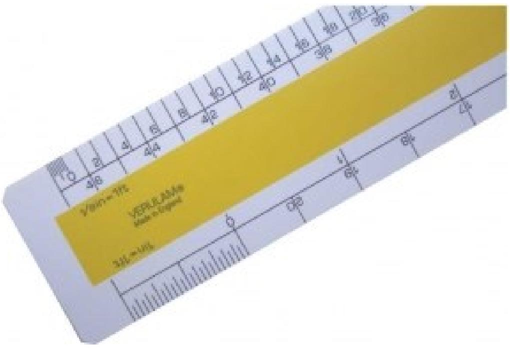
Technical Pen

Pen's Cones

Scale Rule:

The Scale Rule is similar to a normal rule but is graduated in the metric (or imperial) system to set scales; with practice, using a scale rule is as easy as reading a normal rule. Standard scales used in the scale rule are 1:1, 1:2, 1:5, 1:10, 1:20, 1:50, 1:100, 1:200; 1:500 and larger.

Scale rules can be "flat" or "triangular"; the flat rule has bevelled edges for when using ink.



Flat Scale Rule

Triangle Scale Rule

Pencils:

High quality pencils should always be used when drawing. Pencils are available in the old style timber pencil or modern technical pencils. The older style timber pencils have a thin rod of graphite in the centre and require constant sharpening to maintain a good sharp point for drawing. Mechanical pens have the graphite inside a tube and as the point wears down or breaks, more lead can be exposed as required. Mechanical pens are also available in a range of standard widths (0.25mm, 0.35mm. 0.5mm, 0.7mm 1mm) which give a constant line width.

Timber Pencil

Mechanical Pencil

When using timber pencils, the pencil should be revolved between the thumb and forefinger to assist in retaining a sharp point; revolving a mechanical pencil is not as important but can assist with maintaining a constant line width.

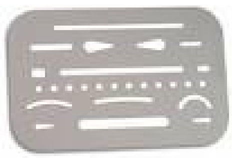
Pencils are available in a range of grades (or hardness) ranging from 9H to 7B. The 9H pencil has a very hard lead and leaves a very narrow and light line; if the draftsperson is not careful, the pencil can act as a knife and cut through the medium. At the opposite end of grades the 7B is very soft and leaves a wide and dark line; lines drawn using softer pencils are easily smudged. The middle range of pencils includes the F and HB grades. The pencils normally used by draftspersons are 3H, 2H, H, F, HB, and B with the H and 2H being the most commonly used.

When using a compass, it is generally accepted to use a lead about 2 grades softer than used when drawing because less pressure is used when drawing a circle using a compass than when drawing a straight line with a pencil.

Eraser and Erasing Shield:
Erasers are available in a range of materials, hardness and abrasiveness depending on the type of pencil/ink and the drawing medium. Care must be taken to retain the drawing surface in as good condition as possible – intense erasing will damage the surface and make it unsuitable for drawing or even create a hole.

The erasing shield is made from thin metal sheeting which has a series of different sized holes and slots. The shield is placed over a line to be erased thus protecting most of the other adjoining lines and text.

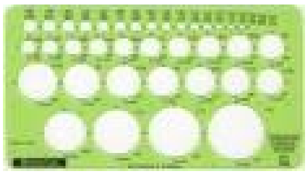
Eraser



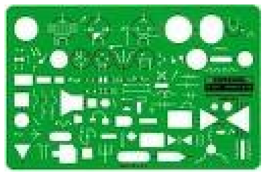
Erasing Shield

Stencils:
Stencils are made from transparent plastic sheets which have letters, numbers, or shapes cut out so a pencil or pen can quickly and accurately reproduce the shape. Lettering guides are available in a range of sizes and are specifically suited to pen sizes (0.25 pen for 2.5mm text, 0.35 pan for 3.5mm text, 0.5 pen for 5mm high text etc). Other stencils are available for symbols and appliances in most drafting disciplines, circles, ellipses and squares for mechanical/basic drawing, and electrical, electronic, architectural and structural to name but a few.

Lettering Guide



Circle Template



Electrical Template

Computer Aided Drafting/Design:

Computer Aided Design (CAD) is a form of design in which people work with computers to create ideas, models, and prototypes. CAD was originally developed to assist people with technical drawing and drafting, but it has expanded to include numerous other potential uses. A variety of software products designed for CAD can be found on the market, with many being targeted to a specific application or industry.

Drafting and technical drawing can be very painstaking, and they require some special skills. Using CAD for drafting still requires many of the same skills, but by working with a computer instead of on paper, people can be much more efficient; they can also play around with ideas much more easily, moving design elements around and running the design through software programs which can determine whether or not the design is structurally viable. For example, an architect working on a bridge can test the design in simulations to see if it will withstand the load it will need to carry.

CAD can be used to design structures, mechanical components, and molecules, among other things. One advantage of using CAD is that people don't have to make prototypes to demonstrate a project and its potential, as they can use a three dimensional modelling program to show people how something might look. The advent of 3D Printing allows components to be cheaply formed from a variety of plastics or powder. CAD also allows for endless variations and experiments to show how the look and feel of something can be altered, and these can be done at the click of a button, rather than with painstaking drafting work.

Casual users sometimes like to play with CAD for things like deciding how to organize their furniture, or lay out a garden; they can drag and drop elements and play with the space in a variety of ways, and generate a configuration which will be suitable and aesthetically pleasing. CAD is used by professionals in a number of industries across the manufacturing sector, and it can also appear in some surprising places, like forensics labs, where researchers recreate crime scenes on a computer to explore scenarios.

Advanced CAD programs usually require extensive training from their users, as they can be very complex and challenging to work with. More casual programs can be learned in shorter periods of time, with some designed to allow people to work within the program immediately, learning as they go. Simple programs can also sometimes have their functionality increased with expansion packs which are designed to provide additional features, so that people can work within a program they are familiar with when they want to develop more complex designs.

The number of CAD software programs available range from cheap easy-to-use but limited commands starting at about $20 to the top end market systems specially designed for a particular industry or company and can cost many thousands of dollars if not in the millions. The following list is only a small number of the many thousands on sale:

Autodesk AutoCAD – The software is the most popular software in the industry and has captured the bulk of industry at about 70% costing about $5000 and can be purchased as a light version for $2000. The full version has 2D & 3D capacities while light has only 2D.

Autodesk Inventor – Aimed specifically for the mechanical industry. Components are created in 3D with accurate material properties being stored in the database.

Components can be subjected to finite element analysis to determine its stress points while assemblies can be automated and recorded to determine collision points.

Autodesk Revit – Revit is an architectural program used to create residential and high rise buildings.

Solid Edge – is an easy-to-use software tool that addresses all aspects of the product development process including 3D design, simulation, manufacturing, design management and more due to a growing ecosystem of apps. Solid Edge combines the speed and simplicity of direct modelling with the flexibility and control of parametric design, made possible with synchronous technology.

StrucPLUS – The software is an add-in that increases productivity and automates structural detailing. It is a suite of powerful parametric modules that uses dialog box driven commands and macros related solely to the preparation of Structural Engineering drawings in the steel, concrete and civil disciplines.

SketchCAD – SketchCAD is an advanced bundle of powerful design software to gives operators the freedom of intuitive 3D sketch design, and artistic presentation combined with the best 2D CAD drafting tools in the business.

The software creates conceptual ideas in 3D, presenting them in the best possible way and then turning those ideas into impressive documents in one powerful solution.

ArborCAD – ArborCAD is purpose built CAD software especially for the needs of Arborists whether conducting and documenting a site survey or producing a Tree Protection Report for a DA.

Drawing Media:

A large variety of drawing mediums are available for producing drawings including Bond Paper, Cartridge Paper, Tracing Paper, Tracing Linen, and Polyester Films and Coated Sheets. Better quality papers are more resilient and stable than the cheaper varieties. As humidity changes, the paper absorbs the moisture in the air and the sheet changes shape and size resulting in inaccurate drawings.

Bond Paper:
Bond paper is a highly durable writing paper and having a weight of about 80gm/m^2. The name comes from it having originally been made for documents such as government bonds. Bond paper is now used for letterheads and other stationary as a paper for electronic printers and plotters but is widely used for graphic work involving pencil, pen and felt-tip markers. Bond paper is made mainly from pulped rag which produces a stronger paper than wood pulp.

Cartridge Paper:
Cartridge paper is a high quality type of heavy paper used for illustration and drawing and was originally used for making weaponry cartridges. Cartridge paper used in drawing is slightly more course than bond paper.

Tracing Paper:
Tracing paper is translucent and made by immersing good quality paper in sulphuric acid for a few seconds. The acid converts some of the cellulose into amyloid form having a gelatinous and impermeable character; when the paper is dried the resultant product is much stronger than the original paper. Tracing paper is named as such for its ability for an artist to trace an image onto it. When tracing paper is placed onto a picture or drawing, the image is easily viewed through the

Tracing paper is available in grades from the lightweight 42gm/m^2 to the heavyweight 280gm/ m$^{2.}$

Vellum:
Vellum can be manufactured from wood pulp or cotton pulp and is used for high quality paper. Vellum is available in a wide range of colours and sizes and can be embossed or

plain and is available from 60 to 110gm/ m^2. Vellum is a good drawing material and is more stable than bond, cartridge and tracing paper.

Drafting Linen:
Drafting linen is made from undyed muslin (finely woven) fabric, normally cotton; the cloth was then highly starched and calendered (paper is passed between sever pairs of rollers to give a shiny surface) to create a smooth surface for precise ink and graphite lines. Linen provided an excellent surface for drawing but is highly unstable in humid conditions.

Polyester Films:
Polyester drafting film is a highly stable drawing media. The film has a matte finish on the drawing side which provides a good surface for drawing in ink and pencil, and good erasability when using an eraser with little damage to the surface. Film has excellent tensile strength and tear resistance although can be easily ripped if the edge is first nicked. Although the surface feels smooth, film is very abrasive so harder graphite pencils or special plastic pencils, and tungsten or ceramic pens should be used when drawing.

Types of Lines:

A standard system of linetype construction is used on drawings and drawn in 2 line widths or thicknesses, thick and thin. Thick lines include visible outlines, cutting planes and break lines; thin lines include hidden, hatching, extension, centre lines, dimension, break, phantom and existing or adjacent lines. The correct use of linetype allows the tradesperson, architect, engineer or "lay" person to correctly read and interpret the drawing.

Visible Outlines:
Visible outlines are 0.5mm wide continuous lines and are used to show all edges that are seen by the eye when looking at the object. Only hard knuckle edges are shown, tangents are curves that form a smooth transition and as such cannot be seen.

Hidden Outlines:
A hidden lines are 0.25mm wide dashed lines and show surfaces that cannot be seen. The dashes are the same length and are approximately 3mm long while the gaps are all equal lengths approximately 1mm long. The distances are estimated only and are never measured. The dashes must start and end on a visible outline.

Dimension Lines:
Dimension lines are 0.25mm wide continuous lines and used to show the extent of a dimension. The dimension text appears above the dimension line while a leader is another form of dimension line and used to connect dimensions (radius or diameter) and notes to a drawing feature.

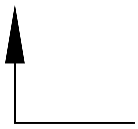
Projection Lines:
Projection lines are 0.25mm wide continuous lines and used in conjunction with dimension lines. Projection lines extend from the dimension to the points which the dimension line refers to on the object within the view.

Centrelines:
Centrelines are 0.25mm wide and used to locate the centres of holes or circular parts of an object. The line consists of a series of long and short dashes, separated by a gap. The long dashes are approximately 25mm long while the short dashes and gaps are approximately 3mm long each. Like hidden outlines, the distances are estimated only and are never measured. The long dashes start and end approximately 15 to 20mm outside the visible outline.

Centrelines can also be curved to show the centres of holes around a centre point and are referred to on a drawing as PCD meaning Pitch Circle Diameter.

Hatching Lines:
Section lines are used to show that a surface has been cut in a sectional view. Section lines are drawn 0.25mm wide, parallel, and spaced approximately 3mm apart with the spacing varying according to the material and area to be hatched. Lines are usually drawn at 45° but can also be 30° or 60° depending on the shape of the object.

Cutting Plane:
The cutting plane shows where a section has been taken through an object (where is has been theoretically cut in half to view the inside shape clearly). The line is drawn using a 0.5mm wide continuous line 10mm long and parallel to the cutting plane, and then another 0.5mm wide line 10mm line at right angle to the cutting plane; arrows are placed at the end of this line to identify the direction of viewing the section.



Break Lines:
Break lines are used to show that a part of the object has been removed or broken away to show the internal area clearly. Break lines are drawn with 0.25mm continuous lines; the lines may be straight with a "Z" shape in the middle or curved lines.

Phantom Lines:
A phantom line shows the position of an object that moves or the extents of the original shape. Phantom lines are 0.25mm wide and drawn using a long dashed line approximately 20mm long, followed by 2 short dashes approximately 3mm long, all separated by 3mm wide gaps.

Existing or Adjacent Parts:
Existing or adjacent parts are continuous lines 0.25mm wide and represent any structure or part immediately in the vicinity of the object.

Typical Example of Types of Line

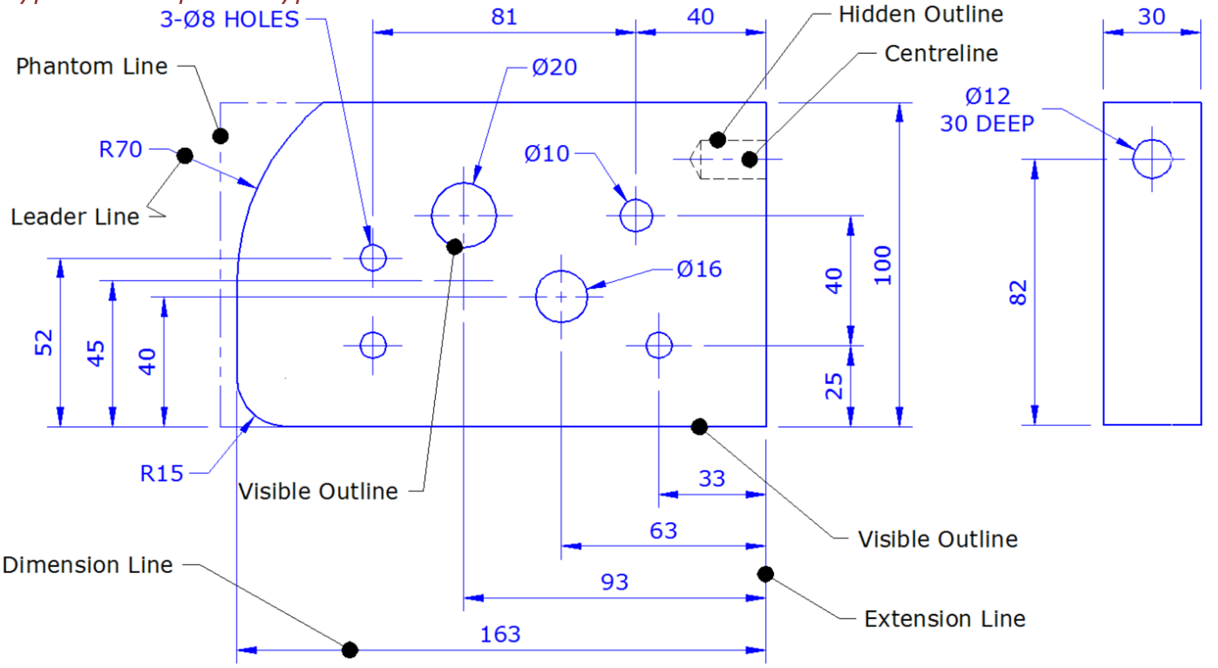


Figure 1.6

The drawing shown in Figure 1.6 shows the outline of a Plate with a series of drilled holes. The dimensions are shown as smaller text while the larger text indicates the type of line.

Orthogonal Projection:

Orthogonal or Orthographic Projection is a means of representing a three-dimensional object in a two-dimensional plane or space called a view. A number of views can be included on a drawing with each view being positioned to each other using one of two projection methods, third angle projection, or first angle projection.

First Angle Projection was the preferred method for drawing for many years however Third Angle Projection proved to be more logical and became the preferred method of projection. In Australia, the method of projection used according to AS1100 is Third Angle Projection.

The rules for Orthogonal Projection are:

- The Top and Bottom Views must be positioned vertically above or below the Front View.
- The Side Views must be positioned horizontally in line with the Front View.
- The height of the Side Views must be the same as the Front View.
- The width of the Side Views must be the same as the Top and/or Bottom Views.
- The views should be evenly spaced over the drawing.

Third Angle Projection:

In Third Angle Projection, the object is fully located in front of the viewing plane; any visible feature is drawn using a continuous outline while any hidden feature is drawn using dashed lines.

N.B. The view are drawn from where the object is being viewed. View from the Left, drawn on the Left; view from on top, draw the view on the top.

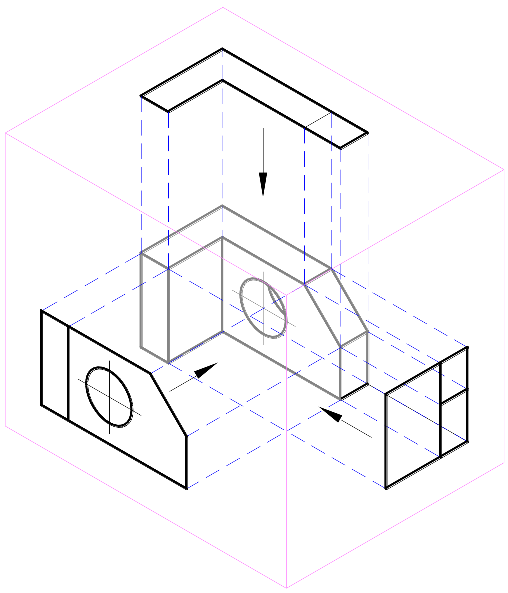


Figure 1 7

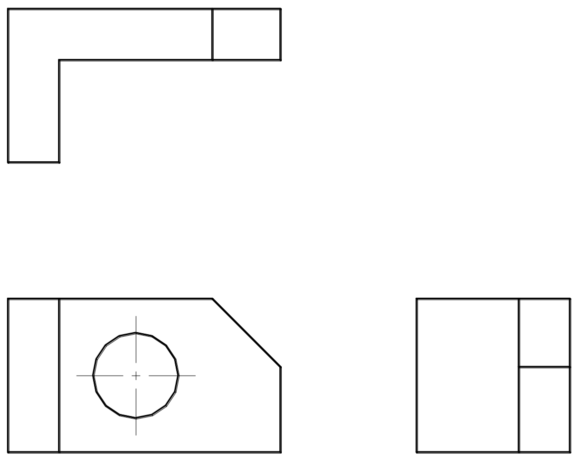


Figure 1.8

In Figure 1 7, the orthogonal planes are represented by the boundary box (magenta lines). The faces of the 3 visible sides have been projected along the dashed lines (blue) and drawn as seen from the viewing direction. In Figure 1.8, the views are shown with the planes opened flat to leave the Front, Right and Top views.

A drawing produced in Third Angle Projection can be identified with the following symbol as shown in Figure 1.9 and to the dimensions shown in Figure 1.10.

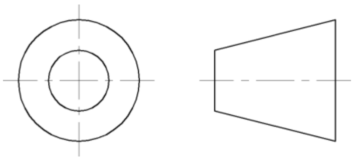


Figure 1.9

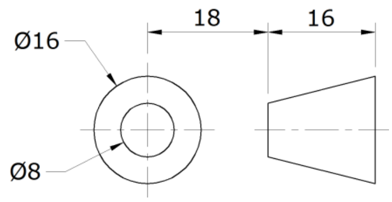


Figure 1.10

First Angle Projection:

In First Angle Projection, the object is fully located behind of the viewing plane; any visible feature is drawn using a continuous outline while any hidden feature is drawn using dashed lines. The shape of the view and the details shown are exactly the same as the view drawn in third angle projection – only the position of the view changes. The view when viewed from the left is drawn on the right while the view from above is drawn below.

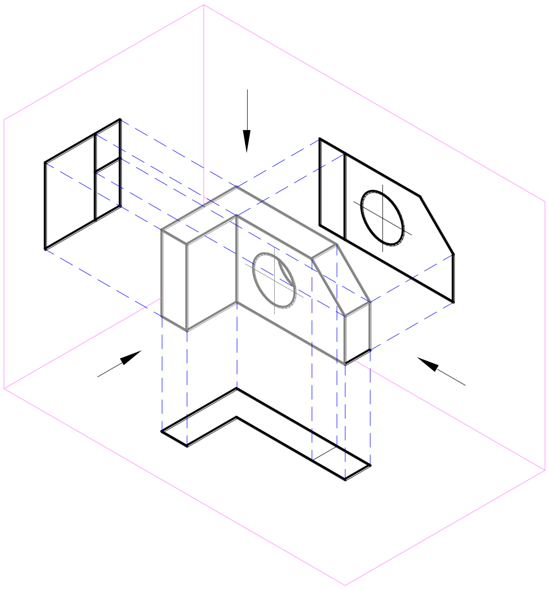


Figure 1.11

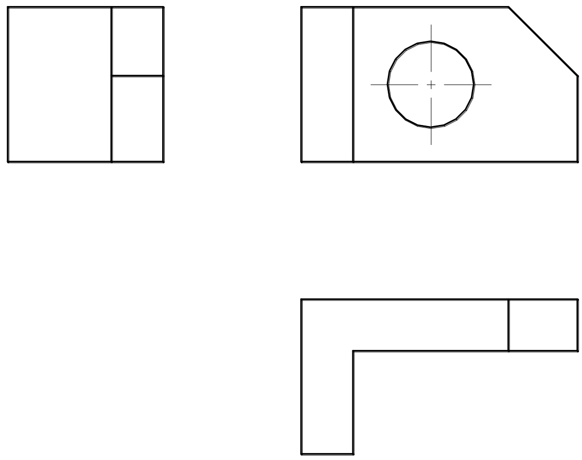


Figure 1.12

In Figure 1.11, the orthogonal planes are represented by the boundary box (magenta lines). The faces of the 3 visible sides have been projected along the dashed lines (blue) and drawn on the other side of the object and the viewing direction. In Figure 1.12, the views are shown with the planes opened flat to leave the Front, Right and Top views but are the direct opposite to that shown in Figure 1.8. The right side view is drawn on the left of the front view while the top view is drawn below the front view.

A drawing produced in First Angle Projection can be identified with the following symbol as shown in **Error! Reference source not found.** and to the dimensions shown in **Error! Reference source not found.**.

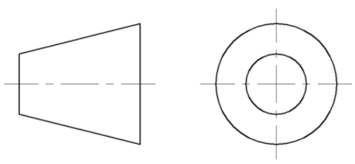


Figure 1.13

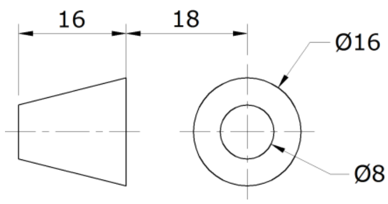


Figure 1.14

Number of Views:

The number of views required depends on the complexity of the component; some drawings may require only one view with the width of the material shown under the Title while other components may require 5 or 6-views to fully describe the object. Figure 1.15 shows a complex cam that requires only 1-view to fully show all the features and dimensions; the thickness is constant and Side View would only show a rectangle so the thickness can be placed below the Title.

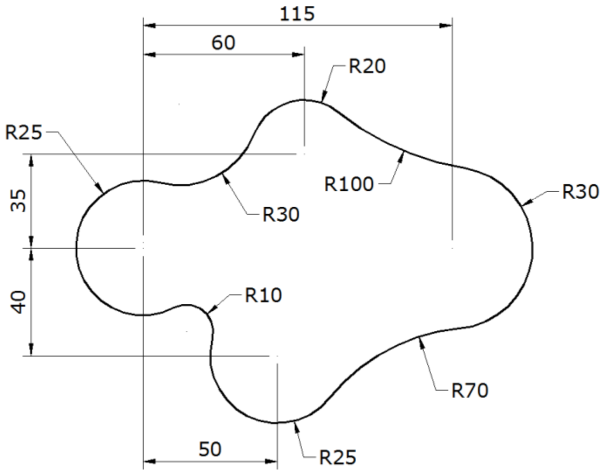


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Figure 1.15

Figure 1.16 shows a simple hypothetical block with a series of different shape holes; however 5-views are required to fully describe the shape.

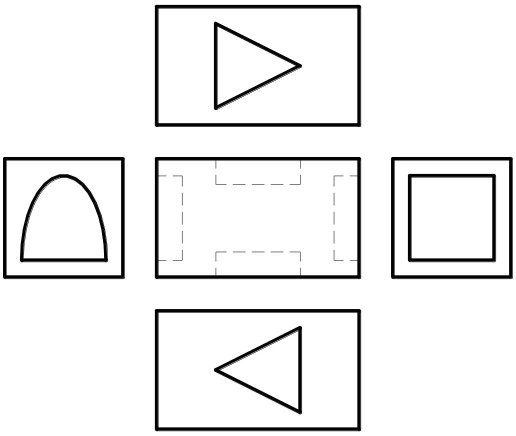


Figure 1.16

Most detail drawing require 3-views to fully display the shape of the component and its dimensions however some components could only require 2-views, especially if it is symmetrical.

N.B. The number of views depends on the complexity of the object being drawn.

Determining the Front View:

The Front View will display the most detail, or, it is the largest view. Most draftspersons use the largest view because it requires less drawing room to layout the views. To use an example, a detail drawing of a 50mm x 50mm x 8mm thick angle bar, 200 long has to be prepared. If the most detail is the criteria then the 3 views will not fit onto an A4 sheet as can be seen in Figure 1.17. If the criteria used to select the view is the largest view, then the 3 views will fit onto an A4 sheet as can be seen in Figure 1.18 which reduces printing expenses; and smaller sheets are easier to handle on job sites.

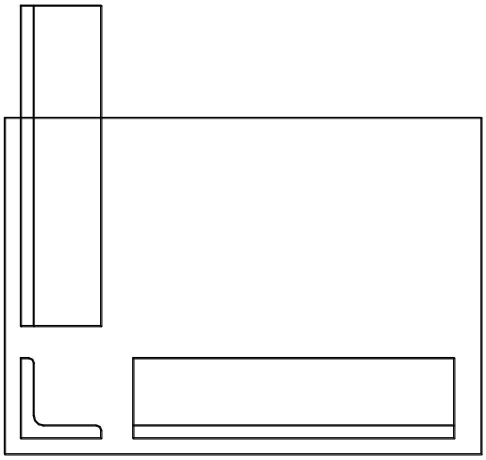


Figure 1.17

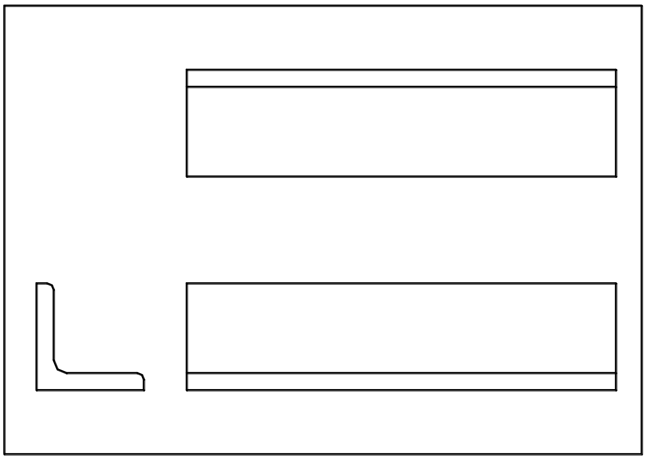


Figure 1.18

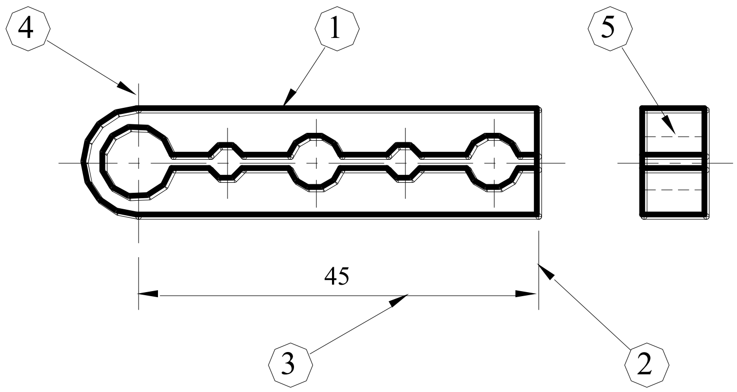
When selecting the Front View, the following should also be considered:

- Reduce the number of views required to fully describe the information to be specified.
- Avoid the need for hidden outlines.
- Avoid the unnecessary repetition of detail.

Skill Practice Exercises:

Skill Practice Exercise MEM30032-SP-0101.

In the space provided, name the type of line indicated



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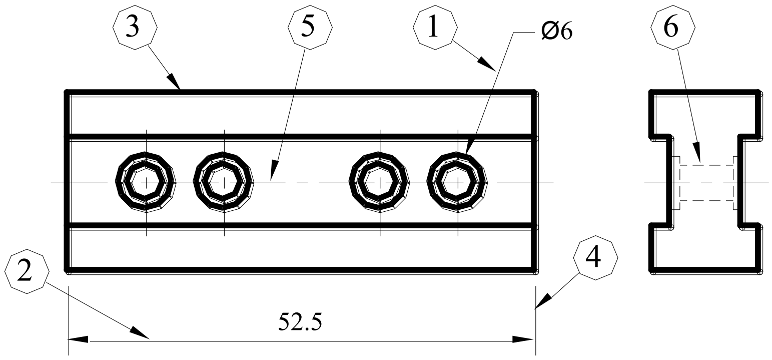

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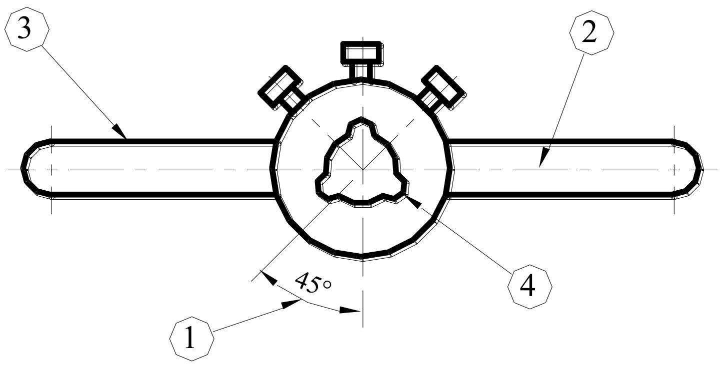

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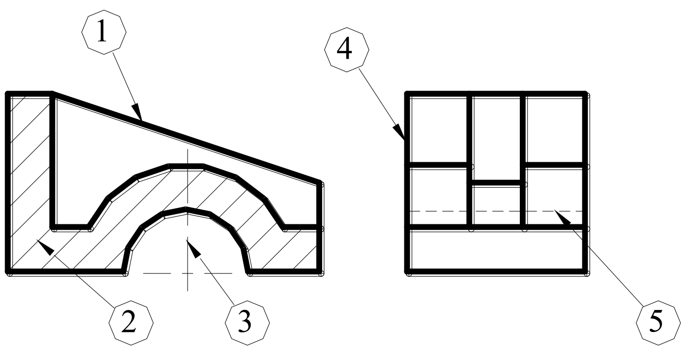

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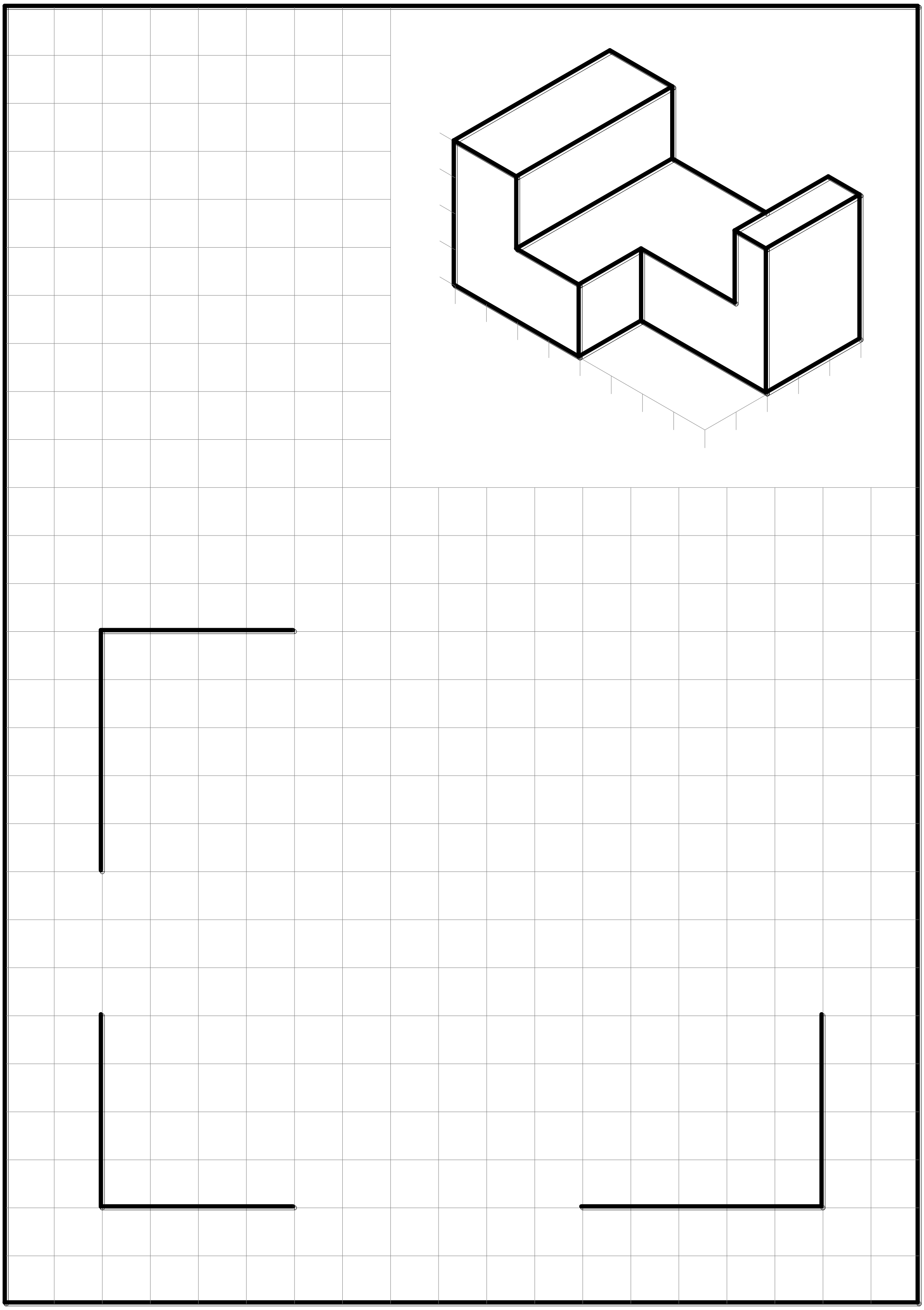
Skill Practice Exercise MEM30032-SP-103

CAD- Create A new drawing using the template called MEM30032-SP-103 on the network drive and produce the views in Third Angle Projection on the grid supplied. Save the file in your work area as MEM30032-SP-103.

Manual - Sketch the views in Third Angle Projection on the grid supplied.



Name: ____